



КОРИДОРИ СРБИЈЕ



European
Investment
Bank

КОРИДОРИ СРБИЈЕ ДОО

БЕОГРАД, КРАЉА ПЕТРА 21

Бр. I-729/13

29.04. / 13. год

Београд

CORRIDOR X HIGHWAY PROJECT

Funding Agency: EIB
ID No.: SERAPIS number 2006-0324
Corridor X branch: Xd, Nis – FYROM border
Highway: E 75, Grabovnica – Levosoje
Section: Grdelica (Gornje Polje) – Caricina Dolina
 (CORRX.E75.EIB.PACK1-LOT2.ICB)

LOT: Construction of Highway E 75
Section: Grdelica (Gornje Polje) – Caricina Dolina
LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina

CONTRACT

Employer: Koridori Srbije d.o.o. Beograd
 21, Kralja Petra Street
 11000 Belgrade
 Republic of Serbia

Contractor: JV Trace and Mostovik
 12, Nikola Obrazopisov Str.
 1408 Sofia
 Bulgaria

Belgrade, April 2013

КОНТРАКТ
№ 100/2019
Датум: 10.01.2019

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СРБИЈЕ
1992

TRACE
ТРЕЈС ГРУП ХОЛД А.Д.

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КРАСНА
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(1) Clarifying Document



ОМ ОРГУДИ
АОРН
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ТРЕЙС ГРУП ХОЛД АА



КОРИДОРИ СРБИЈЕ

КОРИДОРИ СРБИЈЕ Д.О.О. БЕОГРАД
Инжењерске делатности и техничко
саветовање

Краља Петра бр. 21, 11000 Београд
телефон +381 11 3344 174
факс +381 11 3248 682

office@koridorisrbije.rs
www.koridorisrbije.rs, www.koridor.rs

матични број 20498153, ПИБ 105940792
160-318918-33 Ванса Интеса а.д. Београд
205-142889-64 Комерцијална банка а.д. Београд
105-535005-73 Аиж Банка а.д. Ниш

No: J-729/13-1

Date: 29.04.2013.

**REFERENCE: Corridor X Highway Project, Construction of Highway E75
Section: Grdelica (Gornje Polje) – Caricina Dolina
LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina
ICB No: CORRX.E75.EIB.PACK1-LOT2.ICB**

SUBJECT: CLARIFYING DOCUMENT

THIS CLARIFYING DOCUMENT made the 29th day of April 2013, between Koridori Srbije d.o.o. Beograd, 21 Kralja Petra Street, Belgrade, Serbia (hereinafter “the Employer”), of the one part, and JV Trace and Mostovik, 12, Nikola Obrazopisov Str. 1408 Sofia, Bulgaria (hereinafter “the Contractor”), of the other part, for **Construction of Highway E75, Section: Grdelica (Gornje Polje) – Caricina Dolina (LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina; (ICB No: CORRX.E75.EIB.PACK1-LOT2.ICB).**

The Employer and the Contractor agree as follows:

1. The Contractor confirms that based on the current knowledge he will perform construction works within offered time for completion, with Accepted Contract Amount, with recourses, equipment and others as specified in the Bid or similar equivalent (subject of approval in accordance with the Contract).
2. The Contractor agrees with the changes in the Contract as specified in the letter of Koridori Srbije d.o.o. ref. 3214/12 dated June 20, 2012 (items No. 2, 3, 4 and 5), i.e. the Contractor agrees with the following:
 2. Particular Conditions of Contract, Part A Contract Data, Performance Security, Sub-Clause 4.2, following text shall be added: “Acceptable Bank to the Employer means any Bank whose rating is minimum “6 (investment threshold – acceptable risk)” (here and after “minimum rating”) according to the Agency for rating assessment COFACE. If during execution of the Contract the rating of the Bank from which the Contractor provided the Security falls below the minimum rating, the Contractor shall, within 28 days starting from the issue of notice by the Employer, substitute such Bank Security with a new Security issued by the Bank with minimum rating. Until such substitution of Security is provided to the Employer all payments under the contract shall be withheld. Such substitution is not eligible for any change of cost or price. Bank rating shall be verified by the Employer on quarterly base.”
 3. Particular Conditions of Contract, Part A Contract Data, Total Advance Payment, Sub-Clause 14.2, following text shall be added: “Acceptable Bank to the Employer means any Bank whose rating is minimum “6 (investment threshold – acceptable risk)” (here and after “minimum rating”) according to the Agency for rating assessment COFACE. If during execution of the Contract the rating of the Bank from which the Contractor provided the Guarantee falls below the minimum rating, the Contractor shall, within 28 days starting from



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the issue of notice by the Employer, substitute such Bank Guarantee with a new Guarantee issued by the Bank with minimum rating. Until such substitution of Guarantee is provided to the Employer all payments under the contract shall be withheld. Such substitution is not eligible for any change of cost or price. Bank rating shall be verified by the Employer on quarterly base.”

4. Particular Conditions of Contract, Part B Specific Provisions, The Contract Price, Sub-Clause 14.1 shall be replaced with the following: “Particular Conditions of Contract, Part B Specific Provisions, The Contract Price, Sub-Clause 14.1 (b): Replace the Sub-Clause with the following paragraph: The prices in Bill of Quantities include all duties, taxes and other levies excluding VAT (Value Added Taxes). Companies are not exempted from taxation, duties and other levies. The Contractor shall pay cost of custom duties, other import duties and other impositions, levies from their own proceeds. The Contract is VAT excluded, and the Contract Price shall not be adjusted for any of these costs except as stated in Sub-Clause 13.7 [Adjustments for Changes in Legislation]. “
5. Particular Conditions of Contract, Part B Specific Provisions, The Contract Price, Sub-Clause 14.1 (e) shall be added: “not applicable”.
3. The Contractor shall do business, including the payments by the Employer, in the Republic of Serbia via branch office of the Lead Partner of JV i.e. Trace.

Branch office name: TRACE GROUP HOLD PLC OGRANAK BEOGRAD; Address: Kneza Milosa br. 9/5th floor, Belgrade; Registration number: 29505098; TIN: 107953138; Bank: Unicredit bank Serbia JSC; RSD account 170-37000040000-12.

4. Contract Agreement, item 2 shall be as follows:

The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.

- (i) the Clarifying Documents
- (ii) the Letter of Acceptance
- (iii) the Letter of Bid
- (iv) the Addenda Nos. 1-3
- (v) the Particular Conditions
- (vi) the General Conditions
- (vii) the Special Specification
- (viii) the General Specification
- (ix) the Drawings and
- (x) the completed Schedules
5. Particular Condition of Contract, Part A – Contract Data, Sub-clause 2.1 Right for access to the Site shall be as follows:
“Time for access to the Site:
Not later than the expiry of the days shown in column No. 2 of Attachment to the Work Programme Revision I, submitted by the Contractor on March 19, 2013 and Revision II submitted by the Contractor on April 15, 2013. The initial date from which begins the counting of the days under column No. 2 is the commencement date, which should be not later than May 15, 2013.”
6. Particular Condition of Contract, Part B – Specific Provisions, Sub-clause 14.7 Payment: (b) After text “the amount certified in each Interim Payment Certificate” following shall be added: “immediately after certification of amount by the responsible person of the Employer but”. (c) After text “the amount certified in each Final Payment Certificate” following shall be added: “immediately after certification of amount by the responsible person of the Employer but”.
7. Particular Conditions of Contract, Part B – Specific Provisions, Sub-Clause 15.2 Termination by Employer: The text of this Sub-clause shall be replaced with following text: “Add the following paragraph after the end of Sub Clause (c) (ii): (iii) - to fulfill milestones defined in its initial and/or revised time programme by more than 5 (five) months.”

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8. Following text shall be added as Remark in the Preamble i.e. "The following Preamble should be treated as Special Specifications and should be read in conjunction with General Specifications and shall extend and modify them as appropriate".
9. Although it was foreseen that the Performance security will be in the same currency of the Accepted Contract Amount (i.e. RSD), the Employer accepted Performance security in EURO in the amount of 20% of the Accepted Contract Amount (as specified in the Letter of Acceptance).
10. Although it was foreseen that the Advance Payment Guarantee will be in the same currency of the Accepted Contract Amount (i.e. RSD), the Employer will accept Advance Payment Guarantee in EURO in the amount of 10% of the Accepted Contract Amount.
11. Exchange rate to be applied for calculation of amount of Performance security in EURO and amount of Advance Payment Guarantee in EURO is middle rate of National Bank of Serbia on the Base Date i.e. 1EURO = 101,7528 RSD.
12. The Contract shall be governed by the laws of the Republic of Serbia (Particular Conditions of Contract, Part A – Contract Data, Sub-clause 1.4) and therefore all insurance relating to the Contract (including, but not limited to the insurance referred to Clause 18) shall be placed with insurance company established in accordance with the Insurance Law of Republic of Serbia.
13. Part of the Contract documents, under bullet (x) the completed Schedules of the Contract Agreement will be Unit price analyses submitted by the Contractor during evaluation of bids. Submitted Unit price analyses are detailing all its integral parts, the cost of materials, labour, equipment, transport, design overheads (logistic, safety, etc.), and any other aspect that influence directly or indirectly its formation and are given by the Contractor in order to eliminate, by any means, endangering of the Contract implementation due to incompleteness of cost elements, obligations and procedures. In particular, the Contractor confirmed that high quality, up-to-date materials and equipment will be used in accordance with the Technical Specifications and Design and in compliance with all valid norms, regulations and standards in the country where works will be carried out.

Signed by the said JV Trace and Mostovik in the presence of:
Mr. Tsvetan Tsonev, Executive Director of Trace Group Hold PLC

Signed by the Koridori Srbije d.o.o. Beograd in the presence of:
Mr. Dmitar Đurović, Director

Signed by _____ (for the Contractor)

Signed by _____ (for the Employer)





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(2) Contract Agreement





TRACE
"ТРЕЙС ГРУП ХОЛД" АА

Contract Agreement

THIS AGREEMENT made the 29th day of April 2013, between Koridori Srbije d.o.o. Beograd, 21 Kralja Petra Street, Belgrade, Serbia (hereinafter "the Employer"), of the one part, and JV Trace and Mostovik, 12, Nikola Obrazopisov Str. 1408 Sofia, Bulgaria (hereinafter "the Contractor"), of the other part:

WHEREAS the Employer desires that the Works known as **Grdelica (Gornje Polje) – Caricina Dolina (LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina; (ICB No: CORR.X.E75.EIB.PACK1-LOT2.ICB)** should be executed by the Contractor, and has accepted a Bid by the Contractor for the execution and completion of these Works and the remedying of any defects therein,

The Employer and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.

- (i) the Clarifying Documents
- (ii) the Letter of Acceptance
- (iii) the Letter of Bid
- (iv) the Addenda Nos. 1-3
- (v) the Particular Conditions
- (vi) the General Conditions
- (vii) the Special Specification
- (viii) the General Specification
- (ix) the Drawings and
- (x) the completed Schedules

3. In consideration of the payments to be made by the Employer to the Contractor as indicated in this Agreement, the Contractor hereby covenants with the Employer to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.

4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with the laws of the Republic of Serbia on the day, month and year indicated above.

Signed, Sealed, and Delivered by the said JV Trace and Mostovik
in the presence of: Mr. Tsvetan Tsonev, Executive Director of Trace Group Hold PLC

The Common Seal of Koridori Srbije d.o.o. Beograd
was hereunto affixed in the presence of: Mr. DIMITAR ĐUROVIĆ, Director

Signed by _____ (for the Contractor)

Signed by 2. Зубовић _____ (for the Employer)

Handwritten text, possibly a signature or date, located in the top left corner.



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(3) JV Agreement and Power of Attorney

JV Agreement

Power of Attorney



JV Agreement



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"ТРЕЙС ГРУП ХОЛД" АА

JOINT VENTURE AGREEMENT

Today 30.12.2011, the following Agreement is signed between:

TRACE GROUP HOLD PLC, EIK: 123682269

Headquarter and Head office address: Bulgaria, Sofia 1407, 71 "James Bouchier" blvd., represented by Mr. Tsvetan Tsonev, Dipl. Eng - Executive Director, ID № 6302245869, ID Card № 626250362, issued on 09.10.2009 by MVR – Sofia

and

MOSTOVIK LLC, PSRN: 1025501657710

Headquarter and Head office address: Prospekt Mira 5\5, Omsk. 644080, Russian Federation, Represented by Director General Oleg Shishov,

/Hereinafter called "Partners"/

HEREBY IT IS DECLARED AND AGREEMENT ACHIEVED ON THE FOLLOWING:

1. Subject of activity

Driven by mutual interest oriented towards the achievement of common economical goals and under the terms of the present Joint Venture Agreement, the partners hereby establish a Joint Venture in order to unite their efforts for:

- participation in bid for selection of Contractor for construction of project with identification number:

Project: Construction of Highway E 75, Section: Grdelica (Gornje-Polje) – Caricina Dolina

ICB. №: CORRX.E75.EIB.PACK1.ICB

LOT 1: Road And Bridges From Grdelica to Tunnel Predejane

LOT 2: Road And Bridges From Grdelica to Caricina Dolina

Project: Corridor X Highway

with Employer Koridori Srbije D.O.O., Beograd, Serbia.

- execution of the Contract in case of awarding thereof to the Joint Venture.

The present Joint Venture does not have status of legal entity under the provisioned by the Bulgarian legislation. The partners preserve their legal independence of entities, registered and operating in accordance with their national legislation.

2. Realization of activity of the Joint Venture

2.1 Each partner shall engage himself in the activity of the Joint Venture exercising due attention and care and shall carry out the assigned thereto activities and shall observe all the agreements having legal power concluded within the Joint Venture. Partners give their consent that the bid shall be signed in such a manner that legally to bind all partners, however explicitly demonstrating that all partners shall be jointly and severally liable for the execution of the Contract in accordance with the Contract terms of the Employer.

2.2 **TRACE GROUP HOLD PLC is determined as the Leader of the Joint Venture** and shall be liable for the management of the Joint Venture receiving of instructions from the Employer, and shall submit the bid of the Joint Venture to the Employer. The entire execution of the Contract including payments shall be responsibility of the Leading Partner.

2.2 The Leader of the Joint Venture undertakes to provide any assistance to the partners during the process of execution of their functions, in regards of the execution of the Project. The partners undertake the same obligation in regards of the Leader of Joint Venture.

2.3 The Leader of the Joint Venture is hereby this agreement unconditionally authorized to undertake obligations and receive instructions for and on behalf of each one and all partners in the Joint Venture. The Leader of the Joint Venture is hereby this agreement authorized to buy tender documentation, to conclude a contracts with the Employer, to receive instructions for and on behalf of all partners of the Joint Venture from the Employer, to undertake obligations from the Employer, to provide a bid security for participation on behalf of the Joint Venture, to sign the bid for the tender, the Contract of execution of the Project in case of awarding thereof to the Joint Venture, to open a bank account in the name of the Joint Venture and to manage the bank account of the Joint Venture, to receive instructions from the Employer on behalf of the Joint Venture, as well as on behalf of on each person involved

2.4 Each partner from the Joint Venture undertakes entirely the financial liabilities (expenditures) upon the participation in tendering, and the execution of the Contract as well as the obligations for the accurate preparation and applying of all the necessary documents.

2.5 Each of the partners shall have percentage participation in the execution of the Contract, as follows:

1. Trace Group Hold PLC -
2. Mostovik

90.0%
10.0%



In accordance with the above cited, the financial commitments of each one of the partners are determined in terms of percentage of the value of Contract.

The distribution of profits and losses between the partners shall be done in accordance with the percentage participation thereof in execution of the Contract.

The determined percentage of participation shall be adjusted depending on the particular participation of each of the partners under the Contract in the process of execution of the works.

Decisions within joint venture will be taken with full majority. In failing of reaching full majority decision leader TRACE GROUP HOLD PLC has the right to take decision personally that is mandatory for other partner.

2.6 Each of the partners in the Joint Venture has the right to be informed about all the questions regarding their joint activity. Each of the partners has the obligation to assist and actively participate in the execution of the joint activity, to carry out his obligations (financial and any whatsoever), representing his share and percentage in pursuance with the agreed with the Employer, to indemnify entirely the other partners, when the latter partner has caused through his guilty actions or lack of action loss unto the Joint Venture, to observe confidential the entire information, revealed unto him in reference with the joint activity thereof, to undertake the respective part of the expenditures referred to the Joint Venture, its activity and the management of Joint Venture, to fulfil the instructions of the representative of the Leader of the Joint Venture and not to act as disloyal competition.

3. Name of Joint Venture

The name of the Joint Venture is «**TRACE MOSTOVIK**»

4. Rights of Partners

- 4.1 The partners authorize **Mr. Tsvetan Ivanov Tsonev**, Dipl. Eng, Executive Director of TRACE GROUP HOLD PLC to undertake obligations, to sign the bid and receive instructions from the Employer, both for and on behalf of the Joint Venture, as well as for and on behalf of each one of the partners in the Joint Venture.
- 4.2 **Mr. Tsvetan Ivanov Tsonev**, Dipl. Eng, Executive Director of TRACE GROUP HOLD PLC is nominated for a Representative who have the authority to conduct all business for and on behalf of any and all the partners of the Joint Venture during the bidding process and, in the event the Joint Venture is awarded the Contract, during contract execution.
- 4.2 All the interrelations between the partners within the Joint Venture which are not subject of this Agreement shall be arranged through signing of additional contracts between them within the frames of the Joint Venture, so that to determine therewith the potential further responsibilities for protection of the interest of the Employer.

5. Obligations of Partners



5.1 Each partner must relate towards the other partners with the highest possible degree of loyalty and to acting in good faith and is obliged to provide the other partners with full information about the achievement of the purposes of Joint Venture.

5.2 All the partners of the Joint Venture shall be jointly and severally legally liable for the execution of the Contract, which shall be signed between the Joint Venture and the Employer. Each partner is responsible towards the Joint Venture for the performance of his obligations, resulting from the subject and purpose of the Joint Venture as defined in art.1 of the present Agreement. The Leader of the Joint Venture is hereby this Agreement unconditionally authorized to obligate and receive instructions, for and on behalf of each one and all partners in the Joint Venture.

5.3 All partners in the Joint Venture this Agreement therewith legally unconditionally bind themselves to remain within the Joint Venture for the whole period of execution of the Contract. Partners give consent and undertake to perform the works together with all responsibilities arising from the Contract concluded between the Joint Venture and the Employer.

6. Restrictions

The partners undertake not to participate either individually or in any other competitive Joint Ventures or Consortia formed with the same purpose as the present Joint Venture as cited in art. 1 of this Agreement.

7. Termination

The Joint Venture shall terminate its existence only after elapsing of the Defects Liability Periods and the completion of all payments in case of consequently awarded Contract. Further, the Joint Venture shall be terminated also in case of failure to be awarded the Contract thereto.

8. Indemnifications

In case of breach of the Contract on behalf of any of the partners in Joint Venture the other partners have the right to be indemnified for the losses suffered thereby.

9. Arbitration

All the activities of the partners, directed towards the realization of the Project, shall be legally settled under the provisions of the Bulgarian law.

All disputes between the parties hereto shall be settled through negotiations and upon failure to reach consent - by the Arbitration court of Bulgarian Chamber of Commerce and Industry.

10. Head Office

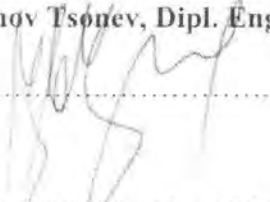


The Head Office of Joint Venture, is the Head Office of the Leader of Joint Venture –
TRACE GROUP HOLD PLC

11. Language

The ruling language of this Joint Venture Agreement is the English language.

Specimen of the signature of
Mr. Tsvetan Ivanov Tsonev, Dipl. Eng



Central Office of Management of the Leader of Joint Venture:

Sofia 1407, 12 "Nikola Obrazopisov" Str., fax:+359 2 80 66 711, tel: +359 2 80 66 700; e-mail: tracegroup@tracebg.com

Signed:

1. On behalf of **TRACE GROUP HOLD PLC**
Mr. Tsvetan Ivanov Tsonev, Dipl. Eng.



2. On behalf of **MOSTOVIK**
Mr. Oleg Shishov



АНЕКС КЪМ СПОРАЗУМЕНИЕ ЗА
ОБЕДИНЕНИЕ

ANNEX TO JOINT VENTURE
AGREEMENT

Днес, година се сключи настоящото допълнително споразумение към Споразумение за Обединение от 30.12.2011 между:

The following Annex to Joint Venture Agreement dated 30.12.2011 has been concluded on between:

„ТРЕЙС ГРУП ХОЛД“ АД

„TRACE GROUP HOLD“ PLC

със седалище и адрес на управление: Република България, гр. София, п.к. 1408, ул. „Никола Образописов“ №12, регистрирано в Търговския регистър при Агенция по вписванията под ЕИК 123682269, представлявано от Изпълнителния директор Цветан Иванов Цонев, ЕГН 6302245869, лична карта № 626250362, изд. на 09.10.2009 г. от МВР- София,
и

having its registered headquarter and head office at Republic of Bulgaria, Sofia 1408, 12 “Nikola Obrazopisov” str., registered in the Trade Registry at the Registry Agency with Identification Number 123682269, represented by the Executive Director – Mr. Tsvetan Ivanov Tsonev, UIN 6302245869, ID card № 626250362, issued on 09.10.2009 by Police Sofia.

and

„Научно-производствено обединение Мостовик“ ООД, рег.1025501857710, със седалище и адрес на управление: Проспект Мира 5/5, Омск, 644080, Руска федерация, представлявано от Изпълнителния директор Олег Шипов,

MOSTOVIK LLC, PSRN:1025501857710, Headquarter and head office address: Prospekt Mira 5/5, Omsk, 644080, Russian Federation, Represented by Director General Oleg Shishov,

В качеството им на Партньори в Обединение “ТРЕЙС МОСТОВИК”

In their capacity of Partners in Joint Venture “TRACE MOSTOVIK”

С НАСТОЯЩОТО СЕ ДЕКЛАРИРА И ПОСТИГА СЪГЛАСИЕ ВЪРХУ СЛЕДНОТО:

HEREINAFTER THE PARTIES AGREE WITH THE FOLLOWING:

Партньорите се съгласяват да обединят усилията си за изпълнение на Договора за възлагане на строителството на следния обект:

Herewith the Parties agree to unite their efforts for the execution of the Contract for construction of the following project:

Строителство на Магистрала Е 75, участък: Гърделица (Горно поле) – Царичина Долина,
ЛОТ 2: Път и мостове от тунел Предеяне до Царичина Долина,

Construction of Highway E75, Section: Grdelica (Gornje Polje) – Caricina Dolina,

LOT 2: Road and bridges from Predejane tunnel to Caricina Dolina,

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“ТРЕЙС ГРУП ХОЛД” АД

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КАДРИ

ICB No:CORRX.E75.EIB.PACK1-LOT2.ICB

ICB No:CORRX.E75.EIB.PACK1-LOT2.ICB

С Възложител: „Koridori Srbije” D.O.O.,
Белград, Сърбия.

With Employer Koridori Srbije D.O.O.Beograd,
Serbia.

С настоящото се декларира промяна в
седалището и адреса на управление на
ведещия партньор „ТРЕЙС ГРУП ХОЛД”
АД от Република България, гр. София, п.к.
1407, бул. „Джеймс Баучер” №71 на Република
България, гр. София, п.к. 1408, ул. „Никола
Образописов” №12.

Herewith a change in the headquarter and head
office address of the Lead partner **TRACE
GROUP HOLD PLC** is declared and namely
from Republic of Bulgaria, Sofia 1407, 71 “James
Bourchier” blvd to Republic of Bulgaria, Sofia
1408, 12 “Nikola Obrazopisov” str.

Всички останали клаузи на Споразумението за
Обединение, сключено на 30.12.2011г. остават
непроменени и в сила.

All other clauses of the Joint Venture Agreement
dated 30.12.2011 remain unaffected and in force.

За и от името на „ТРЕЙС ГРУП ХОЛД” АД/ On behalf of TRACE GROUP HOLD PLC



За и от името на „Научно-производствено обединение Мостовик” / On behalf of MOSTOVIK LLC



Power of Attorney



**ПРОТОКОЛ ОТ ЗАСЕДАНИЕ
СЪВЕТА НА ДИРЕКТОРИТЕ НА
„ТРЕЙС ГРУП ХОЛД“ АД**



Днес, 30.12.2011 г., в гр. София, се проведе заседание на Съвета на директорите на „Трейс Груп Холд“ АД, ЕИК 123682269.

На заседанието присъстваха всички членове на Съвета на директорите, а именно:

Николай Ганчев Михайлов - Председател

Цветан Иванов Цонев - Изпълнителен директор

Иван Димитров Христов - Член

Мирослав Калчев Манолов - Член

Манол Пейчев Денев - Член

Антон Николов Дончев - Член

Мария Георгиева Каварджикова - Член

Заседанието има изискуемия кворум и може да взема решения по всички точки от дневния ред.

Заседанието протече при следния ДНЕВЕН РЕД:

**PROTOCOL
OF SESSION OF THE BOARD OF DIRECTORS OF TRACE
GROUP HOLD PLC**

Today 30.12.2011 in Sofia took place the meeting of the Board of Directors of Trace Group Hold PLC, Bulstat: 123682269.

At the meeting attended by all members of the Board of Directors as follows:

Nikolay Ganchev Mihaylov - Chairman

Tsvetan Ivanov Tsonev - Executive director

Ivan Dimitrov Hristov - Member

Miroslav Kalchev Manolov - Member

Manol Peychev Denev - Member

Anton Nikolov Dontchev - Member

Maria Georgieva Kavardjikova- Member

The meeting has the quorum necessary and may decide on all items of the agenda.

The meeting took place with the following Agenda:



1. Вземане на решение за склучување на договор за уружение, коешто да учествува в тръжна процедура.

2. Упълномощавање на Изпълнителниот директор.

След направените разискувања, бяха взети следните решения с единодушие:

По т. 1 от дневниот ред

Съветът на директорите на „Трейс Груп Холд“ АД **РЕШИ** дружеството да склучи договор за създаване на сдружение със „Мостовик“ ООД, в който „Трейс Груп Холд“ АД да бъде определен за водещ партньор в Сдружението, което да участва в тръжна процедура за възлагане изпълнението на обект:

Проект: Строеж на автомагистрала Е75, участък Грделица- (Горние Поле)- Царицина долина

ICB : CORR.X.E75.EIB.PACK1.ICB

ЛОТ1: Път и мостове от Грделица до тунел Предежане

ЛОТ2: Път и мостове от Грделица до Царицина долина

Проект: Коридор 10 Автомагистрала

с Възложител Коридори Србија ООД, Белград, Србија.

TRACE
ТРЕЙС ГРУП ХОЛД АА

1. Decision to conclude a contract for a Joint Venture for participation in a bid.

2. Authorization of the Executive Director.

After discussions, the following decisions were taken unanimously:

1. The Board of directors of TRACE GROUP HOLD PLC decide to conclude a contract to establish a Joint Venture with MOSTOVIK Ltd., in which TRACE GROUP HOLD PLC is determined as the Leader in the Joint Venture in order to participate in bid for awarding the execution of project:

Project: Construction of Highway E 75, Section: Grdelica (Gornje Polje) – Caricina Dolina

ICB : CORR.X.E75.EIB.PACK1.ICB

LOT 1: Road And Bridges at sub-section Grdelica to Tunnel Predejane

LOT 2: Road And Bridges at sub-section Grdelica to Caricina Dolina

Project: Corridor X Highway

with Employer Koridori Srbije D.O.O., Beograd, Serbia.

По т. 2 от дневния ред

Съветът на директорите на „Трейс Груп Холд“ АД, УПЪЛНОМОЩАВА Цветан Иванов Цонев в качеството му на Изпълнителен Директор на „ТРЕЙС ГРУП ХОЛД“ АД да представява дружеството като извършва всички необходими правни и фактически действия, в това число да подпише Договор за създаване на сдружение, в което „ТРЕЙС ГРУП ХОЛД“ АД да бъде определен за водещ партньор, да подпише и предаде офертата от името на Сдружението, както и всичко останало, което той намери за добре по такъв начин, че да осъвърше юридически неотменимо нашето дружество във връзка с участието му в Сдружение и търг относно обекта, описан в т. 1 от настоящия протокол.

„ТРЕЙС ГРУП ХОЛД“ АД

Поради изчерпване на дневния ред заседанието беше закрито.

Съвет на директорите:

Николай Ганчев Михайлов – Председател

Цветан Иванов Цонев – Изпълнителен директор

Иван Димитров Христов – Член

Мирослав Калчев Манолов – Член

Манол Пейчев Денев – Член

Антон Николов Дончев – Член

Мария Георгиева Каварджикова - Член

2. The Board of directors of TRACE GROUP HOLD PLC authorized Tsvetan Ivanov Tsonev in a capacity of Executive director of TRACE GROUP HOLD PLC to represent the Joint Venture by completing all the necessary legal and actual activities, including signing of Contract to establish a Joint Venture in which TRACE GROUP HOLD PLC is a leading partner, to sign and to deliver a bid on behalf of the Joint Venture, as well as everything else in a way to bind our company legally irreversibly concerning its participation in Joint Venture and in a bid for project, described in paragraph 1 of this Protocol.

Due to the depletion of the agenda the Board meeting was closed.

Board of Directors:

Nikolay Ganchev Mihaylov Chairman

Tsvetan Ivanov Tsonev Executive Director

Ivan Dimitrov Hristov Member

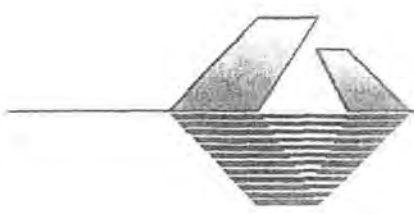
Miroslav Klchev Manolov Member

Manol Peychev Denev Member

Anton Nikolov Dontchev Member

Ivan Stefanov Trifonov Member





НАУЧНО - ПРОИЗВОДСТВЕННОЕ ОБЪЕДИНЕНИЕ

МОСТОВИК

ООО «НПО «Мостовик»
Россия, 644080, г. Омск-80, пр. Мира, д.5, корп.5
ИНН/КПП 5502005562/997350001
р/с 40702810445000102245 в ОАО Омское СБС №8534 г.Омск
к/с 3010181090000000673 БИК 045209673
тел. 381-2-65-66-37
381-2-65-97-53
факс 381-2-65-66-66

POWER OF ATTORNEY

Done in Omsk City of Omsk region, the Russian Federation

16.04.2013

Limited Liability Company Scientific-Industrial Union MOSTOVIK (Taxpayer Identification Number 5502005562, Tax code 997350001, Principle State Registration Number 1025501857710, legal address: 644080, Russia, Omsk City, Prospect Mira Street, 5/5) established in accordance with the legislation of the Russian Federation in the person of the Director General Oleg Shishov, acting on the basis of the Charter, grants

I AUTHORIZE

Tsvetan Ivanov Tsonev, holding Identity Card № 626250362, issued on 09.10.2009 from MVR-Sofia, ID №: 6302245869, with permanent address: Bulgaria, Sofia, 76 "Rodopski izvor" str., fl. 2, app. 18, in a representative capacity of «TRACE MOSTOVIK» JOINT VENTURE to represent the Joint Venture by completing all the necessary legal and actual activities with regard to the completion of the contract parts and to sign the Contract for construction of the following:

Corridor X Highway Project,

Construction of Highway E75, Section: Grdelica (Gornje Polje) – Caricina Dolina,

LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina,

ICB No:CORRX.E75.EIB.PACK1-LOT2.ICB

With Employer Koridori Srbije D.O.O.Beograd, Serbia.

The authorized is unconditionally empowered to conclude the Contract with the Employer, on behalf of the Joint Venture and each partner.




Director General of SIU Mostovik Co Ltd
O.Shishov

Отгрузка: станция « ПЛАМЯ »
Зеландно-Сибирской ж.д., Код станции 830107, код предприятия 4581



НАУЧНО - ПРОИЗВОДСТВЕННОЕ ОБЪЕДИНЕНИЕ

МОСТОВИК

TRACE
21/733
«ТРЕЙС ГРУП ХОЛД» АА



(4) Performance Security



08-02-2013
1032/22/172

ORIGINAL

Issuing Bank: UniCredit Bulbank AD, 7, Sveta Nedelya Sq., Sofia 1000, Bulgaria

Beneficiary: Koridori Srbije d.o.o. Beograd, 21 Kralja Petra Street, Belgrade, Republic of Serbia

Date: 08 February, 2013

PERFORMANCE GUARANTEE No.: 961LGI1130390801

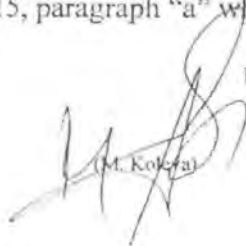
We have been informed that **Joint Venture "TRACE MOSTOVIK"** address: 12, "Nikola Obrazopisov" Str. 1408 Sofia, Bulgaria, established with Joint Venture Agreement between TRACE GROUP HOLD PLC, EIK 123682269, address: Bulgaria, Sofia 1408, 12 "Nikola Obrazopisov" Str. and MOSTOVIK LLC, PSRN: 1025501857710, address: Prospekt Mira 5/5, Omsk, 644080, Russian Federation (hereinafter called "the Contractor") will enter into Contract with you for the execution of **Construction of Highway E 75, section Grdelica (Gornje Polje) – Caricina Dolina, LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina, ICB No.: CORRX.E75.EIB.PACK1-LOT2.ICB** (hereinafter called "the Contract").

Furthermore, we understand that according to the conditions of the Contract, a performance guarantee is required.

At the request of the Contractor, we UniCredit Bulbank AD, 7, Sveta Nedelya Sq., Sofia 1000, Bulgaria hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of **EUR 7,525,155.54 (Say: seven millions five hundred twenty five thousand one hundred fifty five and 0.54 EURO)**, such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation(s) under the Contract, without your needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire no later than the **17th Day of May, 2016**, and any demand for payment under it must be received by us at this office on or before that date.

This guarantee is subject to Uniform Rules for Demand Guarantees, ICC Publication No. 758, except Art.15, paragraph "a" which is hereby excluded.


(M. Kokorova)

UNICREDIT BULBANK AD




(M. Kuchanova)

UniCredit Bulbank

7 Sv. Nedelya Sq.
1000 Sofia, Bulgaria
Tel +359 2 9232 111

TRACE 23/783
ТРЕЙС ГРУП ХОЛД*АА

НЕ ИМА ОРИГОНАЛ
КОПИЈА

ORIGINAL

Issuing Bank: UniCredit Bulbank AD, 7, Sveta Nedelya Sq., Sofia 1000, Bulgaria**Beneficiary: Koridori Srbije d.o.o. Beograd, 21 Kralja Petra Street, Belgrade, Republic of Serbia****Date: 12 April, 2013****Amendment No. 1 TO Performance Guarantee No.: 961LGI1130390801**

We, UniCredit Bulbank AD, 7, Sveta Nedelya Sq., Sofia 1000, Bulgaria herewith replace the first paragraph of the above mentioned guarantee, as follows:

We have been informed that Joint Venture "TRACE MOSTOVIK" address: 12, "Nikola Obrazopisov" Str., 1408 Sofia, Bulgaria, established with Joint Venture Agreement between TRACE GROUP HOLD PLC, EIK 123682269, address: Bulgaria, Sofia 1408, 12 "Nikola Obrazopisov" Str., and MOSTOVIK LLC, PSRN: 1025501857710, address: Prospekt Mira 5/5, Omsk, 644080, Russian Federation (hereinafter called "the Contractor") has entered into Contract with you dated 15 January, 2013 – the date of your Letter of Acceptance, for the execution of Construction of Highway E 75, section Grdelica (Gornje Polje) – Caricina Dolina, LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina, ICB No.: CORR.X.E75.EIB.PACK1-LOT2.ICB (hereinafter called "the Contract").

All other terms and conditions of the above mentioned guarantee remain unchanged.


(M. Kuleva)

UNICREDIT BULBANK AD


(M. Kamenova)

UniCredit Bulbank

7 Sv. Nedelya Sq.
1000 Sofia, Bulgaria
Tel: +359 2 9232 111

(5) Letter of Acceptance





КОРИДОРИ СРБИЈЕ Д.О.О. БЕОГРАД
Инженерско-архитектонско-градитељско
стапованство

Улица Краља Петра I бр. 11
11000 Београд, Србија
Телефон: +381 (0)11 2601111
Факс: +381 (0)11 2601112
Е-пошта: info@koridori.rs

КОРИДОРИ СРБИЈЕ

No: 1-22/13
Date: 15.01.2013

JV Trace and Mostovik
71 "James Bourchier" blvd. 1407 Sofia
Bulgaria

REFERENCE: Corridor X Highway Project, Construction of Highway E75
Section: Grdelica (Gornje Polje) – Caricina Dolina
LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina
ICB No: CORR.X.E75.EIB.PACK1-LOT2.ICB

SUBJECT: LETTER OF ACCEPTANCE

This is to notify you that your Bid dated January 13, 2012 for execution of the

Construction of Highway E75, Section: Grdelica (Gornje Polje) – Caricina Dolina (LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina, ICB No: CORR.X.E75.EIB.PACK1-LOT2.ICB for the Accepted Contract Amount of the equivalent of

3,828,528,232.75 RSD

(three billion eight hundred twenty eight million five hundred twenty eight thousand two hundred thirty two Serbian Dinars and 75/100),

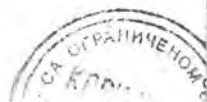
as corrected and modified in accordance with the Instructions to Bidders, is hereby accepted by our Agency.

You are requested to furnish the Performance Security within 28 days in accordance with the Conditions of Contract, using for that purpose one of the Performance Security Forms included in Section IX, Annex to the Particular Conditions - Contract Forms, of the Bidding Document, in the amount of 20% of Accepted Contract Amount following the provisions of the ITB Clause 34.5.

Authorized Signature: [Signature]
Name and Title of Signatory: Mr. Dimitar Đurović, Director
Name of Agency: Koridori Srbije d.o.o. Beograd



Attachment: Contract Agreement



Contract Agreement

THIS AGREEMENT made the _____ day of _____, between Koridori Srbije d.o.o. Beograd, 21 Kralja Petra Street, Belgrade, Serbia (hereinafter "the Employer"), of the one part, and JV Trace and Mostovik, 71 "James Bouchier" blvd. 1407 Sofia, Bulgaria (hereinafter "the Contractor"), of the other part:

WHEREAS the Employer desires that the Works known as **Construction of Highway E75, Section: Grdelica (Gornje Polje) – Caricina Dolina (LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina, ICB No: CORR.E75.EIB.PACK1-LOT2.ICB)** should be executed by the Contractor, and has accepted a Bid by the Contractor for the execution and completion of these Works and the remedying of any defects therein.

The Employer and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.
 - (i) the Clarifying Documents
 - (ii) the Letter of Acceptance
 - (iii) the Letter of Bid
 - (iv) the Addenda Nos. 1-3
 - (v) the Particular Conditions
 - (vi) the General Conditions
 - (vii) the Specification
 - (viii) the Drawings and
 - (ix) the completed Schedules
3. In consideration of the payments to be made by the Employer to the Contractor as indicated in this Agreement, the Contractor hereby covenants with the Employer to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.
4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with the laws of the Republic of Serbia on the day, month and year indicated above.

Signed, Sealed, and Delivered by the said _____
in the presence of: _____

The Common Seal of Koridori Srbije d.o.o. Beograd
was hereunto affixed in the presence of: Mr. DMITAR DUROVIĆ, Director

Signed by _____ (for the Contractor)

Signed by _____ (for the Employer)

(6) Letter of Bid and Confirmation with Modification of Bid

Letter of Technical Bid

Letter of Financial Bid

Confirmation with Modification of Bid

(According to changes presented in the Invitation for opening of Financial Bids)

Letter of Technical Bid



Letter of Technical Bid (Technical Bid Submission Sheet)

Date: 13 January, 2012

ICB No.: CORR.X.E75.EIB.PACK1.ICB

Invitation for Bid No.: CORR.X.E75.EIB.PACK1.ICB

To: Koridori Srbije d.o.o. Beograd, 21 Kralja Petra Street, 11000 Belgrade, Republic of Serbia

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Document, including Addenda issued in accordance with Instructions to Bidders (ITB 8) N^o 1, 2 and 3;
- (b) We offer to execute in conformity with the Bidding Document the following Works:

Construction of Highway E 75, section Grdelica (Gornje Polje) – Caricina Dolina,

LOT 1: Construction of Highway E75, Road and bridges at sub-section Grdelica – Tunnel Predejane

LOT 2: Construction of Highway E75, Road and bridges at sub-section Tunnel Predejane– Caricina Dolina

- (c) Our bid shall be valid for a period of onehundredfifty (150) days from the date fixed for the bid submission deadline in accordance with the Bidding Document, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
- (d) If our bid is accepted, we commit to obtain a performance security in accordance with the Bidding Document;
- (e) We, including any subcontractors or suppliers for any part of the contract, have or will have nationalities from eligible countries, in accordance with ITB 4.2;
- (f) We, including any subcontractors or suppliers for any part of the contract, do not have any conflict of interest in accordance with ITB 4.3;
- (g) We are not participating, as a Bidder or as a subcontractor, in more than one bid in this bidding process in accordance with ITB 4.3, other than alternative offers submitted in accordance with ITB 13;
- (j) We, including any of our subcontractors or suppliers for any part of the contract, have not been declared ineligible by the Bank, under the Employer's country laws or official regulations or by an act of compliance with a decision of the United Nations Security Council;
- (k) We are not a government owned entity/ ~~We are a government owned entity but meet the requirements of ITB 4.5.~~

Bidder to use as appropriate

TRACE
ТРЕЙС ГРУП ХОЛД АА

30/733



(l) We have paid, or will pay the following commissions, gratuities, or fees with respect to the bidding process or execution of the Contract:

Name of Recipient	Address	Reason	Amount
<u>NONE</u>	<u>NONE</u>	<u>NONE</u>	<u>NONE</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

(If none has been paid or is to be paid, indicate "none.")

- (m) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed; and
- (n) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.
- (o) We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf will engage in bribery.

Name TSVETAN TSONEV In the capacity of **Authorized representativ** _____

Signed _____

Duly authorized to sign the bid for and on behalf of **JOINT VENTURE "TRACE MOSTOVIK"**

Dated on 13 day of January , 2012

[Handwritten signature and illegible text]

[Handwritten signature]
TRACE
31/733
ТРЕЙС ГРУП ХОЛДЪНГ

[Circular stamp, partially visible]

Letter of Financial Bid

Letter of Financial Bid (Financial Bid Submission Sheet)

Date: 13 January, 2012

ICB No.: CORR.X.E75.EIB.PACK1.ICB

Invitation for Bid No.: CORR.X.E75.EIB.PACK1.ICB

To: Koridori Srbije d.o.o. Beograd, 21 Kralja Petra Street, 11000 Belgrade, Republic of Serbia

We, the undersigned, declare that:

(h) We have examined and have no reservations to the Bidding Document, including Addenda issued in accordance with Instructions to Bidders (ITB 8) № 1, 2 and 3;

(i) We offer to execute in conformity with the Bidding Document the following Works:

Construction of Highway E 75, section Grdelica (Gornje Polje) – Caricina Dolina,

LOT 1: Construction of Highway E75, Road and bridges at sub-section Grdelica – Tunnel Predejane

LOT 2: Construction of Highway E75, Road and bridges at sub-section Tunnel Predejane– Caricina Dolina

(j) The total price of our Bid, excluding any discounts offered in item (d) below is:

for **LOT 1: Construction of Highway E75, Road and bridges at sub-section Grdelica – Tunnel Predejane** – 4 327 717 721.38 RSD (four three two seven seven one seven seven two one point three eight)

for **LOT 2: Construction of Highway E75, Road and bridges at sub-section Tunnel Predejane– Caricina Dolina** – 4 242 981 034.46 RSD (four two four two nine eight one zero three four point four six)

(k) The discounts offered and the methodology for their application are:

- in the case of winning **LOT 1** we offer discount in the amount of **10%** (ten percent) of the total price of our Bid;

- in the case of winning **LOT 2** we offer discount in the amount of **10%** (ten percent) of the total price of our Bid;

- in the case of winning both **LOT1** and **LOT2** we offer discount in the amount of **13%** (thirteen percent) of the total price of our Bid for **LOT1** and **LOT2**.

(l) Our bid shall be valid for a period of one hundred fifty (150) days from the date fixed for the bid submission deadline in accordance with the Bidding Document, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(m) If our bid is accepted, we commit to obtain a performance security in accordance with the Bidding Document;

(n) We, including any subcontractors or suppliers for any part of the contract, have or will have nationalities from eligible countries, in accordance with ITB 4.2;



(o) We, including any subcontractors or suppliers for any part of the contract, do not have any conflict of interest in accordance with ITB 4.3;

(p) We are not participating, as a Bidder or as a subcontractor, in more than one bid in this bidding process in accordance with ITB 4.3, other than alternative offers submitted in accordance with ITB 13;

(j) We, including any of our subcontractors or suppliers for any part of the contract, have not been declared ineligible by the Bank, under the Employer's country laws or official regulations or by an act of compliance with a decision of the United Nations Security Council;

(k) We are not a government owned entity/ ~~We are a government owned entity but meet the requirements of ITB 4.5;~~¹

(l) We have paid, or will pay the following commissions, gratuities, or fees with respect to the bidding process or execution of the Contract:

Name of Recipient	Address	Reason	Amount
<i>NONE</i>	<i>NONE</i>	<i>NONE</i>	<i>NONE</i>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

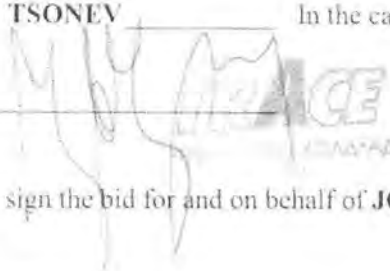
(If none has been paid or is to be paid, indicate "none.")

(m) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed; and

(n) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive;

(o) We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf will engage in bribery.

Name TSVETAN TSONEV In the capacity of **Authorized representative** _____

Signed _____


Duly authorized to sign the bid for and on behalf of **JOINT VENTURE "TRACE MOSTOVIK"**

Dated on 13 day of January, 2012

¹ Bidder to use as appropriate



Confirmation with Modification of Bid

(According to changes presented in the Invitation for opening of Financial Bids)



JV "TRACE MOSTOVIK"

7
15/12

To
Koridor Srbije d.o.o
Attn: Mr. Mihajlo Misic
21 Kralja Petra Street
11000 Belgrade, Serbia
E-mail: procurement@koridorisrbije.rs
Fax: +381 11 32 48 682

2nd July, 2012

REGARDING: Construction of Highway E75, Section Grdelica (Gornje Polje)- Caricina Dolina (LOT 1 and LOT 2), CORR.E75.EIB.PACK1.ICB

SUBJECT: Modification to Financial Bid

Dear Mr. Mihajlo Misic,

JV TRACE MOSTOVIK hereby provides an official Statement, that JV TRACE MOSTOVIK agrees with the changes in the Contract as specified in the letter of Koridori Srbije d.o.o. ref. 3214/12 dated June 20, 2012 (items No. 2, 3, 4 and 5): changes to the tender documents that are necessary.

According to all changes JV TRACE MOSTOVIK hereby modifies its Financial bid for **LOT 1: Construction of Highway E75, Road and bridges at sub-section Grdelica – Tunnel Predejane** and Financial bid for **Lot 2- Construction of Highway E75, Road and bridges at sub-section Tunnel Predejane- Caricina Dolina** as replacing the whole Appendix to Bid for Lot 1 Schedule of Adjustment data- Table A Local Currency, Table B. Foreign Currency (FC) for Lot 1, Table C. Summary of Payment Currencies for Lot 1, and replacing whole Appendix to Bid for Lot 2 Schedule of Adjustment data- Table A Local Currency, Table B. Foreign Currency (FC) for Lot 2, Table C. Summary of Payment Currencies for Lot 2, Cash flow for Lot 1 and Cash flow for Lot 2 with attachments to this letter as follows:

1. Appendix to Bid Schedule of Adjustment Data for Lot 1;
2. Appendix to Bid Schedule of Adjustment Data for Lot 2;
3. Cash flow for Lot 1;
4. Cash flow for Lot 2.

Total price of our bid for Lot 1 and Total price of our bid for Lot 2 remain unchanged.

Attachments:

1. Official Statement that JV TRACE MOSTOVIK agrees with the changes in the contract;
2. Appendix to Bid Schedule of Adjustment Data for Lot 1;
3. Appendix to Bid Schedule of Adjustment Data for Lot 2;
4. Cash flow for Lot 1;
5. Cash flow for Lot 2.

Kind regards,


TSVETAN TSONOV
Authorized Representative
JV TRACE MOSTOVIK



JV "TRACE MOSTOVIK"

STATEMENT

The undersigned Mr. Tsvetan Ivanov Tsonev, Identity Card № 626250362 issued on 09.10.2009 by Ministry Of Interior, Sofia, personal № 6302245869, authorized representative of "JV TRACE MOSTOVIK", Republic of Bulgaria participator in bid for construction of project:

CONSTRUCTION OF HIGHWAY E75, SECTION GRDELICA (GORNJE POLJE)- CARICINA DOLINA

LOT 1: CONSTRUCTION OG HIGHWAY E75, ROAD AND BRIDGES AT SUB-SECTION GRDELICA- TUNNEL PREDEJANE

LOT 2: CONSTRUCTION OG HIGHWAY E75, ROAD AND BRIDGES AT SUB-SECTION TUNNEL PREDEJANE- CARICINA DOLINA

ICB NO.: CORR.X.E75.EIB.PACK1-LOT2.ICB

with Employer Koridor Srbije d.o.o.,

"TRACE MOSTOVIK" hereby provides an official Statement, that **JV TRACE MOSTOVIK** agrees with the changes in the Contract as specified in the letter of Koridori Srbije d.o.o, ref. 3214/12 dated June 20, 2012 (items No. 2, 3, 4 and 5): changes to the tender documents that are necessary:

ITEM No. 2

Particular conditions of contract, part a contract data, performance security, sub- clause 4.2., following text shall be added: "Acceptable Bank to the Employer means any Bank whose rating is minimum "6 (investment threshold- acceptable risk)" (here and after "minimum rating") according to the Agency for rating assessment COFACE. If during execution of the Contract the rating of the Bank from which the Contractor provided the Security falls below the minimum rating, the Contractor shall, within 28 days starting from the issue of notice by the Employer, substitute such bank Security with a new Security issued by the Bank with minimum rating. Until such substitution of Security is provided to the Employer all payments under the contract shall be withheld. Such substitution is not eligible for any change of cost or price. Bank rating shall be verified by the Employer on quarterly base."

ITEM No. 3

Particular Condition of Contract, Part A Contract Data, Total Advance Payment, Sub-clause 14.2, following text shall be added: "Acceptable Bank to the Employer means any Bank whose rating is minimum "6 (investment threshold- acceptable risk)" (here and after "minimum rating") according to the Agency for rating assessment COFACE. If during execution of the Contract the rating of the Bank from which the Contractor provided the Security falls below the minimum rating, the Contractor shall, within 28 days starting from the issue of notice by the Employer, substitute such bank Guarantee with a new Guarantee issued by the Bank with minimum rating. Until such substitution of Guarantee is provided to the Employer all payments under the contract shall be withheld. Such substitution is not eligible for any change of cost or price. Bank rating shall be verified by the Employer on quarterly base."

ITEM No. 4

Particular Conditions of Contract, Part B Specific Provisions, The Contract Price, Sub-Clause 14.1 shall be replaced with the following: "Particular Conditions of Contract, Part B Specific Provisions, the contract Price, Sub-Clause 14.1 (b) Replace the Sub- Clause with the following paragraph: The prices in Bill of Quantities include all duties, taxes and other levies excluding VAT (Value Added Taxes). Companies are not exempted form taxation, duties and other levies. The Contractor shall pay cost of custom duties, other

JV "TRACE MOSTOVIK"

import duties and other impositions, levies from their own proceeds. The Contract is VAT excluded, and the Contract Price shall be not adjust for any of these cost except as stated in Sub-Clause 13.7 [Adjustment for Changes in Legislations]."

ITEM No. 5

Particular Conditions of Contract, Part B Specific Provisions, The Contract Price, Sub-Clause 14.1 (e) shall be added: "not applicable".

The present statement is issued in compliance with letter ref. 3214/12 dated June 20, 2012 and in compliance with letter ref 3329/12 dated 25 June, 2012 received by Koridori Srbije d.o.o.

TSVETAN TSONEV

Authorized Representative
JV TRACE MOSTOVIK



Date: 2nd July, 2012

Appendix to Bid

For LOT1

Schedule of Adjustment Data

[In Tables A below, the Bidder shall (a) indicate its amount of local currency payment, and (b) derive its proposed weightings for local currency payment. In the case of very large and/or complex works contracts, it may be necessary to specify several families of price adjustment formulae corresponding to the different works involved.]

Table A. Local Currency

Index code	Index description	Source of index	Base value and date	Bidder's related currency amount	Bidder's proposed weighting
	Nonadjustable	-	-	-	A: 0.10
	Labour	*	28 days prior to bid submission date	34 033.70 RSD/month	B: 0.15
	Quarried aggregates	*		993.40 RSD/t	C: 0.15
	Cement	*		8 279.50 RSD/t	D: 0.15
	Reinforcing steel	*		66 236.50 RSD/t	E: 0.15
	Bitumen	*		66 236.50 RSD/t	F: 0.12
	Diesel fuel	*		110.60 RSD/l	G: 0.18
	Total				1.00

Note: Bidder's proposed weighting should be consistent with the works.

Index description	Source of index
Labour	Statistical Office of the Republic Serbia, Communication ZP11 (Statistics of Earnings) - Table 1, Average gross salaries and wages per employee - Construction
Quarried aggregates	Statistical Office of the Republic Serbia, Communication CN 20 - Indices of producers prices of manufactured products in Republic of Serbia, Other mining and quarrying
Cement	Statistical Office of the Republic Serbia, Communication CN 20 - Indices of producers prices of manufactured products in Republic of Serbia, Materials for incorporating in construction
Reinforcing steel	Statistical Office of the Republic Serbia, Communication CN 20 - Indices of producers prices of manufactured products in Republic of Serbia, Manufacture of basic metals
Bitumen	Statistical Office of the Republic Serbia, Communication CN 20 - Indices of producers prices of manufactured products in Republic of Serbia, Manufacture of coke and refined petroleum products
Diesel fuel	Statistical Office of the Republic Serbia, Communication CN 20 - Indices of producers prices of manufactured products in Republic of Serbia, Liquid fuels and lubricants

* Source of index


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Appendix to Bid

For LOT2

Schedule of Adjustment Data

[In Tables A below, the Bidder shall (a) indicate its amount of local currency payment, and (b) derive its proposed weightings for local currency payment. In the case of very large and/or complex works contracts, it may be necessary to specify several families of price adjustment formulae corresponding to the different works involved.]

Table A. Local Currency

Index code	Index description	Source of index	Base value and date	Bidder's related currency amount	Bidder's proposed weighting
	Nonadjustable	-	-	-	A: 0.10
	Labour	*	28 days prior to bid submission date	34 033.70 RSD/month	B: 0.15
	Quarried aggregates	*		993.40 RSD/t	C: 0.15
	Cement	*		8 279.50 RSD/t	D: 0.15
	Reinforcing steel	*		66 236.50 RSD/t	E: 0.15
	Bitumen	*		66 236.50 RSD/t	F: 0.12
	Diesel fuel	*		110.60 RSD/l	G: 0.18
Total					1.00

Note: Bidder's proposed weighting should be consistent with the works.

Index description	Source of index
Labour	Statistical Office of the Republic Serbia, Communication ZPII (Statistics of Earnings) - Table I: Average gross salaries and wages per employee - Construction
Quarried aggregates	Statistical Office of the Republic Serbia, Communication CN 20 - Indices of producers prices of manufactured products in Republic of Serbia: Other mining and quarrying
Cement	Statistical Office of the Republic Serbia, Communication CN 20 - Indices of producers prices of manufactured products in Republic of Serbia: Materials for incorporating in construction
Reinforcing steel	Statistical Office of the Republic Serbia, Communication CN 20 - Indices of producers prices of manufactured products in Republic of Serbia: Manufacture of basic metals
Bitumen	Statistical Office of the Republic Serbia, Communication CN 20 - Indices of producers prices of manufactured products in Republic of Serbia: Manufacture of coke and refined petroleum products
Diesel fuel	Statistical Office of the Republic Serbia, Communication CN 20 - Indices of producers prices of manufactured products in Republic of Serbia: Liquid fuels and lubricants

* Source of index

JOINT VENTURE "TRACE MOSTOVIK"

Cash Flow

FOR LOT 1: Construction of Highway E75, Road and bridges at sub-section Grdelica – Tunnel Predejane

Month	Value of work	Advance payment	Advance	Payments to Contractor	
	[RSD]	[RSD]	repayment	Monthly total	Cumulated value
	[RSD]	[RSD]	[RSD]	[RSD]	[RSD]
1	77 959 512,83	393 428 883,76		471 388 396,59	471 388 396,59
2	130 719 532,14			130 719 532,14	602 107 928,73
3	163 111 254,00			163 111 254,00	765 219 182,73
4	148 149 519,52			148 149 519,52	913 368 702,25
5	105 941 505,92			105 941 505,92	1 019 310 208,17
6	106 874 394,41			106 874 394,41	1 126 184 602,58
7	113 694 983,39			113 694 983,39	1 239 879 585,97
8	142 625 327,33			142 625 327,33	1 382 504 913,30
9	140 032 899,36			140 032 899,36	1 522 537 812,66
10	168 870 938,16		33 774 187,63	135 096 750,53	1 657 634 563,19
11	131 974 562,83		26 394 912,57	105 579 650,26	1 763 214 213,45
12	277 345 402,54		55 469 080,51	221 876 322,03	1 985 090 535,49
13	298 099 483,74		59 619 896,75	238 479 586,99	2 223 570 122,48
14	170 966 706,85		34 193 341,37	136 773 365,48	2 360 343 487,96
15	172 443 366,74		34 488 673,35	137 954 693,39	2 498 298 181,35
16	189 630 326,07		37 926 065,21	151 704 260,86	2 650 002 442,21
17	163 785 556,84		10 917 205,48	152 868 351,36	2 802 870 793,57
18	213 339 035,79		10 917 205,48	202 421 830,31	3 005 292 623,88
19	168 748 988,40		10 917 205,48	157 831 782,92	3 163 124 406,80
20	220 443 108,52		10 917 205,48	209 525 903,04	3 372 650 309,84
21	249 770 044,20		10 917 205,48	238 852 838,72	3 611 503 148,56
22	247 843 579,08		10 917 205,48	236 926 373,60	3 848 429 522,16
23	109 194 898,60		10 917 205,48	98 277 693,12	3 946 707 215,28
24	22 723 910,36		35 142 288,02	-12 418 377,66	3 934 288 837,62
TOTAL	3 934 288 837,62	393 428 883,76	393 428 883,77	3 934 288 837,62	


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JOINT VENTURE "TRACE MOSTOVIK"

Cash Flow

FOR LOT 2: Construction of Highway E75, Road and bridges at sub-section Tunnel Predejane- Caricina Dolina

Month	Value of work	Advance payment	Advance	Payments to Contractor	
	[RSD]	[RSD]	repayment [RSD]	Monthly total [RSD]	Cumulated value [RSD]
1	45 342 270,32	385 725 548,59		431 067 818,91	431 067 818,91
2	31 624 300,79			31 624 300,79	462 692 119,70
3	54 197 240,40			54 197 240,40	516 889 360,10
4	71 242 851,10			71 242 851,10	588 132 211,20
5	110 722 203,30			110 722 203,30	698 854 414,50
6	142 962 500,76			142 962 500,76	841 816 915,26
7	171 616 690,18			171 616 690,18	1 013 433 605,44
8	204 229 532,28			204 229 532,28	1 217 663 137,72
9	211 524 846,10			211 524 846,10	1 429 187 983,82
10	272 406 061,09		54 481 212,22	217 924 848,87	1 647 112 832,69
11	242 960 727,10		48 592 145,42	194 368 581,68	1 841 481 414,37
12	299 693 002,77		59 938 600,55	239 754 402,22	2 081 235 816,59
13	259 946 798,66		51 989 359,73	207 957 438,93	2 289 193 255,51
14	235 896 412,68		47 179 282,54	188 717 130,14	2 477 910 385,66
15	229 155 676,20		45 831 135,24	183 324 540,96	2 661 234 926,62
16	291 853 683,22		58 370 736,64	233 482 946,58	2 894 717 873,19
17	213 744 533,83		19 343 076,24	194 401 457,59	3 089 119 330,78
18	270 818 326,33			270 818 326,33	3 359 937 657,11
19	189 365 236,32			189 365 236,32	3 549 302 893,43
20	101 925 477,95			101 925 477,95	3 651 228 371,38
21	87 102 369,00			87 102 369,00	3 738 330 740,38
22	78 164 627,95			78 164 627,95	3 816 495 368,33
23	37 599 969,38			37 599 969,38	3 854 095 337,71
24	3 160 148,16			3 160 148,16	3 857 255 485,87
TOTAL	3 857 255 485,87	385 725 548,59	385 725 548,58	3 857 255 485,87	

(7) Appendix to Bid

Schedule of Adjustment Data (Table A)



Appendix to Bid
Schedule of Adjustment Data
Table A. Local Currency

Section: Grdelica (Gornje Polje) – Caricina Dolina
 LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina

Index code	Index description	Source of index	Base value and date December 19, 2011	Bidder's proposed weighting
	Nonadjustable	—		A: 0.10
	Labour	Statistical Office of the Republic Serbia, Communication ZP11 (Statistics of Earnings) – Table 1: Average gross salaries and wages per employee – Construction	48.357 (X 2011)	B: 0.15
	Quarried aggregates	Statistical Office of the Republic Serbia, Communication CN 20 – Indices of producers prices of manufactured products in Republic of Serbia: Other mining and quarrying	102.8 XII 2010=100	C: 0.15
	Cement	Statistical Office of the Republic Serbia, Communication CN 20 – Indices of producers prices of manufactured products in Republic of Serbia: Materials for incorporating in construction	100.5 XII 2010=100	D: 0.15
	Reinforcing steel	Statistical Office of the Republic Serbia, Communication CN 20 – Indices of producers prices of manufactured products in Republic of Serbia: Manufacture of basic metals	88.2 XII 2010=100	E: 0.15
	Bitumen	Statistical Office of the Republic Serbia, Communication CN 20 – Indices of producers prices of manufactured products in Republic of Serbia: Manufacture of coke and refined petroleum products	114.0 XII 2010=100	F: 0.12
	Diesel fuel	Statistical Office of the Republic Serbia, Communication CN 20 – Indices of producers prices of manufactured products in Republic of Serbia: Liquid fuels and lubricants	114.5 XII 2010=100	G: 0.18
Total				1.00

Base Date is December 19, 2011 (28 days prior to the latest date for bid submission) and selling rate on Base Date is 1 EUR=102.0581 RSD.

Note: Bidder's proposed weighting should be consistent with the works.

**(8) Addenda Nos. 1-3 and
Employer's letter No. 3214/12 dated June 20, 2012**

Addenda Nos. 1-3

Employer's letter No. 3214/12 dated June 20, 2012

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Addenda Nos. 1-3



Prospective Bidders

REFERENCE: Serbia, Corridor X Highway Project, Construction of Highway E75,
Section: Grdelica (Gornje Polje)-Caricina Dolina, ICB No:
CORRX.E75.EIB.PACK1.ICB

SUBJECT: Addendum No.1 of Bidding Documents

Dear Madam/Sir,

Due to numerous received requests for clarifications of bidding documents and queries for time extension, in order to allow Bidders to prepare and submit qualitative bids, Employer is extending the deadline for the submission of bids for Procurement of Construction of Highway E75, Section: Grdelica (Gornje Polje)-Caricina Dolina, ICB No: CORRX.E75.EIB.PACK1.ICB in accordance with ITB 22.2 as follows:

ITB clause 22.1, referring to deadline for submission of bids should be replaced to read as follows:

Deadline for submission of bids is:

Date: January 16, 2012

Time: 12:00 hours, local time (GMT+1)

Employer's address for bid submission purposes shall remain the same.

ITB clause 25.1, referring to bid opening should be replaced to read as follows:

The bid opening (only the technical bid-Envelope No. 1) shall take place at:

Street Address: 11, Nemanjina Street, floor IV, room 141

City: Belgrade

Country: Republic of Serbia

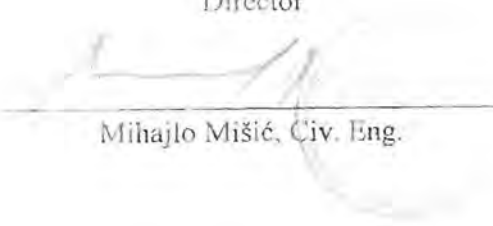
Date: January 16, 2012

Time: 13:00 hours, local time (GMT+1)

Please confirm in writing receipt of Addendum No.1.

Kind regards.

Director



Mihajlo Mišić, Civ. Eng.



Prospective Bidders

REFERENCE: Serbia, Corridor X Highway Project, Construction of Highway E75, Section: Grdelica (Gornje Polje) – Caricina Dolina, LOT 1: Road and bridges from Grdelica to Tunnel Predejane and LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina, ICB No: CORR.X.E75.EIB.PACK1.ICB

SUBJECT: Addendum No.2 of Bidding Documents

Dear Madam/Sir,

In accordance with ITB item 8 Amendment to Bidding Documents, the Employer hereby issues the Addendum No. 2 to the Bidding Documents for Procurement of Construction of Highway E75, Section: Grdelica (Gornje Polje) – Caricina Dolina, LOT 1: Road and bridges from Grdelica to Tunnel Predejane and LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina, ICB No: CORR.X.E75.EIB.PACK1.ICB.

Addendum refers to Volume 1, Part 1 Bidding Procedures (Section IV), Part 2 Works Requirement (Scope of Works and Specification), Part 3 Drawings and Volume 2, Section VIII.

Volume 1

Part 1 – Bidding Procedures

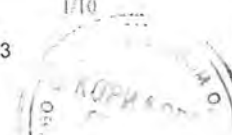
Section IV. Bidding Forms

Bill of Quantities

LOT 1

1. Complete BoQ for Civil Engineering Design, 01.01 Highway Alignment (page 1-72 and 1-73) shall be replaced with following BoQ:

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
01.01.01.		PRELIMINARY WORKS				
01.01.01.01	2.1	Geotechnical investigations		<i>lump sum</i>		
01.01.01.02	2.4	Removal of bushes and trees	km ²	6.10		
		a) cutting bushes up to Ø10 cm: 13346 m ²				
		b) cutting bushes Ø10 - Ø25 cm: 16312 m ²				
		c) cutting trees Ø10 - Ø20 cm: 3017 pcs.				
		d) cutting trees Ø20 - Ø40 cm: 1379 pcs.				
		e) uprooting stumps Ø10 - Ø20 cm: 3017 pcs.				
		f) uprooting stumps Ø20 - Ø40 cm: 1379 pcs.				
01.01.01.03	2.5.	Demolition of buildings	m ²	356.00		
01.01.01.04	2.7	Demolition of the existing pavement	m ²	2.730.00		
TOTAL PRELIMINARY WORKS						
01.01.02.		EARTH WORKS				
01.01.02.01	3.1.	Topsil stripping		<i>(price included in the price of excavation and embankment)</i>		
01.01.02.02	3.2	Bulk excavation and transport (including topsoil stripping and stockpiling, excavation of soil of low bearing capacity, topsoiling and grassing)				
		Excavation in III and IV category soil with loading, transport and unloading of material from the excavation or borrow pit				
		up to 60 m	m ³	12.342.00		
		up to 500 m	m ³	52.978.00		
		500 m - 1000 m	m ³	120.595.00		
		1000 m - 3000 m	m ³	66.481.00		
		Excavation in V and VI category soil with loading, transport and unloading of material from the excavation or borrow pit				
		up to 60 m	m ³	19.196.00		
		up to 500 m	m ³	66.110.00		
		500 m - 1000 m	m ³	190.523.00		
		1000 m - 3000 m	m ³	101.296.00		
01.01.02.03	3.3	Subsoil finishing	m ²	129.670.00		
01.01.02.04	3.4	Construction of embankment (including topsoil stripping, construction of stepped side cuts, shoulder central part, leveling, topsoiling and grassing of embankment slopes)				
		a) topsoil stripping 39995 m ³	m ³	332.771.00		
		b) surplus topsoil 21863 m ³				



Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
01.01.02.05	3.6.1.	c) stepped side cuts: 1907 m ³ d) shoulder central part: 4298 m ³ e) topsoiling of slopes: 75349 m ² f) topsoiling and grassing of shoulders: 15313 m ² g) lining with stone the embankment slopes: 745 m ² h) lining of slope with stone: 2887 m ³ Substitution of soil of low bearing capacity with sandy gravel layer	m ³	7.658,00		
TOTAL EARTH WORKS						
01.01.03.		DRAINAGE AND DEWATERING				
01.01.03.01	4.3	Drainage channels Excavation	m ³	4.108,00		
		Lining of channels of MB 30 concrete onto 5-10 cm thick sandy gravel bed.	m ²	4.142,00		
		-Segmented lined channel	m ²	1.166,00		
		-Trapezoidal channel				
		Procurement and installation of drain channels for controlled drainage of run-off. Drain channel dimensions: 100x100x20 cm. It shall be installed onto sandy gravel bed, fully in accordance with designed details.	m ³	3.305,00		
01.01.03.02	4.3	Procurement and installation of drain channels for controlled water drainage down the embankment slope	m ³	644,00		
		Casting of 20 cm thick layer of MB 20 concrete over shoulder onto 5-10 cm thick sand gravel bed	m ²	5.622,00		
TOTAL DRAINAGE AND DEWATERING						
01.01.04.		SUB-BASES				
01.01.04.01	AS-3.4 additions 1 specifications	Sandy gravel materials - placing subgrade layer	m ³	134.392,00		
01.01.04.02	6.2 AS-6.2.2 additions 1 specifications	Procurement and placing of 0/63 mm crushed stone as rolled sub-base of pavement structure. Broken stone layer shall be placed onto finished subgrade accepted by the Supervising Engineer. Stone of this size shall meet requirements of SRPS U.E. 9020. Payment per 1 m ³ of placed material including procurement and transport • d=70 cm	m ³	77.485,00		
01.01.04.03	AS-6.2.2 additions 1 specifications	Placing and rolling the sub-base of 0/31.5 mm crushed stone onto rolled subgrade accepted by the Engineer. Rolling shall be performed until even surface is achieved according to designed gradients and crossfalls with tolerance of ±1 cm. Thickness: d=10 cm, d=18 cm, d=30 cm, d=38 cm	m ³	38.229,00		
TOTAL SUB-BASES						
01.01.05.		SUPERSTRUCTURE				
01.01.05.01	7.1	Procurement and placing of 18/24 cm curbs	m ³	3.707,00		
01.01.05.02	7.2	Procurement and installation of 90 cm concrete gutters	m ³	4.663,00		
TOTAL SUPERSTRUCTURE						
01.01.06.		ASPHALT PAVEMENT				
01.01.06.01	9.3	Placing of bituminous base course BNS 22sA (Bit 60) consisting of stone aggregate, d= 8 cm	m ³	25.468,00		
		d= 8+8= 16 cm	m ²	76.914,00		
01.01.06.03	9.5	Placing of 4 cm thick wearing course made of skeleton mastic asphalt SMA 11s	m ²	102.383,00		
01.01.06.04	9.6	Placing of 6 cm thick wearing course made of asphalt concrete AB 11. Shoulder shall be stabilized at lower pavement side, d=6cm	m ²	3.267,00		
TOTAL ASPHALT PAVEMENT						
01.01.07.		ROAD EQUIPMENT				
01.01.07.01	12.6.7.	Procurement and installation of 1,5 m high road fence made of galvanized mesh on poles of 40x40 mm steel boxes	m ³	9.872,00		
TOTAL ROAD EQUIPMENT						

2. Complete BoQ for Civil Engineering Design, 01.04 Pipe Culverts (page 1-79) shall be replaced with following BoQ:

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
01.04.01.		EARTH WORKS				
01.04.01.01	3.5	Wedges next to structures	m ³	3 228,50		
TOTAL EARTH WORKS:						
01.04.02.		STRUCTURES, CULVERTS				
01.04.02.01	11.3	Small slab-top and pipe culverts				
01.04.02.02	11.3	Excavation in III and IV category soil for culverts				
		a) 30% hand excavation	m ³	1 037,00		
		b) 70% mechanical excavation	m ³	2 419,00		
		a) demolition of the existing pipes/structure	m ³	45,00		
01.04.02.03	11.3	Bed of sandy gravel materials, 20 cm thick - price includes procurement and placing of sandy gravel material under the pipes	m ²	249,00		
01.04.02.04	11.3	Concrete work MB 30	m ³	938,00		
01.04.02.05	11.3	Prefabricated concrete pipe culverts				
		Ø1000 mm	m ³	37,00		
		Ø1200 mm	m ³	86,00		
		Ø1600 mm	m ³	190,00		
		Ø2000 mm	m ³	158,00		
01.04.02.06	11.3	Waterproofing of top surfaces of pipe culverts with two paper layers and three coats of bitumen solution over bituminized paper. Payment per 1 m ² of unfolded area.	m ²	2 681,00		
01.04.02.07	11.3	Construction of 20 cm thick paving made of broken stone onto 10 cm thick sand layer with infill of 1:3 cement mortar mix near culverts. Payment per 1 m ² of finished paving.	m ²	67,00		
01.04.02.08	11.3	Procurement and fitting of metallic gratings on manholes	pcs	1,00		
TOTAL STRUCTURES, CULVERTS:						

3. Complete BoQ for 11. Traffic-technical and service equipment for roads, 11.03. Traffic Equipment - delivery + full installation (page 1-139) shall be replaced with following BoQ:

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
11.03.		TRAFFIC EQUIPMENT - delivery + full installation				
OPEN SECTION						
11.3.01		Double sided distance barrier, H2W7 assembly-type	m	96		
11.3.02		Single sided distance barrier, H1W4* on the road	m	1432		
11.3.03		Single sided distance barrier, H1W5	m	10944		
11.3.04	12.6	Sleeves for single sided distance barrier, H1W5 assembly-type	m	256		
11.3.05		Sleeves for single sided distance barrier, H1W5 on object	m	940		
11.3.06		Single sided distance barrier, H2W3	m	8		
11.3.07		Single sided distance barrier, H2W4	m	2840		
Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
11.3.08		Single sided distance barrier, H2W4* on object	m	4616		
11.3.09		Single sided barrier	m	32		
11.3.10		Single sided distance barrier, H1W5-H2W4 crossing	pcs	50		
11.3.11	12.6	Direction sign	pcs.	70		
11.3.12		Retroreflecting stud on safety barrier	pcs	1250		
11.3.13		Oblique ending of single-sided distance barrier, 12m	pcs	19		
TRAFFIC EQUIPMENT						

4. 12. Technical infrastructure, 12.09. Displacement and protection of lineside telecommunication cables, 12.09.01 Collision 1, item no. 12.09.01.01. Material, item no. 12.09.01.01.01 (page 1-152), work description shall be replaced with following "One STA 3x4x1,2VF+8x4x1,2NF+12x4x0,9NF cable, with 55 mm diameter".

5. 12. Technical infrastructure, 12.09. Displacement and protection of lineside telecommunication cables, 12.09.01 Collision 1, item no. 12.09.01.01. Material, item no. 12.09.01.01.03 (page 1-152), work description shall be replaced with following one "PNK 3x10mm²".

LOT 2

6. Complete BoQ for Civil Engineering Design, 01.01. Highway Alignment (page 1-164, 1-165) shall be replaced with following BoQ:

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
01.01.01. PRELIMINARY WORKS						
01.01.01.01	2.1	Geotechnical investigations		lump sum		
01.01.01.02	2.4	Removal of bushes and trees a) cutting bushes up to Ø10 cm: 10064 m ² b) cutting bushes Ø10 - Ø25 cm: 8405 m ² c) cutting trees Ø10 - Ø20 cm: 2275 pcs. d) cutting trees Ø20 - Ø40 cm: 1040 pcs. e) uprooting stumps Ø10 - Ø20 cm: 2275 pcs. f) uprooting stumps Ø20 - Ø40 cm: 1040 pcs.	km ³	4.60		
01.01.01.03.	2.5.	Demolition of buildings	m ²	1 549.00		
01.01.01.04	2.7.	Demolition of the existing pavement	m ²	5 145.00		
TOTAL PRELIMINARY WORKS:						
01.01.02. EARTH WORKS						
01.01.02.01	3.1.	Topsoil stripping		<i>(price included in the price of excavation and embankment)</i>		
01.01.02.02	3.2	Bulk excavation and transport (including topsoil stripping and stockpiling, excavation of soil of low bearing capacity, topsoiling and grassing) Excavation in III and IV category soil with loading, transport and unloading of material from the excavation or borrow pit up to 60 m up to 500 m 500 m - 1000 m 1000 m - 3000 m Excavation in V and VI category soil with loading, transport and unloading of material from the excavation or borrow pit up to 60 m up to 500 m 500 m - 1000 m 1000 m - 3000 m	m ³	7 365.00 31 614.00 71 963.00 39 671.00 6 259.00 21 554.00 62 116.00 33 025.00		
01.01.02.03.	3.3	Subsoil finishing	m ²	99 707.00		
01.01.02.04.	3.4.	Construction of embankment (including topsoil stripping, construction of stepped side cuts, shoulder central part, leveling, topsoiling and grassing of embankment slopes) a) topsoil stripping: 22659 m ³ b) surplus topsoil: 11737 m ³ c) stepped side cuts: 3461 m ³ d) shoulder central part 2528 m ³ e) topsoiling of slopes: 45674 m ² f) topsoiling and grassing of shoulders: 8934 m ² g) lining with stone the embankment slopes: 1889 m ³ h) lining of slope with stone : 620 m ³	m ³	178 902.00		
01.01.02.05	3.6.1.	Substitution of soil of low bearing capacity with sandy gravel layer	m ³	444.00		
TOTAL EARTH WORKS:						
01.01.03. DRAINAGE AND DEWATERING						
01.01.03.01.	4.3.	Drainage channels Excavation Lining of channels of MB 30 concrete onto 5-10 cm thick sandy gravel bed. -Segmented lined channel -Trapezoidal channel	m ³ m ² m ²	3 092.00 2 595.00 3 577.00		
		Procurement and installation of drain channels for controlled drainage of run-off. Drain channel dimensions: 100x100x20 cm. It shall be installed onto sandy gravel bed, fully in accordance with designed details	m ³	880.00		
		Procurement and installation of drain channels for controlled water drainage down the embankment slope.	m ³	436.00		
01.01.03.02	4.3.	Casting of 20 cm thick layer of MB 20 concrete over shoulder onto 5-10 cm thick sand gravel bed.	m ²	3 943.00		
TOTAL DRAINAGE AND DEWATERING:						
01.01.04. SUB-BASES						
01.01.04.01	AS-3.4 additional specifications	Sandy gravel materials - placing subgrade layer	m ²	94 075.00		



Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
01.01.04.02	6.2 AS-6.2.2 additional specifications	Procurement and placing of 0/63 mm crushed stone as rolled sub-base of pavement structure. Broken stone layer shall be placed onto finished subgrade accepted by the Supervising Engineer. Stone of this size shall meet requirements of SRPS U1 9020. Payment per 1 m ³ of placed material including procurement and transport. d=70 cm	m ³	61 982,00		
01.01.04.03	AS-6.2.2 additional specifications	Placing and rolling the sub-base of 0/31.5 mm crushed stone onto rolled subgrade accepted by the Engineer. Rolling shall be performed until even surface is achieved according to designed gradients and crossfalls with tolerance of ± 1 cm. Thickness: d=10 cm, d=18 cm, d=30 cm, d=38 cm	m ³	27 743,00		
TOTAL SUB-BASES:						
Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
01.01.05. SUPERSTRUCTURE						
01.01.05.01	7.1	Procurement and placing of 18/24 cm curbs	m	2 933,00		
01.01.05.02	7.2	Procurement and installation of 90 cm concrete gutters	m	3 641,00		
TOTAL SUPERSTRUCTURE:						
01.01.06. ASPHALT PAVEMENT						
01.01.06.01	9.3	Placing of bituminous base course BNS 22sA (Bit 60) consisting of stone aggregate d= 8 cm	m ²	17 719,00		
		d= 8+8= 16 cm	m ²	53 509,00		
01.01.06.03	9.5	Placing of 4 cm thick wearing course made of skeleton mastic asphalt SMA 11s	m ²	71 227,00		
01.01.06.04	9.6	Placing of 6 cm thick wearing course made of asphalt concrete AB 11. Shoulder shall be stabilized at lower pavement side d=6 cm	m ²	529,00		
TOTAL ASPHALT PAVEMENT:						
01.01.08. ROAD EQUIPMENT						
01.01.07.01	12.6.7	Procurement and installation of 1.5 m high road fence made of galvanized mesh on poles of 40x40 mm steel boxes	m	6 681,00		
TOTAL ROAD EQUIPMENT:						

7. Civil Engineering Design, 01.03.05. Detour of M1 road, 01.03.05.05. Superstructure, item No. 01.03.05.05.01 (page 1-169), text "70 cm" shall be replaced with text "90 cm".

8. Complete BoQ for Civil Engineering Design, 01.04 Pipe Culverts (page 1-174) shall be replaced with following BoQ:

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
01.04.01. EARTH WORKS						
01.04.01.01	3.5	Wedges next to structures	m ³	3 175,50		
TOTAL EARTH WORKS:						
01.04.02. STRUCTURES, CULVERTS						
01.04.02.01	11.3	Small slab-top and pipe culverts				
01.04.02.02	11.3	Excavation in III and IV category soil for culverts				
		a) 30% hand excavation	m ³	2 790,00		
		b) 70% mechanical excavation	m ³	6 510,00		
		a) demolition of the existing pipes/structure	m ³	222,00		
01.04.02.03	11.3	Bed of sandy gravel materials, 20 cm thick - price includes procurement and placing of sandy gravel material under the pipes	m ²	257,00		
01.04.02.04	11.3	Concrete work, MB 30	m ³	946,00		
01.04.02.05	11.3	Prefabricated concrete pipe culverts:				
		Ø1600 mm	m	412,50		
		Ø2000 mm	m	77,00		
01.04.02.06	11.3	Waterproofing of top surfaces of pipe culverts with two paper layers and three coats of bitumen solution over bituminized paper. Payment per 1 m ² of unfolded area.	m ²	2 889,00		
01.04.02.07	11.3	Construction of 20 cm thick paving made of broken stone onto 10 cm thick sand layer with infill of 1:3 cement mortar mix near culverts. Payment per 1 m ² of finished paving.	m ²	100,00		
01.04.02.08	11.3	Procurement and fitting of metallic gratings on manholes	pcs	3,00		
TOTAL STRUCTURES, CULVERTS:						

9. 07.20. Supporting structure of reinforced earth, 07.20.09 Reinforcement Works, item no. 07.20.09.01 (page 1-187) unit of measurement "m³" shall be replaced with "kg".

10. 07.22. Supporting structure made of walls and piles, 07.22.15 Sundries, item no. 07.22.15.01 (page 1-191), T.S. reference "11.1.5" shall be replaced with T.S. "11.5".

11. 07.M3. Retaining wall M3 leftwards, 07.M3.05 Sundries, item no. 07.M3.05.01 (page 1-199) shall be deleted.

12. 08.16. Top Slab Culvert at km 884+067.303, 08.16.02. Concrete, item no. 08.16.02.01 (page 1-220), unit of measurement "m²" shall be replaced with "m³".
13. 08.17. Slab Top Culvert at km 884+815.865, 08.17.02. Concrete, item no. 08.17.02.01 (page 1-222), unit of measurement "m²" shall be replaced with "m³".
14. 08.17. Inlect Structures at km 884+815.865, 08.17.02. Concrete, item no. 08.17.02.01 (page 1-223), unit of measurement "m²" shall be replaced with "m³".
15. 08.22. Top Slab Culvert at km 0+112.53, 08.22.02. Concrete, item no. 08.22.02.01 (page 1-232), unit of measurement "m²" shall be replaced with "m³".
16. Complete BoQ for 11. Traffic-technical and service equipment for roads, 11.03. Traffic Equipment - delivery + full installation, Open section (page 1-255) shall be replaced with following BoQ:

No.	T.S	Work description	Unit	Quantity	Unit price	Total
11.03. TRAFFIC EQUIPMENT - delivery + full installation						
OPEN SECTION						
11.3.01	12.6	Double sided distance barrier H2W7 assembly-type	m	48		
11.3.02		Single sided distance barrier H1W4* on the road	m	424		
11.3.03		Single sided distance barrier, H1W5	m	7172		
11.3.04		Single sided distance barrier, H2W4	m	2250		
11.3.05						
		Single sided distance barrier H2W4* on the structure	m	4096		
11.3.06		Single sided barrier	m	16		
11.3.07		Single sided distance barrier H1W5-H2W4 crossing	pcs	28		
11.3.08		Direction sign	pcs	34		
11.3.09	Retroreflecting stud on safety barrier	pcs	500			
No.	T.S	Work description	Unit	Quantity	Unit price	Total
11.3.10		Oblique ending of single-sided distance barrier, 12m	pcs	18		
OPEN SECTION						

Section IV. Bidding Forms

17. Bidders Qualification, Form EXP - 2(b-1), page 1-304, after the table for Earthworks and rock excavation, following table shall be added:

Embankment Construction	Year / Quantity performed by the Bidder (m ³ /year)				
	2006	2007	2008	2009	2010
Project name					
...					
...					
Total:					

Part 2 Works Requirement, Scope of Works, LOT 1

1.3. Results of Traffic, Surveying, Hydrological and Geotechnical Investigations, 1.3.3 Hydrological Investigations:

18. 1.3.3.1 Hydrological considerations and drainage concept (page 1-309), sentence starting with "On this highway section as well as on the entire length from Leskovac ..." shall be replaced with following "Along this motorway section as well as along the whole route from Leskovac to border with BYRM roadway runoff will be subjected to treatment prior to discharge into natural river and other streams. Contaminated water will thus be treated to a predefined degree of purity in oil separators prior to its discharge into river and brooks."
19. 1.3.3.3 Design considerations (page 1-310), sentence starting with "Storm water sewage is consisting of HDPE pipes having 300-400 mm ..." shall be replaced with following "Storm water sewage is consisting of HDPE pipes having 300-500 mm in diameter laid in trenches varying 0.90 - 1.10 m in width on minimum 0.10 m thick sandy-gravel layer. Bridge drainage system is consisting of polyester pipes having 250-400 mm in diameter. These pipes were hung under the bridge structures."
20. Table with Outlet points including outlet pipe shortcuts (page 1-310 and 1-311), shall be replaced with following:
Outlet points including outlet pipe shortcuts are shown in the Table below (a total of 44 separators):

Watershed	Sections mark of drainage	Position	Start / Recipient station	End / Recipient station	Ø	Length / Separator
			station	station	mm	m
1	D1	left	873+875.00	873+825.00	-	50.0
		middle				
		right	873+875.00	873+825.00	-	50.0
	IS 1	left	01600-	873+804.00	500	S1:10/100
2	D2	left	873+911.90	874+101.92	300	190.0
		middle				
		right	873+911.90	874+101.92	300	190.0
		IS 2	left	01600-	873+804.00	400
3	D3	left	874+117.47	874+220.05	300	102.6
		middle	874+117.47	874+220.05	300	102.6
		right				
		IS 3	left	J. Morava river	874+238.04	300

Watershed	Sections mark of drainage	Position	Start /	End /	Ø	Length / Separator
			Recipient station	Recipient station		
			station	station	mm	m
4	Д4'	left				
		middle	874+351.49	874+481.15	400	129.7
		right	874+385.55	874+481.15	300	95.6
	Д4''	left				
		middle	874+546.10	874+481.10	300	65.0
		right	874+546.10	874+481.10	300	65.0
IS 4	left	J. Morava river	874+480.15	400	S4:20/200	
5	Д5	left				
		middle	874+706.25	874+586.25	300	120.0
		right				
	IS 5	left	J. Morava river	874+579.55	300	S5:10/100
6	Д6'	left				
		middle	874+746.75	874+786.74	300	40.0
		right				
	Д6''	left				
		middle	874+986.78	874+786.74	300	200.0
		right				
IS 6.2	left	Ø1200-	874+903.62	400	S6:15/150	
7	Д7'	left				
		middle	874+746.75	874+786.74	300	40.0
		right				
	Д7''	left				
		middle	874+986.78	874+786.74	400	200.0
		right				
	IS 7.1	left	Ø1200-	874+903.62	300	S7.1:10/100
	IS 7.2	right	J. Morava river	875+146.80	400	S7.2:20/200
IS 7.3	left	Ø1000-	875+162.59	400	S7.3:15/150	
8	Д8	left				
		middle	875+698.00	875+538.02	300	160.0
		right	875+738.43	875+538.02	300	200.4
	IS 8	left	J. Morava river	874+579.55	400	S8:20/200
9	Д9'	left	875+825.00	876+025.00	300	200.0
		middle				
		right	875+800.00	876+025.00	300	225.0
	Д9''	left	876+099.50	876+025.00	300	74.5
		middle				
		right	876+210.40	876+025.00	400	185.4
	IS 9.1	right	Ø1600-	876+025.00	300	S9.1:10/100
	IS 9.2	right	Ø1600-	876+025.00	400	S9.2:20/200
IS 9.3	left	Ø1600-	876+025.00	300	S9.3:15/150	
10	Д10	left	876+500.00	876+419.70	300	80.3
		middle	876+500.00	876+419.70	300	80.3
		right				
	IS 10	middle	J. Morava river	876+410.79	300	S10:10/100
11	Д11	left	876+610.90	876+542.10	300	68.8
		middle	876+610.90	876+542.10	300	68.8
		right				
	IS 11	left	Ø2000-	876+531.57	300	S11:10/100
12	Д12	left				
		middle	876+661.82	876+741.77	300	80.0
		right				
	IS 12	left	J. Morava river	876+746.76	300	S12:10/100
13	Д13'	left				
		middle	877+225.00	877+345.05	400	120.1
		right				
	Д13''	left				
		middle	877+365.05	877+345.05	(mm)	20.0
		right				
IS 13.2	right	J. Morava river	877+203.30	500	S13:50/500	
14	Д14	left				
		middle	877+465.85	877+400.80	300	65.0
		right				
	IS 14	right	Ø2000-	877+483.95	300	S14:10/100
15	Д15	left				
		middle	877+683.20	877+498.22	300	185.0
		right				
	IS 15	right	Ø2000-	877+483.95	400	S15:15/150
16	Д16	left	878+017.25	877+747.75	400	269.5
		middle	878+017.25	877+937.20	300	80.1
		right	877+937.20	877+747.50	400	189.7
		right				
	IS 16	right	Ø1600-	877+740.95	400	S16:30/300



Watershed	Sections mark of drainage	Position	Start /	End/	Ø	Length / Separator
			Recipient station	Recipient station		
			station	station	mm	m
17	J17	left	878+283.75	878+048.75	500	235.0
		middle	878+283.75	878+048.75	400	235.0
		right				
	IS 17		Ø1600-	878+043.43	500	S17:30/300
18	J18	left				
		middle	878+283.75	878+485.25	500	201.5
		right	878+642.95	878+592.25	500	55.7
	IS 18	left	J. Morava river	878+485.25	400	S18:20/200
19	J19	left				
		middle'	878+715.25	879+095.15	400	379.9
		middle"	879+275.00	879+095.15	300	179.8
		right'	878+794.80	879+210.75	400	415.9
		right"	879+757.25	879+361.00	400	396.3
	IS 19.1	left	channel	879+095.15	400	S19.1:30/300
	IS 19.2	left	channel	879+289.30	400	S19.2:15/150
	IS 19.4	right	Ø2000-	879+200.00	500	S19.3:50/500
	T19	left	879+885.00	879+786.82	300	98.2
		right	879+805.50	879+786.82	300	18.7
IS 19.5	middle	culvert	879+775.00	300	S19.4:15/150	

3.0 Functional and Technical Characteristics of Applied Design Concepts

21.3.2. Typical Cross Sections (page 1-334) paragraph starting with "At the same time plants shall serve as..." as well as 5 paragraphs afterwards shall be deleted.

22.3.5 Drainage (page 1-336) first three paragraphs shall be deleted.

Part 2 Works Requirement, Scope of Works, LOT 2

1.3. Results of Traffic, Surveying, Hydrological and Geotechnical Investigations, 1.3.3 Hydrological Investigations:

23.1.3.3.1 Hydrological considerations and drainage concept (page 1-359), sentence starting with "On this highway section as well as on the entire length from Leskovac ..." shall be replaced with following "Along this motorway section as well as along the whole route from Leskovac to border with FYROM, roadway runoff will be subjected to treatment prior to discharge into natural river and other streams. Contaminated water will thus be treated to a predefined degree of purity in oil separators prior to its discharge into river and brooks."

24.1.3.3.3 Design considerations (page 1-360), sentence starting with "Storm water sewage is consisting of HDPE pipes having 300-400 mm ..." shall be replaced with following "Storm water sewage is consisting of HDPE pipes having 300-500 mm in diameter laid in trenches varying 0.90 - 1.10 m in width on minimum 0.10 m thick sandy-gravel layer. Bridge drainage system is consisting of polyester pipes having 250-400 mm in diameter. These pipes were hung under the bridge structures."

25. Table with Outlet points including outlet pipe shortcuts (page 1-361), shall be replaced with following:

Outlet points including outlet pipe shortcuts are shown in the Table below:

Watershed	Sections mark of drainage	Position	Start /	End/	Ø	Length / Separator
			Recipient station	Recipient station		
			station	station	mm	m
20	T20	left	880+774.00	880+803.50	300	29.5
		right	880+906.50	880+929.50	300	23.0
	IS 20.3	left	J. Morava river	880+803.50	300	S20.2:10/100
	IS 20.4	right	J. Morava river	878+485.25	300	S20.3:10/100
	J20	left	881+364.15	881+454.75	300	90.6
		middle'	881+364.15	881+454.75	300	90.6
		middle"	881+594.75	881+454.75	300	140.0
	IS 20.2	right				
IS 20.2	left	J. Morava river	878+485.25	500	S20.1:30/300	
21	J21	left	882+377.85	882+150.25	100	227.6
		middle'	881+817.00	882+037.00	300	220.0
		middle"	882+216.96	882+037.00	300	180.0
		right				
	IS 21.1	right	channel	881+576.60	500	S21.1:30/300
IS 21.2	right	J. Morava river	881+789.65	300	S21.2:15/150	
22	J22	left	882+476.65	882+243.55	400	233.3
		middle				
		right				
	IS 22	left	slope	882+240.00	400	S22:20/200
23	J23	left	882+677.00	882+753.15	300	76.2
		middle	882+677.00	882+753.15	300	76.2
		right				
	IS 23	left	Ø2000-	882+759.36	300	S23:15/150

Watershed	Sections mark of drainage	Position	Start /	End /	Ø	Length /
			Recipient station	Recipient station		
			station	station		
24	J24	left	882-832.00	882-771.75	400	60.3
		middle	882-832.00	882-771.75	400	60.3
		right				
	IS 24	left	Ø2000-	882-759.30	500	S24:50/500
25	J25	left	883-420.48	883-560.00	300	139.5
		middle	883-374.00	883-560.00	300	186.0
		right				
	IS 25	right	channel	883-560.00	300	S25:15/150
26	J26	left	883-650.00	883-588.65	300	61.3
		middle				
		right				
	IS 26	left	Stream Banavčjski	883-576.50	300	S26:10/100
27	D27	left				
		middle	883-589.97	883-670.00	300	80.0
		right	883-670.00	883-816.12	400	146.1
	IS 27	right	884-050.00	883-816.12	300	233.9
28	D28	right		883-824.00	500	S27:50/500
		left				
		middle		884-298.00	300	884-298.0
	IS 28	right	Ø1600-	884-298.00	300	884-298.0
29	D29	right		884-306.22	300	S28:15/150
		left	884-362.35	884-482.50	300	120.1
		middle				
	IS 29.1	right	Ø1600-	884-406.85	300	44.5
IS 29.2	right	Ø1600-	884-496.00	300	S29.1:10/100	
30	D30	right		884-575.90	300	S29.2:10/100
		left	884-572.30	884-661.70	300	84.4
		middle	884-601.80	884-661.70	300	59.9
	IS 30	right	slope	884-656.40	300	151.5
31	D31	middle	884-807.90	884-656.40	300	151.5
		right	884-807.90	884-661.70	400	5.3
		right	884-656.40	884-655.80	400	S30:30/300
	IS 31	left	slope	885-112.10	885-052.00	300
32	D32	middle	885-197.55	885-237.55	300	40.0
		right	885-162.50	885-052.00	300	110.5
		right	885-307.50	885-237.55	300	69.9
	IS 32	left	Ø2000-	885-300.00	400	S32:15/150
33	D33	left				
		middle	885-440.80	885-344.35	300	96.5
		right				
	IS 33	right	slope	885-344.35	300	S33:10/100

3.0 Functional and Technical Characteristics of Applied Design Concepts

26. 3.2. Typical Cross Sections (page 1-384) paragraph starting with "At the same time plants shall serve as..." as well as 5 paragraphs afterwards shall be deleted.

27. 3.5 Drainage (page 1-385) first three paragraphs shall be deleted.

Part 2 Works Requirement, Special Specification, LOT 1

28. After item 14.02.01 Maintenance of Vegetation (page 1-708) add the following item: "11.1.4.1 Procurement and placing of Ø100 plastic pipes for weepholes. Weepholes on the wall shall be spaced 2.5 m apart and leveled according to the design. Measurement: Measurement will be done per sizes stated in the design. Measurement unit will be meter of length. Payment: Unit price includes procurement, transport and placing of Ø100 plastic pipes. Unit price includes the item described above. Payment will be done per one meter of length."

29. After item 11.1.4.1 (page 1-708) add the following item: "11.1.4.2 Procurement and placing of Ø200 plastic perforated pipes. Pipes shall be laid over the water impermeable bedding and inclined as stated in the design. Filter layers shall be placed over the pipes. Measurement: Measurement will be done per sizes stated in the design. Measurement unit will be meter of length. Payment: The unit price includes procurement, transport and laying of Ø200 perforated plastic pipes. Unit price includes the item stated above. Payment will be done per meter of length."

30. After item 11.1.4.2 (page 1-708) add the following item: "13.10.10 Procurement, transport and fitting of cast iron rungs, DIN 1212. Works shall be executed fully in accordance with technical regulations, drawings and the Engineer's instructions. Measurement and Payment: Payment will be done per one fitted rung."

Part 2 Works Requirement, Special Specification, LOT 2

31. After item 14.02.01 Maintenance of Vegetation (page 1-734) add the following item: "11.1.4.1 Procurement and placing of Ø100 plastic pipes for weepholes. Weepholes on the wall shall be spaced 2.5 m apart and leveled according to the design. Measurement: Measurement will be done per sizes stated in the design. Measurement unit will be meter of length. Payment: Unit price includes procurement, transport and placing of Ø100 plastic pipes. Unit price includes the item described above. Payment will be done per one meter of length."
32. After item 11.1.4.1 (page 1-734) add the following item: "11.1.4.2 Procurement and placing of Ø200 plastic perforated pipes. Pipes shall be laid over the water impermeable bedding and inclined as stated in the design. Filter layers shall be placed over the pipes. Measurement: Measurement will be done per sizes stated in the design. Measurement unit will be meter of length. Payment: The unit price includes procurement, transport and laying of Ø200 perforated plastic pipes. Unit price includes the item stated above. Payment will be done per meter of length."
33. After item 11.1.4.2 (page 1-734) add the following item: "13.10.10 Procurement, transport and fitting of cast iron rungs, DIN 1212. Works shall be executed fully in accordance with technical regulations, drawings and the Engineer's instructions. Measurement and Payment: Payment will be done per one fitted rung."

Part 3, Drawings, LOT 1

34. Drawing No. 00 Layout of motorway, Sc=1:25000 (containing 1 drawing) shall be added.
35. Drawing No. 01 Layout of motorway, Sc=1:1000 (containing 10 drawings) shall be replaced with new Drawing No. 01 (containing 9 drawings).
36. Drawing No. 04 Standard cross section, Sc=1:100 (containing 13 drawings) shall be replaced with new Drawing No. 04 (containing 13 drawings).

DUE TO THE SIZE OF DRAWINGS, THEY WILL BE SENT ONLY BY E-MAIL! FAX VERSION OF ADDENDUM NO 2 DOES NOT CONTAIN ANY DRAWINGS.

Part 3, Drawings, LOT 2

37. Drawing No. 00 Layout of motorway, Sc=1:25000 (containing 1 drawing) shall be added. (Note: This drawing is the same as Drawing No. 00 for LOT 1)
38. Drawing No. 01 Layout of motorway, Sc=1:1000 (containing 8 drawings) shall be replaced with new Drawing No. 01 (containing 7 drawings).
39. Drawing No. 04 Standard cross section, Sc=1:100 (containing 13 drawings) shall be replaced with new Drawing No. 04 (containing 13 drawings).

DUE TO THE SIZE OF DRAWINGS, THEY WILL BE SENT ONLY BY E-MAIL! FAX VERSION OF ADDENDUM NO 2 DOES NOT CONTAIN ANY DRAWINGS.

Volume 2

Section VIII. Particular Conditions (PC), Part A - Contract Data

40. In Sub-Clause Performance Security 4.2 replace "10 percent" with "15 percent".

Please confirm in writing receipt of Addendum No.2.

Director

Mihajlo Mišić, Civ. Eng.



KORIĐORI SRBIJE

56/12
10.04.12
Бр. 1000/12

КОРИДОРИ СРБИЈЕ Д.О.О. БЕОГРАД
Краља Петра 21, 11000 Београд
www.koridor10.rs www.koridorX.rs
тел. 33 44 174, ПИБ: 105940792, Мар.бр: 20498153

Prospective Bidders

REFERENCE: Serbia, Corridor X Highway Project, Construction of Highway E75, Section: Grdelica (Gornje Polje) – Caricina Dolina, LOT 1: Road and bridges from Grdelica to Tunnel Predejane and LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina, ICB No: CORRX.E75.EIB.PACK1.ICB

SUBJECT: Addendum No.3 of Bidding Documents

Dear Madam/Sir,

In accordance with ITB item 8 Amendment to Bidding Documents, the Employer hereby issues the Addendum No. 3 to the Bidding Documents for Procurement of Construction of Highway E75, Section: Grdelica (Gornje Polje) – Caricina Dolina, LOT 1: Road and bridges from Grdelica to Tunnel Predejane and LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina, ICB No: CORRX.E75.EIB.PACK1.ICB.

Addendum refers to Volume 1, Part 1 Bidding Procedures (Section III and IV) and Part 2 Works Requirement (Special Specification).

Volume 1**Part 1 – Bidding Procedures****Section III. Evaluation and Qualification Criteria**

1. Qualification, 2.3 Financial Situation, 2.3.3. Financial Resources, within the column Requirement after the end of bullet (ii) following text shall be added: "(iii) total yearly outputs envisaged from the contracts listed in FIN-4 in the next 2 years plus the necessary output for the contract(s) for which the bidder submits the bid, should not exceed the maximum yearly output of the last 3 years by more than a 35%."

Section IV. Bidding Forms**Bill of Quantities****LOT 1**

2. Complete BoQ for 02.01. Stormwater sewage system (page 1-80) shall be replaced with following BoQ:

02.01. Stormwater sewage system

8.5.1/2 Stormwater sewage system and pipe drainage

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/2.01	8.5.1/2.01	Geodetic marking the route	m	7.135,00		
8.5.1/2.02	4.4.1	Mechanical and hand trench excavation in III and IV category soil for placing of sewers in the road structure 0-2 m mechanical excavation (90%)	m ³	6.603,00		
		hand excavation (10%)	m ³	733,67		
8.5.02.01.01	4.4.1.2	Placing of sand around pipes	m	5.100,00		
8.5.02.01.04	4.4.1.2	Filling trenches above pipes with gravel	m ³	2.705,10		
8.5.1/2.01.05	4.4.2	Filling of drainage channels with filter material	m ³	818,00		
8.5.02.01.06	4.4.1.2	Transport of the excavated material	m ³	5.109,00		
8.5.02.01.07	4.4.2	Pumping water from the trench		Lump sum		
8.5.1/2.01.08	11.1.6	Procurement and laying of rubber mat below the pave road	m ²	20.306,50		
8.5.1/2.01.09	4.4.1	Procurement and laying of plastic half-perforated drain pipes for subgrade and median drainage -Ø110 mm	m ¹	4.061,30		
8.5.1/2.10	4.4.6	Procurement, transport, distribution along the trench and assembly of sewer pipes in the trench Ø160 mm PVC SN8 (gully connections)	m ¹	145,00		
8.5.1/2.11	4.4.7	Procurement, transport, distribution along the trench and assembly of sewer pipes in the trench Ø 300 mm PE1HD SN8 class Ø 400 mm PE1HD SN8 class	m ¹	5.208,00 1.458,00		
8.5.1/2.12	4.1.3.6	Cast iron covers	pcs.	114,00		
		Ø600 mm gutter grating	pcs.	103,00		
8.5.1/2.13	8.5.1/2.13	Cast iron rungs	pcs.	1.238,00		
8.5.1/2.14	8.5.1/2.14	Street gutters with grating	pcs.	107,00		
8.5.2/2.15	8.5.2/2.15	Construction of recipient structure with wing walls of impervious reinforced concrete MB 4B	m ³	7,00		



Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/2.16.	4.4.4.	Construction of Ø 100cm round manholes by using prefabricated elements of impervious reinforced concrete MB 40.	m ¹	470,00		
8.5.1/2.17.	8.5.1/2.17.	Construction of outlet structures of MB 30 concrete at points of rainwater sewer discharge to water stream.	pcs.	7,00		
8.5.1/2.18.	4.1.3.3.	Concreting the trench below the pipe drainage.	m ³	446,74		
8.5.02.01.19.	4.4.1.1.	Trench strutting	m ²	10.500,00		
8.5.02.01.20.	4.4.3.2.	Pipeline testing	m ¹	7.135,00		
8.5.02.01.21.	4.4.1.1.	Securing of the existing installations		Lump sum		
8.5.02.01.22.	4.4.3.2.	Washing of channel and removal of all rough segments and dirt. Flushing shall be performed through the use of water tankers.	m ¹	7.135,00		
8.5.1/2.23.	8.5.1/2.23.	Geodetic survey of stormwater sewage system including report preparation.	m ¹	7.135,00		
SUB-TOTAL						
Unforeseen work (5% of sub-total)						
TOTAL STORMWATER SEWAGE SYSTEM (8.5.1/2):						

3. Following BoQ shall be added after BoQ for 02.01. Stormwater sewage system, 8.5.1/2 Stormwater sewage system and pipe drainage:

8.5.1/3 Bridge runoff interception on Juzna Morava river at km 874+297.329 of highway

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/3.01.	4.4.1.	Mechanical and hand excavation in II and III category material for laying of sewer pipes. 0-2m				
		Mechanical excavation (90%)	m ³	84,50		
		Excavation by hand (10%)	m ³	9,40		
8.5.1/3.02.	4.4.6.	Procurement, transport, carrying along the trench and assembly of sewers in trench. Ø 300 mm GRP-Polyester (pressure pipes)	m ¹	61,00		
8.5.1/3.03.	8.5.1/3.03. Special spec.	Procurement, transport, carrying and assembly pipes on BRIDGE				
		Ø 250 mm GRP-Polyester (pressure pipes)	m ¹	180,00		
		Ø 300 mm GRP-Polyester (pressure pipes)	m ¹	22,00		
8.5.1/3.04.	8.5.1/3.04.	Procurement, transport and installation of compensator units at bridge expansion joints. Payment per one installed compensator unit depending on diameter.				
		For polyester pipe of Ø300 mm	pcs.	2,00		
8.5.1/3.05.	8.5.1/3.05.	Procurement, transport and installation of pipe supports (hangers). The price includes procurement and installation of base plates, screws, clips and hangers made of stainless steel. Payment per one installed hanger depending on pipe diameter.				
		Pipe hanger DN300 mm	pcs.	96,00		
8.5.1/3.06.	8.5.1/3.06.	Procurement, transport and installation of polyester pipe fittings depending on diameter (HOBAS type or similar). Payment per one installed pipe fitting.				
		T fitting Ø300/150	pcs.	2,00		
		T fitting Ø250/150	pcs.	12,00		
		Revision with blind flange Ø300/150	pcs.	2,00		
8.5.1/3.07.	8.5.1/3.07. Special spec.	Revision with blind flange Ø250/150	pcs.	12,00		
		Bend 45 DN300	pcs.	2,00		
8.5.1/3.07.	8.5.1/3.07. Special spec.	Geodetic survey of rainwater sewage system including report preparation.	m ¹	263,00		
SUB-TOTAL						
Unforeseen work (5% of sub-total)						
TOTAL FOR RAIN WATER SEWAGE SYSTEM ON BRIDGE (8.5.1/3):						



8.5.1/4. Bridge runoff interception on Juzna Morava river at km 875+371.465 of highway

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/4.01.	4.4.1.	Mechanical and hand excavation in II and III category material for laying of sewer pipes. 0-2m				
		Mechanical excavation (90%)	m ³	37,00		
		Excavation by hand (10%)	m ³	4,00		
8.5.1/4.02.	4.4.6.	Procurement, transport, carrying along the trench and assembly of sewers in trench. Ø 250 mm GRP-Polyester (pressure pipes)	m ^l	25,00		
8.5.1/4.03.	8.5.1/4.03. special spec.	Procurement, transport, carrying and assembly pipes on BRIDGE				
		Ø 250 mm GRP-Polyester (pressure pipes)	m ^l	400,00		
		Ø 300 mm GRP-Polyester (pressure pipes)	m ^l	55,00		
8.5.1/4.04.	8.5.1/4.04. special spec	Procurement, transport and installation of compensator units at bridge expansion joints. Payment per one installed compensator unit depending on diameter.				
8.5.1/4.05.	8.5.1/4.05.	For polyester pipe of Ø300 mm	pcs.	2,00		
8.5.1/4.06.	8.5.1/4.06. Special spec.	Procurement, transport and installation pipe hangers.				
		Pipe hanger DN300 mm	pcs.	182,00		
8.5.1/4.07.	8.5.1/4.07. Special spec.	Procurement, transport and installation of polyester pipe fittings depending on diameter (HOBAS type or similar). Payment per one installed pipe fitting.				
		T fitting Ø250/150	pcs.	24,00		
		T fitting Ø300/150	pcs.	4,00		
		Bend 45° Ø300 mm	pcs.	1,00		
8.5.1/4.07.	8.5.1/4.07. Special spec.	Geodetic survey of rainwater sewage system including report preparation.	m ^l	480,00		
SUB-TOTAL						
Unforeseen work (5% of sub-total)						
TOTAL FOR RAIN WATER SEWAGE SYSTEM ON BRIDGE (8.5.1/4.):						

8.5.1/5. Bridge runoff interception on Juzna Morava river at km 876+322.90 of highway

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/5.01.	4.4.1.	Mechanical and hand excavation in II and III category material for laying of sewer pipes. 0-2m				
		Mechanical excavation (90%)	m ³	132,00		
		Excavation by hand (10%)	m ³	14,60		
8.5.1/5.02.	4.4.6.	Procurement, transport, carrying along the trench and assembly of sewers in trench. Ø 250 mm GRP-Polyester (pressure pipes)	m ^l	95,00		
8.5.1/5.03.	8.5.1/5.03. Special spec.	Procurement, transport, carrying and assembly pipes on BRIDGE				
		Ø 250 mm GRP-Polyester (pressure pipes)	m ^l	329,00		
8.5.1/5.04.	03.02.0 4.04. Special spec.	Procurement, transport and installation of compensator units at bridge expansion joints. Payment per one installed compensator unit depending on diameter.				
		For polyester pipe of Ø250 mm	pcs.	2,00		
8.5.1/5.05.	03.02.0 4.05. Special spec.	Procurement, transport and installation pipe hangers.				
		Pipe hanger DN250 mm	pcs.	136,00		
8.5.1/5.06.	03.02.0 4.06. Special spec.	Procurement, transport and installation of polyester pipe fittings depending on diameter (HOBAS type or similar). Payment per one installed pipe fitting.				
		T fitting Ø250/150	pcs.	18,00		
		Bend 45° Ø250 mm	pcs.	2,00		
8.5.1/5.07.	8.5.1/5.07. Special spec.	Geodetic survey of rainwater sewage system including report preparation.	m ^l	380,00		
SUB-TOTAL						
Unforeseen work (5% of sub-total)						
TOTAL FOR RAIN WATER SEWAGE SYSTEM ON BRIDGE (8.5.1/5.):						

8.5.1/6. Bridge runoff interception on Juzna Morava river at km 876+966.03 of highway of highway

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/6.01.	4.4.1.	Mechanical and hand excavation in II and III category material for laying of sewer pipes. <u>0-2m</u>				
		Mechanical excavation (90%)	m ³	77,60		
		Excavation by hand (10%)	m ³	8,60		
8.5.1/6.02.	4.4.6.	Procurement, transport, carrying along the trench and assembly of sewers in trench. Ø 400 mm GRP-Polyester (pressure pipes)	m ¹	56,00		
8.5.1/6.03.	8.5.1/6.03. Special spec.	Procurement, transport, carrying and assembly pipes on BRIDGE				
		Ø 250 mm GRP-Polyester (pressure pipes)	m ¹	402,00		
		Ø 300 mm GRP-Polyester (pressure pipes)	m ¹	329,00		
		Ø 400 mm GRP-Polyester (pressure pipes)	m ¹	160,00		
8.5.1/6.04.	8.5.1/6.04.	Procurement, transport and installation of compensator units at bridge expansion joints. Payment per one installed compensator unit depending on diameter.				
		For polyester pipe of Ø400 mm	pcs.	2,00		
8.5.1/6.05.	8.5.1/6.05.	Procurement, transport and installation of pipe supports (hangers). The price includes procurement and installation of base plates, screws, clips and hangers made of stainless steel. Payment per one installed hanger depending on pipe diameter.				
		Pipe hanger DN250 mm	pcs.	134,00		
		Pipe hanger DN300 mm	pcs.	132,00		
		Pipe hanger DN400 mm	pcs.	82,00		
8.5.1/6.06.	8.5.1/6.06.	Procurement, transport and installation of polyester pipe fittings depending on diameter (HOBAS type or similar). Payment per one installed pipe fitting.				
		T fitting Ø250/150	pcs.	24,00		
		T fitting Ø300/150	pcs.	20,00		
		Bend 45° DN300	pcs.	10,00		
8.5.1/6.07.	8.5.1/6.07. Special spec.	Geodetic survey of rainwater sewage system including report preparation.	m ¹	947,00		
SUB-TOTAL						
Unforeseen work (5% of sub-total)						
TOTAL FOR RAIN WATER SEWAGE SYSTEM ON BRIDGE (8.5.1/6.):						

8.5.1/7. Bridge runoff interception on Juzna Morava river at km 878+395.090 of highway

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/7.01.	4.4.1.	Mechanical and hand excavation in II and III category material for laying of sewer pipes. <u>0-2m</u>				
		Mechanical excavation (90%)	m ³	122,00		
		Excavation by hand (10%)	m ³	11,00		
8.5.1/7.02.	4.4.6.	Procurement, transport, carrying along the trench and assembly of sewers in trench. Ø 250 mm GRP-Polyester (pressure pipes)	m ¹	79,00		
8.5.1/7.03.	8.5.1/7.03. Special spec.	Procurement, transport, carrying and assembly pipes on BRIDGE				
		Ø 250 mm GRP-Polyester (pressure pipes)	m ¹	286,00		
8.5.1/7.04.	8.5.1/7.04. Special spec.	Procurement, transport and installation of compensator units at bridge expansion joints. Payment per one installed compensator unit depending on diameter.				
		For polyester pipe of Ø250 mm	pcs.	2,00		
8.5.1/7.05.	8.5.1/7.05. Special spec.	Procurement, transport and installation pipe hangers.				
		Pipe hanger DN250 mm	pcs.	96,00		
8.5.1/7.06.	8.5.1/7.06. Special spec.	Procurement, transport and installation of polyester pipe fittings depending on diameter (HOBAS type or similar). Payment per one installed pipe fitting.				
		T fitting Ø250/150	pcs.	16,00		
		Bend 45° Ø250 mm	pcs.	4,00		
8.5.1/7.07.	8.5.1/7.07. Special spec.	Geodetic survey of rainwater sewage system including report preparation.	m ¹	319,00		
SUB-TOTAL						
Unforeseen work (5% of sub-total)						
TOTAL FOR RAIN WATER SEWAGE SYSTEM ON BRIDGE (8.5.1/7.):						

8.5.1/12. Devices for water protection against pollution – separators

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/2.01.	8.5.1/2.01.	Geodetic marking the route.	m ¹	224,00		
8.5.1/12.01.	4.4.1.	Mechanical and hand excavation in III and IV category material for laying of sewer pipes. 0-2m				
		Mechanical excavation (90%)	m ³	354,80		
		Excavation by hand (10%)	m ³	39,40		
8.5.02.01.04.	8.5.02.01.04.	Placing of sand around pipes	m ³	101,78		
8.5.02.01.05.	4.4.1.2	Filling trenches above pipes with excavated material.	m ³	292,42		
8.5.02.01.06.	4.4.1.2	Transport of the excess material from excavation	m ²	117,61		
8.5.02.01.07.	4.4.2	Pumping water from the trench		Lump sum		
8.5.1/12.08.	4.4.7.	Procurement, transport, carrying along the trench and assembly of sewer pipes.				
		Ø 300 mm PEHD SN4 , class	m ¹	91,60		
		Ø 400 mm PEHD SN4 , class	m ¹	104,10		
		Ø 500 mm PEHD SN4 , class	m ¹	28,00		
8.5.1/12.09.	03.02.05.03 Special spec.	Procurement, transport and installation of mineral oil separators provided with integrated BY-PASS, Purgator type or equivalent with the following capacities:				
		Qn/Qmax 10/100	pcs.	9,00		
		Qn/Qmax 15/150	pcs.	6,00		
		Qn/Qmax 20/200	pcs.	6,00		
		Qn/Qmax 30/300	pcs.	3,00		
		Qn/Qmax 50/500	pcs.	2,00		
8.5.1/12.10.	4.1.3.6	Cast-iron covers.	pcs.	36,00		
8.5.1/12.11.	4.1.3.6	Cast-iron rungs	pcs.	232,00		
8.5.1/2.12.	4.4.4.	Construction of Ø 100cm round manholes by using prefabricated elements of impervious reinforced concrete MB 40.	m ¹	2,00		
8.5.1/12.13.	03.02.05.04 Special spec.	Construction of recipient structure with wing walls of impervious reinforced concrete MB 40.	m ¹	10,00		
8.5.1/12.14.	03.02.04.07.	Construction of outlet structures of MB 30 concrete at points of rainwater sewer discharge to water stream.	pcs.	26,00		
8.5.1/12.15.	03.02.04.08.	Flat check valves provided with flanges.				
		Ø 300 mm	pcs.	11,00		
		Ø 400 mm	pcs.	12,00		
		Ø 500 mm	pcs.	3,00		
8.5.02.01.16.	4.4.1.1.	Trench strutting	m ²	761,60		
8.5.02.01.17.	4.4.3.2.	Pipeline testing	m ¹	224,00		
8.5.02.01.18.	4.4.3.2.	Washing of channel and removal of all rough segments and dirt. Flushing shall be performed through the use of water tankers.	m ¹	224,00		
8.5.1/12.19.		Geodetic survey and preparation as-built design.	m ¹	224,00		
SUB-TOTAL						
Unforeseen work (5% of sub-total)						
TOTAL FOR DEVICES FOR WATER PROTECTION AGAINST POLLUTION – SEPARATORS (8.5.1/12.):						

02.01. STORMWATER SEWAGE SYSTEM - SUMMARY		
8.5.1/2	Stormwater sewage system and pipe drainage	
8.5.1/3	Bridge runoff interception on Juzna Morava river at km 874+297.329 of highway	
8.5.1/4	Bridge runoff interception on Južna Morava river at km 875+371.465 of highway	
8.5.1/5	Bridge runoff interception on Južna Morava river at km 876+322.90 of highway	
8.5.1/6	Bridge runoff interception on Juzna Morava river at km 876+966.03 of highway of highway	
8.5.1/7	Bridge runoff interception on Južna Morava river at km 878+395.090 of highway	
8.5.1/12	Devices for water protection against pollution – separators	
SUB-TOTAL		
Unforeseen work (5% of sub-total)		
TOTAL STORMWATER SEWAGE SYSTEM (02.01.):		

12. Technical infrastructure, 12.09. Displacement and protection of lineside telecommunication cables, 12.09.02 Collision 2, item no. 12.09.02.01. Material, item no. 12.09.02.01.01 (page 1-153), work description shall be replaced with following "One STA 3x4x1,2VF+8x4x1,2NF+12x4x0,9NF cable, with 55 mm diameter".
12. Technical infrastructure, 12.09. Displacement and protection of lineside telecommunication cables, 12.09.02 Collision 2, item no. 12.09.02.01. Material, item no. 12.09.02.01.03 (page 1-153), work description shall be replaced with following one "PNK 3x10mm2".
12. Technical infrastructure, 12.09. Displacement and protection of lineside telecommunication cables, 12.09.03 Collision 3, item no. 12.09.03.01. Material, item no. 12.09.03.01.01 (page 1-154), work description shall be replaced with following "One STA 3x4x1,2VF+8x4x1,2NF+12x4x0,9NF cable, with 55 mm diameter".



7. 12. Technical infrastructure, 12.09. Displacement and protection of lineside telecommunication cables, 12.09.03 Collision 3, item no. 12.09.03.01. Material, item no. 12.09.03.01.03 (page 1-154), work description shall be replaced with following one "PNK 3x10mm2".
8. In Addendum No. 2, under Section IV. Bidding Forms, Bill of Quantities, LOT 1, change no. 1, 01.01.04 Sub-bases, item 01.01.04.01, item name shall be as follows "Sandy gravel material – rolling sub-grade layer"
9. In Addendum No. 2, under Section IV. Bidding Forms, Bill of Quantities, LOT 1, change no. 1, 01.01.04 Sub-bases, item 01.01.04.02, reference to T.S. shall be "AS-3.4 additional specifications"

LOT 2

10. Complete BoQ for 02.01. Stormwater sewage system (page 1-176) shall be replaced with following BoQ:

02.01. Stormwater sewage system

8.5.1/2 Stormwater sewage system and pipe drainage

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/2.01.	8.5.1/2.01.	Geodetic marking the route.	m ¹	4 331,00		
8.5.1/2.02.	4.4.1.	Mechanical and hand trench excavation in III and IV category soil for placing of sewers in the road structure. <u>0-2 m</u> mechanical excavation (90%)	m ³	4 932,00		
8.5.02.01.03	4.4.1.2	hand excavation (10%)	m ³	548,00		
8.5.02.01.04.	4.4.1.2	Placing of sand around pipes	m ³	2 844,00		
8.5.1/2.01.05.	4.1.2.	Filling trenches above pipes with gravel.	m ³	2 925,00		
8.5.1/2.01.05.	4.1.2.	Filling of drainage channels with filter material	m ³	530,00		
8.5.02.01.06.	4.4.1.2	Transport of the excavated material	m ²	2 875,00		
8.5.02.01.07.	4.4.2	Pumping water from the trench	Lump sum			
8.5.1/2.01.08.	11.1.6	Procurement and laying of rubber mat below the pave road	m ²	15 900,00		
8.5.1/2.01.09.	4.1.3.4 4.4.6	Procurement and laying of plastic half-perforated drain pipes for subgrade and median drainage -Ø110 mm	m ¹	3 180,00		
8.5.1/2.10.	4.4.6.	Procurement, transport, distribution along the trench and assembly of sewer pipes in the trench. Ø160 mm PVC SN8 (gully connections)	m ¹	181,00		
8.5.1/2.11.	4.4.7.	Procurement, transport, distribution along the trench and assembly of sewer pipes in the trench. Ø 300 mm PEHD SN8 class	m ¹	3 436,00		
8.5.1/2.12.	4.1.3.6	Ø 400 mm PEHD SN8 class	m ¹	354,00		
8.5.1/2.13.	8.5.1/2.13.	Cast iron covers	pcs.	109,00		
8.5.1/2.14.	8.5.1/2.14.	Ø600 mm gutter grating	pcs.	149,00		
8.5.1/2.15.	8.5.1/2.15.	Cast iron rungs	pcs.	1 073,00		
8.5.2/2.15.	8.5.2/2.15.	Street gutters with grating	pcs.	133,00		
8.5.1/2.16.	4.4.4.	Construction of recipient structure with wing walls of impervious reinforced concrete MB 40.	m ¹	6,00		
8.5.1/2.17.	8.5.1/2.17.	Construction of Ø 100cm round manholes by using prefabricated elements of impervious reinforced concrete MB 40.	m ¹	391,00		
8.5.02.01.18.	4.1.3.3	Construction of outlet structures of MB 30 concrete at points of rainwater sewer discharge to water stream.	pcs.	5,00		
8.5.02.01.19.	4.1.3.3	Concreting the trench below the pipe drainage	m ³	349,80		
8.5.02.01.20.	4.4.1.1	Trench strutting	m ²	8 183,00		
8.5.02.01.21.	4.4.3.2.	Pipeline testing	m ¹	3 790,00		
8.5.02.01.22.	4.4.1.1.	Securing of the existing installations	Lump sum			
8.5.02.01.22.	4.4.3.2.	Washing of channel and removal of all rough segments and dirt. Flushing shall be performed through the use of water tankers.	m ¹	4 333,00		
8.5.1/2.23.	8.5.1/2.23.	Geodetic survey of stormwater sewage system including report preparation.	m ¹	4 333,00		
SUB-TOTAL						
Unforeseen work (5% of sub-total)						
TOTAL STORMWATER SEWAGE SYSTEM (8.5.1/2):						

11. Following BoQ shall be added after BoQ for 02.01. Stormwater sewage system, 8.5.1/2 Stormwater sewage system and pipe drainage:

8.5.1/8. Bridge runoff interception on Juzna Morava river at km 881+006.705 of highway

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/8.01	4.4.1.	Mechanical and hand excavation in II and III category material for laying of sewer pipes, 0-2m				
8.5.1/8.02.	4.4.6.	Mechanical excavation (90%)	m ³	62,50		
		Excavation by hand (10%)	m ³	7,00		
		Procurement, transport, carrying along the trench and assembly of sewers in trench. Ø 400 mm GRP-Polyester (pressure pipes)	m ^l	45,00		
8.5.1/8.03.	8.5.1/8.03. Special spec.	Procurement, transport, carrying and assembly pipes on BRIDGE				
		Ø 250 mm GRP-Polyester (pressure pipes)	m ^l	301,00		
		Ø 300 mm GRP-Polyester (pressure pipes)	m ^l	240,00		
8.5.1/8.04.	8.5.1/8.04.	Ø 400 mm GRP-Polyester (pressure pipes)	m ^l	315,00		
		Procurement, transport and installation of compensator units at bridge expansion joints. Payment per one installed compensator unit depending on diameter. For polyester pipe of Ø400 mm	pcs.	2,00		
8.5.1/8.05.	8.5.1/8.05.	Procurement, transport and installation of pipe supports (hangers). The price includes procurement and installation of base plates, screws, clips and hangers made of stainless steel. Payment per one installed hanger depending on pipe diameter.				
		Pipe hanger DN250 mm	pcs.	105,00		
		Pipe hanger DN300 mm	pcs.	120,00		
		Pipe hanger DN400 mm	pcs.	155,00		
8.5.1/8.06.	8.5.1/8.06.	Procurement, transport and installation of polyester pipe fittings depending on diameter (HOBAS type or similar). Payment per one installed pipe fitting.				
		T fitting Ø250/150	pcs.	17,00		
		T fitting Ø300/150	pcs.	14,00		
		T fitting Ø400/150	pcs.	18,00		
		Bend 45° Ø400 mm	pcs.	4,00		
8.5.1/8.07.	8.5.1/8.07. Special spec.	Geodetic survey of rainwater sewage system including report preparation	m ^l	905,00		
SUB-TOTAL						
Unforeseen work (5% of sub-total)						
TOTAL FOR RAIN WATER SEWAGE SYSTEM ON BRIDGE (8.5.1/8.):						

8.5.1/9. Bridge runoff interception on Juzna Morava river at km 881+693.488 of highway

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/9.01	4.4.1.	Mechanical and hand excavation in II and III category material for laying of sewer pipes, 0-2m				
		Mechanical excavation (90%)	m ³	98,40		
8.5.1/9.02.	4.4.6.	Excavation by hand (10%)	m ³	11,00		
		Procurement, transport, carrying along the trench and assembly of sewers in trench. Ø 400 mm GRP-Polyester (pressure pipes)	m ^l	71,00		
8.5.1/9.03.	8.5.1/9.03. Special spec.	Procurement, transport, carrying and assembly pipes on BRIDGE				
		Ø 250 mm GRP-Polyester (pressure pipes)	m ^l	80,00		
		Ø 300 mm GRP-Polyester (pressure pipes)	m ^l	60,00		
8.5.1/9.04.	8.5.1/9.04.	Ø 400 mm GRP-Polyester (pressure pipes)	m ^l	206,00		
		Procurement, transport and installation of compensator units at bridge expansion joints. Payment per one installed compensator unit depending on diameter. For polyester pipe of Ø400 mm	pcs.	2,00		
8.5.1/9.05.	8.5.1/9.05.	Procurement, transport and installation of pipe supports (hangers). The price includes procurement and installation of base plates, screws, clips and hangers made of stainless steel. Payment per one installed hanger depending on pipe diameter.				
		Pipe hanger DN250 mm	pcs.	28,00		
		Pipe hanger DN300 mm	pcs.	30,00		
		Pipe hanger DN400 mm	pcs.	104,00		
8.5.1/9.06.	8.5.1/9.06.	Procurement, transport and installation of polyester pipe fittings depending on diameter (HOBAS type or similar). Payment per one installed pipe fitting.				

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/9.07.	8.5.1/9.07. Special spec.	T fitting Ø250/150	pcs.	6,00		
		T fitting Ø300/150	pcs.	4,00		
		T fitting Ø400/150	pcs.	15,00		
		Bend 45° Ø400 mm	pcs.	4,00		
		Geodetic survey of rainwater sewage system including report preparation.	m ¹	477,00		
<i>SUB-TOTAL</i>						
Unforeseen work (5% of sub-total)						
<i>TOTAL FOR RAIN WATER SEWAGE SYSTEM ON BRIDGE (8.5.1/9.):</i>						

8.5.1/10. Bridge runoff interception on Juzna Morava river at km 883+256.496 of highway

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/10.01	4.4.1	Mechanical and hand excavation in II and III category material for laying of sewer pipes. 0-2m				
		Mechanical excavation (90%)	m ³	242,00		
		Excavation by hand (10%)	m ³	27,00		
8.5.1/10.02.	4.4.6.	Procurement, transport, carrying along the trench and assembly of sewers in trench. Ø 300 mm GRP-Polyester (pressure pipes)	m ¹	174,00		
8.5.1/10.03.	8.5.1/10.03. Special spec.	Procurement, transport, carrying and assembly pipes on BRIDGE				
		Ø 250 mm GRP-Polyester (pressure pipes)	m ¹	580,00		
		Ø 300 mm GRP-Polyester (pressure pipes)	m ¹	394,00		
8.5.1/10.04.	8.5.1/10.04.	Procurement, transport and installation of compensator units at bridge expansion joints. Payment per one installed compensator unit depending on diameter. For polyester pipe of Ø300 mm	pcs.	2,00		
8.5.1/10.05.	8.5.1/10.05.	Procurement, transport and installation of pipe supports (hangers). The price includes procurement and installation of base plates, screws, clips and hangers made of stainless steel. Payment per one installed hanger depending on pipe diameter.				
		Pipe hanger DN250 mm	pcs.	194,00		
		Pipe hanger DN300 mm	pcs.	158,00		
8.5.1/10.06.	8.5.1/10.06.	Procurement, transport and installation of polyester pipe fittings depending on diameter (HOBAS type or similar). Payment per one installed pipe fitting.				
		T fitting Ø250/150	pcs.	41,00		
		T fitting Ø300/150	pcs.	28,00		
		Bend 45 DN300	pcs.	12,00		
8.5.1/10.07.	8.5.1/10.07. Special spec.	Geodetic survey of rainwater sewage system including report preparation.	m ¹	1.148,00		
		<i>SUB-TOTAL</i>				
Unforeseen work (5% of sub-total)						
<i>TOTAL FOR RAIN WATER SEWAGE SYSTEM ON BRIDGE (8.5.1/10.):</i>						

8.5.1/11. Bridge runoff interception on Juzna Morava river at km 885+150.585 of highway

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/11.01.	4.4.1.	Mechanical and hand excavation in II and III category material for laying of sewer pipes. 0-2m				
		Mechanical excavation (90%)	m ³	46,00		
		Excavation by hand (10%)	m ³	5,10		
8.5.1/11.02.	4.4.6.	Procurement, transport, carrying along the trench and assembly of sewers in trench. Ø 250 mm GRP-Polyester (pressure pipes)	m ¹	33,00		
8.5.1/11.03.	8.5.1/11.03.	Procurement, transport, carrying and assembly pipes on BRIDGE				
8.5.1/11.04.	Special spec. 8.5.1/11.04.	Ø 250 mm GRP-Polyester (pressure pipes)	m ¹	278,00		
		Procurement, transport and installation of compensator units at bridge expansion joints. Payment per one installed compensator unit depending on diameter. For polyester pipe of Ø250 mm	pcs.	2,00		
8.5.1/11.05.	Special spec. 8.5.1/11.05.	Procurement, transport and installation pipe hangers.				
		Pipe hanger DN250 mm	pcs.	94,00		
8.5.1/11.06.	8.5.1/11.06. Special spec.	Procurement, transport and installation of polyester pipe fittings depending on diameter (HOBAS type or similar). Payment per one installed pipe fitting.				

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/11.07.	8.5.1/11.07. Special spec.	T fitting Ø250/150	pcs.	12,00		
		Bend 45° Ø250 mm	pcs.	4,00		
		Geodetic survey of rainwater sewage system including report preparation.	m ¹	190,00		
<i>SUB-TOTAL</i>						
Unforeseen work (5% of sub-total)						
<i>TOTAL FOR RAIN WATER SEWAGE SYSTEM ON BRIDGE (8.5.1/11.):</i>						

8.5.1/12. Devices for water protection against pollution – separators

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/2.01.	8.5.1/12.01.	Geodetic marking the route.	m ¹	202,00		
8.5.1/12.01.	4.4.1.	Mechanical and hand excavation in III and IV category material for laying of sewer pipes. 0-2m				
		Mechanical excavation (90%)	m ³	320,40		
		Excavation by hand (10%)	m ³	35,60		
8.5.02.01.04.	4.4.1.2	Placing of sand around pipes	m ³	119,05		
8.5.02.01.05.	4.4.1.2	Filling trenches above pipes with excavated material.	m ³	236,95		
8.5.02.01.06.	4.4.1.2	Transport of the excess material from excavation	m ²	133,32		
8.5.02.01.07.	4.4.2	Pumping water from the trench		Lump sum		
8.5.1/12.08.	4.4.7.	Procurement, transport, carrying along the trench and assembly of sewer pipes. Ø 300 mm PEHD SN4 , class	m ¹	114,30		
		Ø 400 mm PEHD SN4 , class	m ¹	18,00		
		Ø 500 mm PEHD SN4 , class	m ¹	70,00		
8.5.1/12.09.	8.5.1/12.09. Special spec.	Procurement, transport and installation of mineral oil separators provided with integrated BY-PASS, Purgator type or equivalent with the following capacities.				
		Qn/Qmax 10/100	pcs.	7,00		
		Qn/Qmax 15/150	pcs.	6,00		
		Qn/Qmax 20/200	pcs.	2,00		
		Qn/Qmax 30/300	pcs.	3,00		
		Qn/Qmax 50/500	pcs.	2,00		
8.5.1/12.10.	4.1.3.6	Cast-iron covers.	pcs.	25,00		
8.5.1/12.11.	4.1.3.6	Cast-iron rungs	pcs.	107,00		
8.5.1/2.12.	4.4.4.	Construction of Ø 100cm round manholes by using prefabricated elements of impervious reinforced concrete MB 40.	m ¹	8,00		
8.5.1/12.13.	03.02.05.04 Special spec.	Construction of recipient structure with wing walls of impervious reinforced concrete MB 40.	m ¹	20,00		
8.5.1/12.14.	8.5.1/12.14.	Construction of outlet structures of MB 30 concrete at points of rainwater sewer discharge to water stream.	pcs.	20,00		
8.5.1/12.15.	8.5.1/12.15.	Flat check valves provided with flanges. Ø 300 mm	pcs.	12,00		
		Ø 400 mm	pcs.	3,00		
		Ø 500 mm	pcs.	5,00		
8.5.02.01.16.	4.4.1.1.	Trench strutting	m ²	686,80		
8.5.02.01.17.	4.4.3.2.	Pipeline testing	m ¹	202,00		
8.5.02.01.18.	4.4.3.2.	Washing of channel and removal of all rough segments and dirt. Flushing shall be performed through the use of water tankers.	m ¹	202,00		
8.5.1/12.19.	8.5.1/12.19.	Geodetic survey and preparation as-built design.	m ¹	202,00		
<i>SUB-TOTAL</i>						
Unforeseen work (5% of sub-total)						
<i>TOTAL FOR DEVICES FOR WATER PROTECTION AGAINST POLLUTION – SEPARATORS (8.5.1/12.):</i>						

02.01. STORMWATER SEWAGE SYSTEM - SUMMARY		
8.5.1/2	Stormwater sewage system and pipe drainage	
8.5.1/8	Bridge runoff interception on Južna Morava river at km 881+006.705 of highway	
8.5.1/9	Bridge runoff interception on Južna Morava river at km 881+693.488 of highway	
8.5.1/10	Bridge runoff interception on Južna Morava river at km 883+256.496 of highway	
8.5.1/11	Bridge runoff interception on Južna Morava river at km 885+150.585 of highway	
8.5.1/12	Devices for water protection against pollution – separators	
SUB-TOTAL		
Unforeseen work (5% of sub-total)		
<i>TOTAL STORMWATER SEWAGE SYSTEM (02.01.):</i>		

12. 12. Technical infrastructure, 12.09. Displacement and protection of lineside telecommunication cables, 12.09.05 Collision 5, item no. 12.09.05.01, Material, item no. 12.09.05.01.01 (page 1-270), work description shall be replaced with following "One STA 3x4x1.2VF+8x4x1.2NF+12x4x0.9NF cable, with 55 mm diameter".

13. 12. Technical infrastructure, 12.09. Displacement and protection of lineside telecommunication cables, 12.09.05 Collision 5, item no. 12.09.05.01 Material, item no. 12.09.05.01.03 (page 1-270), work description shall be replaced with following one "PNK 3x10mm²"
14. 12. Technical infrastructure, 12.09. Displacement and protection of lineside telecommunication cables, 12.09.06 Collision 6, item no. 12.09.06.01 Material item no. 12.09.06.01.01 (page 1-271), work description shall be replaced with following "One STA 3x4x1.2V1 + 8x4x1.2Ni + 12x4x0.9NF cable, with 55 mm diameter"
15. 12. Technical infrastructure, 12.09. Displacement and protection of lineside telecommunication cables, 12.09.06 Collision 6, item no. 12.09.06.01. Material, item no. 12.09.06.01.03 (page 1-271), work description shall be replaced with following one "PNK 3x10mm²"
16. In Addendum No. 2, under Section IV. Bidding Forms, Bill of Quantities, LOT 2, change no. 6, 01.01.04 Sub-bases, item 01.01.04.01, item name shall be as follows "Sandy gravel material - tolling sub-grade layer"
17. In Addendum No. 2, under Section IV. Bidding Forms, Bill of Quantities, LOT 2, change no. 1, 01.01.04 Sub-bases, item 01.01.04.02, reference to T.S. shall be "AS-3.4 additional specifications"

Part 2 - Works Requirements, Special Specification

18. Text on page 1-697 (for LOT 1) and on page 1-715 (for LOT 2) which refers to "DRAINAGE DESIGN" shall be replaced with following:

5. DRAINAGE SYSTEM

8.5.1/2.01, 8.5.1/12.01. GEODETIC SURVEY. *Description of works.* Geodetic survey of rainwater sewage system shall be performed when sewage system is accepted and prior to trench backfilling as follows: position of inspection manholes and gullies, spacing between them (section lengths), pipe diameters per sections, inspection manhole bottom levels and bottom levels and diameters of all pipes in the inspection manhole. After completion of geodetic survey the As-built report shall be prepared and delivered to the Investor. *Measurement and payment:* Payment will be done per m³ of completely surveyed system. 8.5.1/5.03 - 8.5.1/11.04. **PROCUREMENT, TRANSPORT AND FIXING OF PIPES ON BRIDGES.** *Description of works.* Procurement, transport and fixing of polyester GRP pipes and joining fittings on bridges. Pipes and fittings shall be fabricated pursuant to standard EN 1610. All elements will be provided with BD marking meaning that they can be laid not only inside buildings but also in outer parts of structures. Pipes shall be fixed in accordance with Manufacturer's instructions and joined with flanges containing rubber inserts embedded in polyester resin body to guarantee a water impermeable joint. *Measurement and payment:* Payment will be done per m³ of fully assembled pipes dependent upon diameter. 8.5.1/4.04 - 8.5.1/11.04. **PROCUREMENT, TRANSPORT AND FITTING COMPENSATION SOCKETS.** *Description of works:* Procurement, transport and fitting of compensation plates at bridge expansion joint. Thermal elongation shall be compensated for with compensating socket fitted at default spacing. *Measurement and payment:* Payment will be done per one fully fitted compensation socket dependent upon diameter. 8.5.1/4.05 - 8.5.1/11.05. **PROCUREMENT, TRANSPORT AND FITTING OF PIPE SUPPORTS (HANGERS).** *Description of works:* Pipes shall be secured against movement by means of specially designed clips resistant to dynamic movements and ambient conditions spaced as designed. Clips, support, bolts and base plates shall be made of stainless steel. *Measurement and payment:* Payment will be done per one fully fitted support dependent upon pipe diameter. 8.5.1/4.06 - 8.5.1/11.06.

PROCUREMENT, TRANSPORT AND MOUNTING POLYESTER FITTINGS. *Description of works:* Polyester fittings shall be made of pipe lengths to withstand various pressure and rigidity classes same as pipes. The system shall be resistant to chemical agents, blows (even at temperature of -40°C) and UV radiation. The polyester fittings shall be used to connect gullies to stormwater sewers. *Measurement and payment:* Payment will be done per one fully fixed fitting dependent on diameter. 8.5.1/2.14. **STREET GULLIES.** *Description of works:* Procurement, transport and installation of street gully made of reinforced concrete pipe, Ø400 mm. The price includes: gully, coupling and rain grating, SRPS M.16.254. *Measurement and payment:* Payment will be done per one installed gully.

Devices for water protection against pollution - separators. 8.5.1/12.09. **OIL SEPARATORS WITH INTEGRATED BY-PASS.** *Description of works:* Procurement and delivery of separators with bypass line in the reinforced concrete tank, D400 load bearing capacity class. *Material.* BYPASS separators are mineral oil separators designed for treatment of oily rainwater from large areas. Separator is accommodated in the cylindrical or rectangular concrete tank which size is adjusted to a nominal capacity. Maximum flow capacity of this device is five or ten times higher than nominal flow. A separator treats waste water only to a value of nominal flows and in case of higher flows water passes only through bypass line on the assumption that the first wave had washed oil and sludge and that remaining water quantity is relatively clean. Coalescent filter is installed in the tank and its size corresponds to the required nominal flow. Separator mark is provided with the following information: Manufacturer's name; Name of equipment; SFP Qn/Qmax - 1 - Vo - r; Nominal capacity Qn, Max. capacity Qmax, Tank number 1; Catch basin volume Vo, Tank material. Prefabricated separators are those which are fully assembled in the factory. Separator can be assembled in situ only if its nominal flow is 150 or higher. During separator construction, width-length ratio of 1:1.5 to 1:5 shall be respected. Distance between separator bottom and outflow pipe shall be 20% of water depth. Minimum water depth shall be 2.5 m including depth of 0.15 m for light fluid and 0.35 m for deposition of sediments. Water area measured in m² shall amount to 0.2 x NS, total volume measured in m³ shall amount to 0.5 x NS and volume of chamber for light fluid storing shall be 0.03 x NS. Separator lid shall have an indication "Separator" and mark for load bearing capacity class according to EN124. Moreover there shall be a plate with an inscription made of durable material (e.g. stainless steel) and placed on the visible place at inner side, if possible. The following data shall be indicated on the plate: EN858, class (I or II), nominal size (NS), separator volume in l or m³, catch basin volume in l or m³, capacity of oil chamber in l or m³, depth of oil storing maximum volume, year of production, manufacturer's name or mark and certification authority's mark. Other marks can be added. *Measurement and payment:* Payment will be done per one fully installed device. 8.5.2/2.15 - 8.5.1/12.13. **WING MANHOLES.** *Description of works:* Construction of outflow structure provided with wing walls made of reinforced water impermeable concrete, class MB 40, fully in accordance with design details. *Measurement and payment:* Payment will be done per one fully completed structure. 8.5.1/2.12, 8.5.1/12.10. **CAST IRON LIDS.** *Description of works:* Procurement, transport and fitting of cast iron framed lids (100 kN load bearing capacity) for inspection manholes according to SRPS M.16.226. Framed lid shall be fitted to reinforced concrete ring on the manhole top. *Measurement and payment:* Payment will be done per one fully fitted lid. 8.5.1/2.13, 8.5.1/12.11. **CAST IRON RUNGS.** *Description of works:* Procurement, transport and installation of cast iron rungs at each 30 cm of height according to SRPS M.16.285. *Measurement and payment:* Payment will be done per one installed rung. 8.5.1/2.17, 8.5.1/12.14. **OUTFLOW STRUCTURE.** *Description of works:* Construction of MB30 concrete outflow structures at rainwater sewage outlets into the channel according to designed detail. *Measurement and payment:* Payment will be done per one fully completed structure. 8.5.1/2.15. **FLAT CHECK VALVES.** *Description of works:* Procurement, transport and fitting of flat check valves at rainwater sewage outlets into the watercourse according to designed detail. FCV Ø300 mm; FCV Ø400 mm, FCV Ø500 mm, FCV Ø600 mm. *Measurement and payment:* Payment will be done per one fully fitted flat check valve. 8.5.1/2.23., 8.5.1/3.07., - 8.5.1/11.07. 8.5.1/12.19. **GEODETIC SURVEY.** *Description of works.* Geodetic survey of rainwater sewage system shall be performed when sewage system is accepted and prior to trench backfilling as follows: position of inspection manholes and gullies, spacing between them (section lengths), pipe diameters per sections, inspection manhole bottom levels and bottom levels and diameters of all pipes in the inspection manhole. After completion of geodetic survey the As-built report shall be prepared and delivered to the Investor. *Measurement and payment:* Payment will be done per m³ of completely surveyed system.

Volume 2

Particular Conditions of Contract, Part A - Contract Data

19. Sub-clause 1.4 Language for communications shall be replaced with following "The language for communications shall be English and Serbian".

Please confirm in writing receipt of Addendum No.3.

Kind regards

Director

Milica Misić, Civ. Eng.

TRACE
TRPERIC GRUPA KONA AA

10/10

67733

Employer's letter No. 3214/12 dated June 20, 2012





КОРИДОРИ СРБИЈЕ

КОРИДОРИ СРБИЈЕ Д.О.О. БЕОГРАД
Инжењерске делатности и техничко
саветовање

Београд, Петар Кочић 21, 11000 Београд,
телефон: +381 (0)11 441 111
факс: +381 (0)11 441 111

www.koridorisrbije.rs www.koridori.rs

Београд, Београдска 153, ПИБ: 12206779
ИБО ДИ.018.02 Републички Биро за
дошлицу и издавање дозвола за градњу, Београд,
телефон: +381 (0)11 441 111

No: 3244/12
Date: 20.06.12

Bidders

REFERENCE: Serbia, Corridor X Highway Project, Construction of Highway E75, Section: Grdelica – Caricina Dolina (LOT 1 and LOT 2), ICB No: CORR.X.E75.EIB.PACK1.ICB

SUBJECT: Information on final list of substantially responsive Technical Bids and invitation for opening of Financial Bids

Dear Ladies/Sirs,

Thank you for submission of bids for Corridor X Highway Project, Construction of Highway E75, Section: Grdelica – Caricina Dolina (LOT 1 and LOT 2), ICB No: CORR.X.E75.EIB.PACK1.ICB.

We would like to inform you that the following Bidders have substantially responsive Technical Bids upon review of appeals to evaluation of Technical Bids submitted to the Employer, and are invited to opening of their Financial Bids for Construction of Highway E75, Section: Grdelica – Caricina Dolina (LOT 1 and LOT 2), ICB No: CORR.X.E75.EIB.PACK1.ICB:

No.	Company Name	LOT 1	LOT 2
2	JV Integral Inženjering AD and Konstruktor Inženjering d.d. Split	+	+
3	JV Doprastav-Metrostav	only one LOT	
5	Strabag AG	+	+
7	JV Trace and Mostovik	only one LOT	
8	JV Alpine Bau GmbH and Energoprojekt Niskogradnja A.D.	+	+
9	JV Ratko Mitrović Niskogradnja doo and MBA Miljković doo	+	
11	JV Porr Bau GmbH and Putevi AD Užice	+	+
13	JV Azvi SA and TADDEI SpA	+	+

The above listed Bidders with substantially responsive Technical Bids are informed about following changes to the tender documents that become necessary:

1. Payments under the Contract shall be entirely in Serbian Dinars (RSD). Only the Bidders that have required payment in additional/multiple currencies, beside RSD, are requested to submit modification to Financial Bids related to Table C of the Appendix to Bid. The modification



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КОРИДОРИ СРБИЈЕ Д.О.О БЕОГРАД
Београдске државне агенције за инфраструктуру
САВЕТОВАЊЕ
Београд, Београдска 11
Телефон: +381 11 4788 101

ОПШТИНА БЕОГРАД
Београдске државне агенције за инфраструктуру
САВЕТОВАЊЕ
Београд, Београдска 11
Телефон: +381 11 4788 101

should exclude all payments but RSD, so that the Contract Price shall be paid solely in Serbian Dinars (RSD).

2. Particular Conditions of Contract, Part A Contract Data, Performance Security, Sub-Clause 4.2, following text shall be added: "Acceptable Bank to the Employer means any Bank whose rating is minimum "6 (investment threshold – acceptable risk)" (here and after "minimum rating") according to the Agency for rating assessment COFACE. If during execution of the Contract the rating of the Bank from which the Contractor provided the Security falls below the minimum rating, the Contractor shall, within 28 days starting from the issue of notice by the Employer, substitute such Bank Security with a new Security issued by the Bank with minimum rating. Until such substitution of Security is provided to the Employer all payments under the contract shall be withheld. Such substitution is not eligible for any change of cost or price. Bank rating shall be verified by the Employer on quarterly base."
3. Particular Conditions of Contract, Part A Contract Data, Total Advance Payment, Sub-Clause 14.2, following text shall be added: "Acceptable Bank to the Employer means any Bank whose rating is minimum "6 (investment threshold – acceptable risk)" (here and after "minimum rating") according to the Agency for rating assessment COFACE. If during execution of the Contract the rating of the Bank from which the Contractor provided the Guarantee falls below the minimum rating, the Contractor shall, within 28 days starting from the issue of notice by the Employer, substitute such Bank Guarantee with a new Guarantee issued by the Bank with minimum rating. Until such substitution of Guarantee is provided to the Employer all payments under the contract shall be withheld. Such substitution is not eligible for any change of cost or price. Bank rating shall be verified by the Employer on quarterly base."
4. Particular Conditions of Contract, Part B Specific Provisions, The Contract Price, Sub-Clause 14.1 shall be replaced with the following: "Particular Conditions of Contract, Part B Specific Provisions, The Contract Price, Sub-Clause 14.1 (b): Replace the Sub-Clause with the following paragraph: The prices in Bill of Quantities include all duties, taxes and other levies excluding VAT (Value Added Taxes). Companies are not exempted from taxation, duties and other levies. The Contractor shall pay cost of custom duties, other import duties and other impositions, levies from their own proceeds. The Contract is VAT excluded, and the Contract Price shall not be adjusted for any of these costs except as stated in Sub-Clause 13.7 [Adjustments for Changes in Legislation]."
5. Particular Conditions of Contract, Part B Specific Provisions, The Contract Price, Sub-Clause 14.1 (e) shall be added: "not applicable".

According to above mentioned item 1. Bidders initially having submitted financial bids that include for payments in other currencies than RSD shall modify their Financial bids as follows:

Replace the whole Appendix to Bid (Bidding documents, IV. Section Bidding Forms), Schedule of Adjustment Data (pages 1-50, 1-51 and 1-52) with:

**"Appendix to Bid
Schedule of Adjustment Data**

[In Table A, below, the Bidder shall (a) indicate its amount of local currency payment, and (b) derive its proposed weightings for local currency payment. In the case of very large and/or complex works contracts, it





КОРИДОРИ СРБИЈЕ Д.О.О БЕОГРАД
Инжењерске делатности и техничке
саветовање

Улица Тулајчић 71 Београд
Телефон +381 11 4940 113
Факс +381 11 4940 112

Официјална интернет адреса:
www.koridori.rs

Матични број: 130498181 ГРБ - 05040701
ОД-310918-310918/2018
ОД-142887942-Самостални Београдски Сектор
ОД-335505-13. Авијација, мтс

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may be necessary to specify several families of price adjustment formulae corresponding to the different works involved.]

Table A. Local Currency

Index code	Index description	Source of index	Base value and date	Bidder's related currency amount	Bidder's proposed weighting
	Nonadjustable	—	—	—	A: 0,1
	Labour	*	28 days prior to bid submission date		B: _____
	Quarried aggregates	*		C: _____	
	Cement	*		D: _____	
	Reinforcing steel	*		E: _____	
	Bitumen	*		F: _____	
	Diesel fuel	*		G: _____	
Total					1.00

Note: Bidder's proposed weighting should be consistent with the works.

Index description	Source of index
Labour	Statistical Office of the Republic Serbia, Communication ZP11 (Statistics of Earnings) – Table 1: Average gross salaries and wages per employee – Construction
Quarried aggregates	Statistical Office of the Republic Serbia, Communication CN 20 – Indices of producers prices of manufactured products in Republic of Serbia: Other mining and quarrying
Cement	Statistical Office of the Republic Serbia, Communication CN 20 – Indices of producers prices of manufactured products in Republic of Serbia: Materials for incorporating in construction
Reinforcing steel	Statistical Office of the Republic Serbia, Communication CN 20 – Indices of producers prices of manufactured products in Republic of Serbia: Manufacture of basic metals
Bitumen	Statistical Office of the Republic Serbia, Communication CN 20 – Indices of producers prices of manufactured products in Republic of Serbia: Manufacture of coke and refined petroleum products
Diesel fuel	Statistical Office of the Republic Serbia, Communication CN 20 – Indices of producers prices of manufactured products in Republic of Serbia: Liquid fuels and lubricants

* Source of index

Items 2, 3, 4 and 5 don't require any modification of Bidders' Financial bids.

Bidders which consider that any of the above changes impact on their financial bid, have possibility to modify their original Bid Price accordingly. Such modification shall be given as % of change of original Bid Price (that reflects change of the Bidders expenses), and shall be accompanied by supporting information indicating the way such change was evaluated (e.g.: list of the impacts considered, assumptions considered in the valuation, valuation methodology, etc.). The change will be applied to the corrected tender price in accordance with ITB 31.1, after application of any unconditional modifications submitted with the original bid in accordance with ITB 14.4 and before any conditional discounts for award of multiple lots.



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КОРИДОРИ СРБИЈЕ Д.О.О. БЕОГРАД
Инжењерске делатности и техничко
саветовање

•
Кралева Петра 6, 21. КОРДУТ-кошара
11000 Београд
телефон: +381 11 3349171
факс: +381 11 3749187

србис@koridorisrbije.rs
www.koridorisrbije.rs, www.koridorisrbije.rs

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матини бане 20199153 АПС М15940792
160-318918-33 Банка Интеза д. београд
3109-142889-64 Комерцијална банка АД Београд
100-525025-73 Алк Београд ттц

The modifications shall be submitted to the Employer's address by July 3, 2012, at 12:00 hours. Any modification received by the Employer after the deadline mentioned above of bids shall be declared late, rejected, and returned unopened to the Bidder.

Please be informed that if a Bidder does not accept the required changes and doesn't submit the revised Appendix to Bid according to this addendum, if such submission is required, his Bid will be rejected, but Bid Security will not be forfeited.

Opening of Financial Bids will take place at the Koridori Srbije d.o.o., 21 Kralja Petra Street, II floor, room 2.10, 11000 Belgrade on July 3, 2012, at 13:00 hours.

Kind regards.

Director

Mihajlo Mišić, civ.eng.



(9) Particular Conditions

The following Particular Conditions shall supplement the General Conditions. Whenever there is a conflict, the provisions herein shall prevail over those in the General Conditions.

List of Particular Conditions:

Part A Contract Data

Part B Specific Provisions

Part A Contract Data



Part A - Contract Data

Conditions	Sub-Clause	Data
Employer's name and address	1.1.2.2 & 1.3	Koridori Srbije d.o.o. Beograd, 21 Kralja Petra Street, 11000 Belgrade, Serbia
Contractor's name and address	1.1.2.3 & 1.3	JV Trace and Mostovik 12, Nikola Obrazopisov Str. 1408 Sofia, Bulgaria
Engineer's name and address	1.1.2.4 & 1.3	Consortium: Louis Berger SAS/ France, Egnatia Odos/ Greece and Louis Berger d.o.o./ Serbia
Bank's name	1.1.2.11	European Investment Bank (the Bank)
Borrower's name	1.1.2.12	Republic of Serbia
Time for Completion	1.1.3.3	LOT 2: 720 days calculated from receipt of a notice to commence the Works by the Contractor from the Engineer
Defects Notification Period	1.1.3.7	365 days
Sections	1.1.5.6	not applicable
Electronic transmission systems	1.3	facsimile and electronic mail
Governing Law	1.4	The Contract shall be governed by the laws of the Republic of Serbia
Ruling language	1.4	The ruling language is English.
Language for communications	1.4	The language for communications shall be English and Serbian
Time for access to the Site	2.1	Not later than the expiry of the days shown in column No. 2 of Attachment to the Work Programme Revision I, submitted by the Contractor on March 19, 2013 and Revision II submitted by the Contractor on April 15, 2013. The initial date from which begins the counting of the days under column No. 2 is the commencement date, which should be not later than May 15, 2013.
Engineer's Duties and Authority	3.1(b)	Written approval of the Employer will be required whenever the Engineer has to decide on quantity and/or quality of works, on any type of additional payment,

Conditions	Sub-Clause	Data
		<p>and any extension of time, or any other type of variation.</p> <p>The Engineer shall submit samples and requests for procurement of material and equipment to the Employer for his prior consent.</p>
Performance Security	4.2	<p>The performance security will be in the form of a unconditional demand guarantee issued by the reputable bank from an eligible country or by a bank registered and operating under the laws of the Republic of Serbia, acceptable to the Employer, in the amount(s) of 20 percent of the Accepted Contract Amount and in the same currency(ies) of the Accepted Contract Amount.</p> <p>Acceptable Bank to the Employer means any Bank whose rating is minimum “6 (investment threshold – acceptable risk)” (here and after “minimum rating”) according to the Agency for rating assessment COFACE. If during execution of the Contract the rating of the Bank from which the Contractor provided the Security falls below the minimum rating, the Contractor shall, within 28 days starting from the issue of notice by the Employer, substitute such Bank Security with a new Security issued by the Bank with minimum rating. Until such substitution of Security is provided to the Employer all payments under the contract shall be withheld. Such substitution is not eligible for any change of cost or price. Bank rating shall be verified by the Employer on quarterly base.</p>
Subcontractors	4.4	The Contractor shall not subcontract more than 30 % of the Contract price.
Subcontractors	4.4 (b)	The prior consent of the Engineer will be obtained for proposed subcontractors or supplies not listed in the Contract and not exceeding 50.000 Euro or equivalent, while subcontracts valued more than



Conditions	Sub-Clause	Data
		50.000 Euro or equivalent will be referred to the Employer.
Normal working hours	6.5	07:00 to 19:00 hours, Monday to Saturday 07:00 to 13:00 hours, Sundays
Commencement of Works	8.1 (c) & (d)	not applicable
Delay damages for the Works	8.7 & 14.15(b)	0,1 % of the Contract Price per day.
Maximum amount of delay damages	8.7	10 % of the final Contract Price.
Provisional Sums	13.5.(b)(ii)	not applicable
Adjustments for Changes in Cost	13.8	Period "n" applicable to the adjustment multiplier "Pn": n=1 (one)
Total advance payment	14.2	<p>10 % Percentage of the Accepted Contract Amount payable in the currencies and proportions in which the Accepted Contract Amount is payable and in one instalment upon furnishing of acceptable advance payment guarantee issued by the reputable bank from an eligible country or by a bank registered and operating under the laws of the Republic of Serbia, acceptable to the Employer.</p> <p>Acceptable Bank to the Employer means any Bank whose rating is minimum "6 (investment threshold – acceptable risk)" (here and after "minimum rating") according to the Agency for rating assessment COFACE. If during execution of the Contract the rating of the Bank from which the Contractor provided the Guarantee falls below the minimum rating, the Contractor shall, within 28 days starting from the issue of notice by the Employer, substitute such Bank Guarantee with a new Guarantee issued by the Bank with minimum rating. Until such substitution of Guarantee is provided to the Employer all payments under the contract shall be withheld. Such substitution is not eligible for any change of cost or price. Bank rating shall be verified by the Employer on quarterly base.</p>

Conditions	Sub-Clause	Data
Repayment amortization rate of advance payment	14.2(b)	20 % (starting after completion of 30 % of the work)
Percentage of Retention	14.3	10 %
Limit of Retention Money	14.3	10 % of the Accepted Contract Amount
Plant and Materials	14.5(b)(i)	If Sub-Clause 14.5 applies: Plant and Materials for payment Free on Board _____ <i>[list]</i> , not applicable
	14.5(c)(i)	Plant and Materials for payment when delivered to the Site: <i>Reinforcement</i> .
Minimum Amount of Interim Payment Certificates	14.6	1 % of the Accepted Contract Amount.
Publishing source of commercial interest rates for financial charges in case of delayed payment	14.8	six-month EURIBOR + two percent (2 %)
Currencies of Payment	14.15	The Contract Price shall be paid in Serbian Dinars (RSD).
Maximum total liability of the Contractor to the Employer	17.6	Accepted Contract Amount
Periods for submission of insurance:	18.1	a. evidence of insurance.
		b. relevant policies
Maximum amount of deductibles for insurance of the Employer's risks	18.2(d)	5.000 EUR or equivalent
Minimum amount of third party insurance	18.3	250.000 Euro or equivalent per accident with the number of occurrences unlimited
Date by which the DB shall be appointed	20.2	28 days after the Commencement date
The DB shall be comprised of	20.2	Three Members
List of potential DB sole members	20.2	none
Appointment (if not agreed) to be made by	20.3	The President of FIDIC or a person appointed by the President

Table: Summary of Sections

Section Name/Description (Sub-Clause 1.1.5.6)	Time for Completion (Sub-Clause 1.1.3.3)	Damages for Delay (Sub-Clause 8.7)
Not applicable		

Part B Specific Provisions



Part B - Specific Provisions

Definitions	1.1.1.11	<p>“As Built Drawings” are drawings prepared by the Contractor and verified by the Engineer indicating exactly completed works. Final measurement of quantities shall be determined from dimensions and numbers indicated on “as built drawings”. “As Built Drawings” has to be completed and delivered before the taking over of works. The Contractor will submit two copies: prints all in bound sets and in Digital Form (CD) from which clear prints can be made.</p>
Time for Completion	1.1.3.3	<p>The Employer will provide required assistance to the Contractor in obtaining the relevant licenses for performance of construction works at the relevant ministry and under the Laws of the Republic of Serbia in particular for highways, arterial and regional roads, traffic connections to highways, arterial and regional roads; for LOT 2 licenses for construction works on roads (I131G2) and for construction of structures-bridges (I132G1), and any undue delays caused in the issuance of the licenses which is beyond the control of the Contractor will be taken into account for suitable extension of the time for completion of the contract without any penalties or damages to the Contractor.</p>
Other Definitions	1.1.6	<p>Add Sub-Clause 1.1.6.10 as follows: “Clarifying Documents” means the documents entitled clarifying documents which may be incorporated in the Contract by being listed in the Contract Agreement. Clarifying Documents shall not change the meaning of any provisions of the Contract Documents but confirm that the parties are in agreement upon any aspect of those provisions.</p>
Care and Supply of Documents	1.8	<p>Add the following paragraph to the end of the Sub-clause 1.8: In case deviation is established from approved contract drawings the Contractor shall prepare and submit for verification by the Engineer “As built drawings”. If there is no deviation the original contract drawings will be signed and stamped by the Engineer “As built</p>



		drawings". Upon final completion and prior to the submission of the final payment certificate original "As built drawings" signed by the Engineer shall be handed over to the Employer. Final measurement of quantities and payment shall be derived from dimensions and numbers of items indicated on "As built drawings".
Contractor's Use of Employer's Documents	1.11	Add the following paragraph to the end of Sub-clause 1.11: If there is a need to publish or disclose any part of the Contract or other documents made by (or on behalf of) the Employer, the Contractor will refer to the Employer whose decision shall be final.
Confidential Details	1.12	Add the following paragraph to the end of the Sub-clause 1.12: The Contractor shall not publish, permit to be published, or disclose any particulars of the Works in any trade or technical paper or elsewhere without the previous agreement of the Employer. No photographs of the Site or Works or any part thereof shall be taken, published, or circulated without the prior written permission of the Employer and no such permission shall exempt the Contractor from complying with the laws and regulations regarding taking and publishing photographs.
Joint and Several Liability	1.14	Add the following paragraph on the end of the Sub-clause 1.14: d) The lead Partner shall be authorised to act on behalf of each and all partners. The whole of the execution of the Contract, including payments, shall be carried into effect only with the lead partner.
Right for access to the Site	2.1	Add to the second paragraph the following sentence: "in case of difficulties of access to particular sections of the site, the Contractor shall immediately inform the Engineer. The Engineer and the Employer will timely take all the necessary measures to remove the obstacles preventing access."
Permits, licenses and approvals	2.2	Add the following paragraph to the end of Sub-Clause 2.2: Delays in obtaining such permits or approvals shall not be considered as

		justified reason for extension of time for completion or increase of Contract cost. The Contractor shall comply with the requirements of obtained permits and shall give the issuing Authority full opportunity to inspect and examine the Works.
Management Meetings	3.6	Add the following Sub-Clause: Management meeting will be held on a weekly base and attended by the Engineer's, Contractor's, EMP Supervisor's and Employer representatives. The Engineer shall keep record of management meetings and supply copy to all participants.
Avoidance of Interference	4.14	At the end of the Sub-clause 4.14, add the following text: Where any work on the site is likely to disrupt public utility services or traffic the Contractor shall inform the Engineer in writing in due time, which shall not be less than 7 days before commencing such works so that suitable measures can be taken. Construction Works must be organized in such a way to allow uninterrupted flow of the traffic at all times.
Protection of the Environment	4.18	At the end of the Sub-clause 4.18, add the following text: The Contractor will keep the site clean from construction or domestic wastes and restore all damages to the environment around the site caused by his activities.
Progress Reports	4.21	At the beginning of the Sub-clause add the following text: The Contractor, in accordance with Sub-Clause 4.1 (Contractor's General Obligations), shall initially jointly measure and agree with the Engineer an estimate of the quantities of work necessary to fulfil the objectives of the designs and specifications. The Contractor shall continually revise that estimate to take account of any instructed variations as well as any differences between the estimated quantities and the actual quantities of works as measured in accordance with Clause 12 (Measurement and Evaluation). The Contractor shall maintain summary

		<p>record charts of progress made towards completion of the works categories. The charts shall be transmitted electronically to the Engineer and Employer at the end of every week and in respect of each works category shall provide the following information:</p> <ul style="list-style-type: none"> • Estimated category quantity at tender • Currently estimated category quantity • Quantity of the works performed to date • Quantity performed during the reported week • Percentage of the works performed to date • Percentage performed during the reported week • Estimated evaluation of category at tender • Currently estimated evaluation of category • Evaluation of the works performed to date <p>Monthly progress reports shall be prepared by the Contractor and submitted to the Engineer in six copies (three copies in English and three copies in Serbian language).</p>
Engagement of Staff and Labor	6.1	Subject to availability of suitable candidates, the Contractor shall engage unskilled labor from Serbia.
Records of Contractor's Personnel and Equipment	6.10	<p>At the end of the Sub-clause add the following text:</p> <p>The Contractor's personnel and equipment engaged at site has to correspond to those proposed in the bid. In case of need for replacement of personnel and equipment, Contractor has to propose the personnel and equipment with the same or higher qualification/technical characteristics. Additional personnel and equipment can be engaged in order to fulfill the contract obligations.</p>
Workers' Organizations	6.23	<p>Additional sub-clause to be added after Sub-Clause 6.22</p> <p>In countries where national law recognizes workers' rights to form and to join workers' organizations of their choosing without interference and to bargain collectively, the Contractor shall</p>

		<p>comply with national law. Where national law substantially restricts workers' organizations, the Contractor shall enable alternative means for Contractor's Personnel to express their grievances and protect their rights regarding working conditions and terms of employment. In either case described above, and where national law is silent, the Contractor shall not discourage Contractor's Personnel from forming or joining workers' organizations of their choosing or from bargaining collectively, and shall not discriminate or retaliate against Contractor's Personnel who participate, or seek to participate, in such organizations and bargain collectively. The Contractor shall engage with such workers representatives. Worker organizations are expected to fairly represent the workers in the workforce.</p>
Non-Discrimination and Equal Opportunity	6.24	<p>Add the new Sub-clause after Sub-Clause 6.23 above:</p> <p>The Contractor shall not make employment decisions on the basis of personal characteristics unrelated to inherent job requirements. The Contractor shall base the employment relationship on the principle of equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline. In countries where national law provides for non-discrimination in employment, the Contractor shall comply with national law. When national laws are silent on non-discrimination in employment, the Contractor shall meet this Sub-Clause's requirements. Special measures of protection or assistance to remedy past discrimination or selection for a particular job based on inherent requirements of the job shall not be deemed discrimination.</p>
Epidemics	6.25	<p>Add the new Sub-clause:</p> <p>In the event of any outbreak of illness of an epidemic nature, the Contractor shall</p>



		comply with and carry out such regulations, orders and requirements as may be made by the Government, or the local medical or sanitary authorities, for the purpose of dealing with and overcoming the same.
Commencement of Works	8.1	At the end of paragraph (e) add the following paragraph: (f) Permanent works can commence only upon completion of facilities for the Engineer and the Employer.
Programme	8.3	At the end of paragraph (d) (ii) add the following: (iii) The Contractor shall subsequently supply revised cash flow estimates at quarterly intervals if required to do so by Engineer. (iv) Details of the revised Traffic Management Plan. (v) Details of the updated EMP in accordance with the guide developed by the EMP Supervisor. e) In the preparation of the working programme the Contractor shall take into account adverse weather conditions, which may restrict progress in the winter months. Republic of Serbia legislation empowers the Employer to restrict construction works on existing roads during the winter season (15 November to 15 March) in the interest of public safety. Any restriction imposed by the Employer during this period will not form bases of any claim for an extension of the time for the completion of the Works. f) The revised programme and detailed cash flow estimate shall be submitted within 14 days.
Extension of time	8.4	Delete the last sentence and add the following text: When determining each extension of time under Sub-Clause 20.1. the Engineer shall review previous determination and make written recommendation to the Employer who's decision will be final, until it has been changed by Dispute Board. The extension of time is approved by issuing an Addendum to the contract signed by both parties. The total extension of the time may be increased but not decreased.

		The Contractor can not apply for extension of time, later than 1 week prior to expiration of the time for completion in line with the Contract.
Suspension of Work	8.8	At the end of the last paragraph add to the following text: Prior to issuing instruction for suspension of all the works the Engineer shall consult with the Employer in order to obtain approval.
Contractor's Obligations	9.1	Add the following text at the end of Sub-Clause: In order to be entitled to a Taking Over Certificate the Contractor will carry out the tests defined by relevant laws and regulations, as well as under design technical specifications.
Taking Over of the Works and Sections	10.1	Add the following text on the end of the second paragraph: Upon receipt of the Contractors notice the Engineer will notify the Employer, who will report to the relevant ministry. Technical Acceptance of Works and Sections shall comply with relevant laws and regulations, and upon establishment of the Technical Acceptance Committee by the relevant ministry. Taking Over Certificate shall be issued by the Engineer only upon positive report of the Technical Acceptance Committee.
Omissions	12.4	Add the following text on the end of the Sub-Clause: Where the Contractor has not entered a rate or price against any items of work described in the Bills of Quantities, the provisions of Sub-Clause 4.11 (Sufficiency of the Accepted Contract Amount), shall be deemed to apply and the works will not be paid for separately by the Employer.
The Contract Price	14.1 (b)	Replace the Sub-Clause with the following paragraph: The prices in Bill of Quantities include all duties, taxes and other levies excluding VAT (Value Added Taxes). Companies are not exempted from taxation, duties and other levies. The Contractor shall pay cost of custom duties, other import duties and other impositions, levies from their

		own proceeds. The Contract is VAT excluded, and the Contract Price shall not be adjusted for any of these costs except as stated in Sub-Clause 13.7 [Adjustments for Changes in Legislation].
The Contract Price	14.1 (e)	not applicable
Plant and Materials	14.5	Add the following paragraph: (h) The Contractor should attach supporting original documents such as certificates of origin and warranties for quality of materials and installed equipment or plant or other technical documents that Engineer might request.
Payment	14.7	Add the following at the end of Sub Clause 14.7: All bank charges incurred by the Contractor as result of payments made to him by the Employer shall be at the Contractor's own cost. If the Contractor fails, within a reasonable time frame as requested by the Engineer, to comply with any requirement set forth in the Specification or as instructed by the Engineer, the Engineer shall be entitled to withhold an additional 100.000 EUR from the subsequent interim payment certificate until the Contractor complies with the requirement in question.
Payment	14.7 (b)&(c)	In Sub Clause 14.7 (b), after text "the amount certified in each Interim Payment Certificate" following shall be added: "immediately after certification of amount by the responsible person of the Employer but". In Sub Clause 14.7 (c), after text "the amount certified in each Final Payment Certificate" following shall be added: "immediately after certification of amount by the responsible person of the Employer but".
Termination by Employer	15.2	Add the following paragraph after the end of Sub Clause (c) (ii): (iii) - to fulfill milestones defined in its initial and/or revised time programme by more than 5 (five) months.
General Requirements for Insurances	18.1	Replace the first sentence in the second paragraph with following: " Wherever the Contractor is the insuring Party, each insurance shall be effected with insurers

		and in terms acceptable to the Employer.”
Loss and Damage Policy Currency	18.1	In the fifth paragraph replace the sentence: “Each policy insuring against loss or damage shall provide for payments to be made in the currencies required to rectify the loss or damage” with following text: ”All insurances policies to be provided under this contract shall be dominated in the currency of the Contract and all payments made under such policies shall be made in the Contract payment currencies.”.
Arbitration	20.6	Add to Sub-Para (d) of Sub-Clause 20.6 as follows: The dispute with domestic contractors shall be settled by the Chamber of Commerce and Industry of Serbia under its rules.
Ethic Clauses	21	Add the following set of Sub-Clauses at the end of Sub-Clauses set 20.
	21.1	Without the Employer’s prior written authorisation, a Contractor and his staff or any other company with which the Contractor is associated or linked may not, even on an ancillary or subcontracting basis, perform other services, carry out works or supply equipment for the project. This prohibition also applies to any other programmes or projects that could, owing to the nature of the contract, give rise to a conflict of interest on the part of the Contractor.
	21.2	When putting forward a bid, the Bidder must declare that he is affected by no potential conflict of interest, and that he has no particular link with other bidders or parties involved in the project. Should such a situation arise during performance of the contract, the Contractor must immediately inform the Employer.
	21.3	The Contractor must at all time act honourably and impartially in accordance with the code of conduct of his profession. He must refrain from making public statements about the project or services without the Employer’s prior approval. He may not commit the Employer in any way without its prior written consent.

	21.4	For the duration of the contract, the Contractor and his staff must respect human rights and undertake not to violate the political, cultural and religious mores of the recipient state.
	21.5	The Contractor may accept no payment connected with the contract other than that provided for therein. The Contractor and his staff must not exercise any activity or receive any advantage inconsistent with their obligations to the Employer.
	21.6	The Contractor and his staff are obliged to maintain professional secrecy for the entire duration of the contract and after its completion. All reports and documents drawn up or received by the Contractor in connection with the contract are confidential.
	21.7	The contract shall govern the contracting parties' use of all reports and documents drawn up, received or presented by them during the execution of the contract.
	21.8	The Contractor shall refrain from any relationship likely to compromise his independence or that of his staff. If the Contractor ceases to be independent, the Employer may, regardless of injury, terminate the contract without further notice and without the Contractor having any claim to compensation.
	21.9	The Contractor undertakes to provide the Employer on request with supporting evidence regarding the conditions in which the contract is being executed. The Employer may carry out whatever documentary or on-the-spot checks it deems necessary to find evidence in cases of suspected unusual commercial expenses.
	21.10	Failure to comply with one or more of these ethics clauses may result in the exclusion of the Contractor from other Employers contracts and in penalties. The individual or company in question must be informed of the fact in writing.

(10) General Conditions



General Conditions

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General Conditions

Koridori Srbije d.o.o. Beograd, Serbia

Construction of Highway E 75 Grdelica (Gornje Polje) – Caricina Dolina

LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina

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General Conditions

1. General Provisions

1.1 Definitions

In the Conditions of Contract (“these Conditions”), which include Particular Conditions, Parts A and B, and these General Conditions, the following words and expressions shall have the meanings stated. Words indicating persons or parties include corporations and other legal entities, except where the context requires otherwise.

1.1.1 The Contract

1.1.1.1 “Contract” means the Contract Agreement, the Letter of Acceptance, the Letter of Tender, these Conditions, the Specification, the Drawings, the Schedules, and the further documents (if any) which are listed in the Contract Agreement or in the Letter of Acceptance.

1.1.1.2 “Contract Agreement” means the contract agreement referred to in Sub-Clause 1.6 [Contract Agreement].

1.1.1.3 “Letter of Acceptance” means the letter of formal acceptance, signed by the Employer, of the Letter of Tender, including any annexed memoranda comprising agreements between and signed by both Parties. If there is no such letter of acceptance, the expression “Letter of Acceptance” means the Contract Agreement and the date of issuing or receiving the Letter of Acceptance means the date of signing the Contract Agreement.

1.1.1.4 “Letter of Tender” means the document entitled letter of tender or letter of bid, which was completed by the Contractor and includes the signed offer to the Employer for the Works.

1.1.1.5 “Specification” means the document entitled specification, as included in the Contract, and any additions and modifications to the specification in accordance with the Contract. Such document specifies the Works.

1.1.1.6 “Drawings” means the drawings of the Works, as included in the Contract, and any additional and modified drawings issued by (or on behalf of) the Employer in accordance with the Contract.

1.1.1.7 “Schedules” means the document(s) entitled schedules, completed by the Contractor and submitted with the Letter of Tender, as included in the Contract. Such document may include the Bill of Quantities, data, lists, and schedules of rates and/or

prices.

1.1.1.8 "Tender" means the Letter of Tender and all other documents which the Contractor submitted with the Letter of Tender, as included in the Contract.

1.1.1.9 "Bill of Quantities", "Daywork Schedule" and "Schedule of Payment Currencies" mean the documents so named (if any) which are comprised in the Schedules.

1.1.1.10 "Contract Data" means the pages completed by the Employer entitled contract data which constitute Part A of the Particular Conditions.

1.1.2 Parties and Persons

1.1.2.1 "Party" means the Employer or the Contractor, as the context requires.

1.1.2.2 "Employer" means the person named as employer in the Contract Data and the legal successors in title to this person.

1.1.2.3 "Contractor" means the person(s) named as contractor in the Letter of Tender accepted by the Employer and the legal successors in title to this person(s).

1.1.2.4 "Engineer" means the person appointed by the Employer to act as the Engineer for the purposes of the Contract and named in the Contract Data, or other person appointed from time to time by the Employer and notified to the Contractor under Sub-Clause 3.4 [Replacement of the Engineer].

1.1.2.5 "Contractor's Representative" means the person named by the Contractor in the Contract or appointed from time to time by the Contractor under Sub-Clause 4.3 [Contractor's Representative], who acts on behalf of the Contractor.

1.1.2.6 "Employer's Personnel" means the Engineer, the assistants referred to in Sub-Clause 3.2 [Delegation by the Engineer] and all other staff, labour and other employees of the Engineer and of the Employer; and any other personnel notified to the Contractor, by the Employer or the Engineer, as Employer's Personnel.

1.1.2.7 "Contractor's Personnel" means the Contractor's Representative and all personnel whom the Contractor utilises on Site, who may include the staff, labour and other employees of the Contractor and of each Subcontractor; and any other personnel assisting

the Contractor in the execution of the Works.

- 1.1.2.8 “Subcontractor” means any person named in the Contract as a subcontractor, or any person appointed as a subcontractor, for a part of the Works; and the legal successors in title to each of these persons.
- 1.1.2.9 “DB” means the person or three persons appointed under Sub-Clause 20.2 [Appointment of the Dispute Board] or Sub-Clause 20.3 [Failure to Agree on the Composition of the Dispute Board]
- 1.1.2.10 “FIDIC” means the Fédération Internationale des Ingénieurs-Conseils, the international federation of consulting engineers.
- 1.1.2.11 “Bank” means the financing institution (if any) named in the Contract Data.
- 1.1.2.12 “Borrower” means the person (if any) named as the borrower in the Contract Data.

1.1.3 Dates, Tests, Periods and Completion

- 1.1.3.1 “Base Date” means the date 28 days prior to the latest date for submission of the Tender.
- 1.1.3.2 “Commencement Date” means the date notified under Sub-Clause 8.1 [Commencement of Works].
- 1.1.3.3 “Time for Completion” means the time for completing the Works or a Section (as the case may be) under Sub-Clause 8.2 [Time for Completion], as stated in the Contract Data (with any extension under Sub-Clause 8.4 [Extension of Time for Completion]), calculated from the Commencement Date.
- 1.1.3.4 “Tests on Completion” means the tests which are specified in the Contract or agreed by both Parties or instructed as a Variation, and which are carried out under Clause 9 [Tests on Completion] before the Works or a Section (as the case may be) are taken over by the Employer.
- 1.1.3.5 “Taking-Over Certificate” means a certificate issued under Clause 10 [Employer’s Taking Over].
- 1.1.3.6 “Tests after Completion” means the tests (if any) which are specified in the Contract and which are carried out in accordance with the Specification after the Works or a Section (as the case may be) are taken over by the Employer.
- 1.1.3.7 “Defects Notification Period” means the period for notifying defects in the Works or a Section (as the

case may be) under Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects], which extends over twelve months except if otherwise stated in the Contract Data (with any extension under Sub-Clause 11.3 [Extension of Defects Notification Period]), calculated from the date on which the Works or Section is completed as certified under Sub-Clause 10.1 [Taking Over of the Works and Sections].

1.1.3.8 "Performance Certificate" means the certificate issued under Sub-Clause 11.9 [Performance Certificate].

1.1.3.9 "day" means a calendar day and "year" means 365 days.

1.1.4 Money and Payments

1.1.4.1 "Accepted Contract Amount" means the amount accepted in the Letter of Acceptance for the execution and completion of the Works and the remedying of any defects.

1.1.4.2 "Contract Price" means the price defined in Sub-Clause 14.1 [The Contract Price], and includes adjustments in accordance with the Contract.

1.1.4.3 "Cost" means all expenditure reasonably incurred (or to be incurred) by the Contractor, whether on or off the Site, including overhead and similar charges, but does not include profit.

1.1.4.4 "Final Payment Certificate" means the payment certificate issued under Sub-Clause 14.13 [Issue of Final Payment Certificate].

1.1.4.5 "Final Statement" means the statement defined in Sub-Clause 14.11 [Application for Final Payment Certificate].

1.1.4.6 "Foreign Currency" means a currency in which part (or all) of the Contract Price is payable, but not the Local Currency.

1.1.4.7 "Interim Payment Certificate" means a payment certificate issued under Clause 14 [Contract Price and Payment], other than the Final Payment Certificate.

1.1.4.8 "Local Currency" means the currency of the Country.

1.1.4.9 "Payment Certificate" means a payment certificate issued under Clause 14 [Contract Price and Payment].

1.1.4.10 "Provisional Sum" means a sum (if any) which is specified in the Contract as a provisional sum, for the

execution of any part of the Works or for the supply of Plant, Materials or services under Sub-Clause 13.5 [Provisional Sums].

1.1.4.11 "Retention Money" means the accumulated retention moneys which the Employer retains under Sub-Clause 14.3 [Application for Interim Payment Certificates] and pays under Sub-Clause 14.9 [Payment of Retention Money].

1.1.4.12 "Statement" means a statement submitted by the Contractor as part of an application, under Clause 14 [Contract Price and Payment], for a payment certificate.

1.1.5 Works and Goods

1.1.5.1 "Contractor's Equipment" means all apparatus, machinery, vehicles and other things required for the execution and completion of the Works and the remedying of any defects. However, Contractor's Equipment excludes Temporary Works, Employer's Equipment (if any), Plant, Materials and any other things intended to form or forming part of the Permanent Works.

1.1.5.2 "Goods" means Contractor's Equipment, Materials, Plant and Temporary Works, or any of them as appropriate.

1.1.5.3 "Materials" means things of all kinds (other than Plant) intended to form or forming part of the Permanent Works, including the supply-only materials (if any) to be supplied by the Contractor under the Contract.

1.1.5.4 "Permanent Works" means the permanent works to be executed by the Contractor under the Contract.

1.1.5.5 "Plant" means the apparatus, machinery and other equipment intended to form or forming part of the Permanent Works, including vehicles purchased for the Employer and relating to the construction or operation of the Works.

1.1.5.6 "Section" means a part of the Works specified in the Contract Data as a Section (if any).

1.1.5.7 "Temporary Works" means all temporary works of every kind (other than Contractor's Equipment) required on Site for the execution and completion of the Permanent Works and the remedying of any defects.

1.1.5.8 "Works" mean the Permanent Works and the

Temporary Works, or either of them as appropriate.

1.1.6 Other Definitions

- 1.1.6.1 "Contractor's Documents" means the calculations, computer programs and other software, drawings, manuals, models and other documents of a technical nature (if any) supplied by the Contractor under the Contract.
- 1.1.6.2 "Country" means the country in which the Site (or most of it) is located, where the Permanent Works are to be executed.
- 1.1.6.3 "Employer's Equipment" means the apparatus, machinery and vehicles (if any) made available by the Employer for the use of the Contractor in the execution of the Works, as stated in the Specification; but does not include Plant which has not been taken over by the Employer.
- 1.1.6.4 "Force Majeure" is defined in Clause 19 [Force Majeure].
- 1.1.6.5 "Laws" means all national (or state) legislation, statutes, ordinances and other laws, and regulations and by-laws of any legally constituted public authority.
- 1.1.6.6 "Performance Security" means the security (or securities, if any) under Sub-Clause 4.2 [Performance Security].
- 1.1.6.7 "Site" means the places where the Permanent Works are to be executed including storage and working areas and to which Plant and Materials are to be delivered, and any other places as may be specified in the Contract as forming part of the Site.
- 1.1.6.8 "Unforeseeable" means not reasonably foreseeable by an experienced contractor by the Base Date.
- 1.1.6.9 "Variation" means any change to the Works, which is instructed or approved as a variation under Clause 13 [Variations and Adjustments].

1.2 Interpretation

In the Contract, except where the context requires otherwise:

- (a) words indicating one gender include all genders;
- (b) words indicating the singular also include the plural and words indicating the plural also include the singular;
- (c) provisions including the word "agree," "agreed" or "agreement" require the agreement to be record in

writing;

- (d) "written" or "in writing" means hand-written, type-written, printed or electronically made, and resulting in a permanent record; and
- (e) the word "tender" is synonymous with "bid", and "tenderer" with "bidder" and the words "tender documents" with "bidding documents"

The marginal words and other headings shall not be taken into consideration in the interpretation of these Conditions.

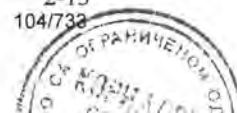
In these Conditions, provisions including the expression "Cost plus profit" require this profit to be one-twentieth (5%) of this Cost unless otherwise indicated in the Contract Data.

1.3 Communications

Wherever these Conditions provide for the giving or issuing of approvals, certificates, consents, determinations, notices, requests and discharges, these communications shall be:

- (a) in writing and delivered by hand (against receipt), sent by mail or courier, or transmitted using any of the agreed systems of electronic transmission as stated in the Contract Data; and
- (b) delivered, sent or transmitted to the address for the recipient's communications as stated in the Contract Data. However:
 - (i) if the recipient gives notice of another address, communications shall thereafter be delivered accordingly; and
 - (ii) if the recipient has not stated otherwise when requesting an approval or consent, it may be sent to the address from which the request was issued.

Approvals, certificates, consents and determinations shall not be unreasonably withheld or delayed. When a certificate is issued to a Party, the certifier shall send a copy to the other Party. When a notice is issued to a Party, by the other Party or the Engineer, a copy shall be sent to the Engineer or the other Party, as the case may be.



1.4 Law and Language The Contract shall be governed by the law of the country or other jurisdiction stated in the Contract Data.

The ruling language of the Contract shall be that stated in the Contract Data.

The language for communications shall be that stated in the Contract Data. If no language is stated there, the language for communications shall be the ruling language of the Contract.

1.5 Priority of Documents

The documents forming the Contract are to be taken as mutually explanatory of one another. For the purposes of interpretation, the priority of the documents shall be in accordance with the following sequence:

- (a) the Contract Agreement (if any),
- (b) the Letter of Acceptance,
- (c) the Tender,
- (d) the Particular Conditions – Part A,
- (e) the Particular Conditions – Part B
- (f) these General Conditions
- (g) the Specification,
- (h) the Drawings, and
- (i) the Schedules and any other documents forming part of the Contract.

If an ambiguity or discrepancy is found in the documents, the Engineer shall issue any necessary clarification or instruction.

1.6 Contract Agreement

The Parties shall enter into a Contract Agreement within 28 days after the Contractor receives the Letter of Acceptance, unless the Particular Conditions establish otherwise. The Contract Agreement shall be based upon the form annexed to the Particular Conditions. The costs of stamp duties and similar charges (if any) imposed by law in connection with entry into the Contract Agreement shall be borne by the Employer.

1.7 Assignment

Neither Party shall assign the whole or any part of the Contract or any benefit or interest in or under the Contract. However, either Party:

- (a) may assign the whole or any part with the prior agreement of the other Party, at the sole discretion of such other Party, and
- (b) may, as security in favour of a bank or financial

institution, assign its right to any moneys due, or to become due, under the Contract.

1.8 Care and Supply of Documents

The Specification and Drawings shall be in the custody and care of the Employer. Unless otherwise stated in the Contract, two copies of the Contract and of each subsequent Drawing shall be supplied to the Contractor, who may make or request further copies at the cost of the Contractor.

Each of the Contractor's Documents shall be in the custody and care of the Contractor, unless and until taken over by the Employer. Unless otherwise stated in the Contract, the Contractor shall supply to the Engineer six copies of each of the Contractor's Documents.

The Contractor shall keep, on the Site, a copy of the Contract, publications named in the Specification, the Contractor's Documents (if any), the Drawings and Variations and other communications given under the Contract. The Employer's Personnel shall have the right of access to all these documents at all reasonable times.

If a Party becomes aware of an error or defect in a document which was prepared for use in executing the Works, the Party shall promptly give notice to the other Party of such error or defect.

1.9 Delayed Drawings or Instructions

The Contractor shall give notice to the Engineer whenever the Works are likely to be delayed or disrupted if any necessary drawing or instruction is not issued to the Contractor within a particular time, which shall be reasonable. The notice shall include details of the necessary drawing or instruction, details of why and by when it should be issued, and the nature and amount of the delay or disruption likely to be suffered if it is late.

If the Contractor suffers delay and/or incurs Cost as a result of a failure of the Engineer to issue the notified drawing or instruction within a time which is reasonable and is specified in the notice with supporting details, the Contractor shall give a further notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this further notice, the Engineer shall proceed

in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

However, if and to the extent that the Engineer's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time, Cost or profit

1.10 Employer's Use of Contractor's Documents

As between the Parties, the Contractor shall retain the copyright and other intellectual property rights in the Contractor's Documents and other design documents made by (or on behalf of) the Contractor.

The Contractor shall be deemed (by signing the Contract) to give to the Employer a non-terminable transferable non-exclusive royalty-free licence to copy, use and communicate the Contractor's Documents, including making and using modifications of them. This licence shall:

- (a) apply throughout the actual or intended working life (whichever is longer) of the relevant parts of the Works,
- (b) entitle any person in proper possession of the relevant part of the Works to copy, use and communicate the Contractor's Documents for the purposes of completing, operating, maintaining, altering, adjusting, repairing and demolishing the Works, and
- (c) in the case of Contractor's Documents which are in the form of computer programs and other software, permit their use on any computer on the Site and other places as envisaged by the Contract, including replacements of any computers supplied by the Contractor.

The Contractor's Documents and other design documents made by (or on behalf of) the Contractor shall not, without the Contractor's consent, be used, copied or communicated to a third party by (or on behalf of) the Employer for purposes other than those permitted under this Sub-Clause.

1.11 Contractor's Use of Employer's Documents

As between the Parties, the Employer shall retain the copyright and other intellectual property rights in the Specification, the Drawings and other documents made by (or on behalf of) the Employer. The Contractor may, at his cost, copy, use, and obtain communication of these documents for the purposes of the Contract. They shall not, without the Employer's consent, be copied, used or communicated to a third party by the Contractor, except as necessary for the purposes of the Contract.

1.12 Confidential

The Contractor's and the Employer's Personnel shall disclose

Details

all such confidential and other information as may be reasonably required in order to verify the Contractor's compliance with the Contract and allow its proper implementation.

Each of them shall treat the details of the Contract as private and confidential, except to the extent necessary to carry out their respective obligations under the Contract or to comply with applicable Laws. Each of them shall not publish or disclose any particulars of the Works prepared by the other Party without the previous agreement of the other Party. However, the Contractor shall be permitted to disclose any publicly available information, or information otherwise required to establish his qualifications to compete for other projects.

1.13 Compliance with Laws

The Contractor shall, in performing the Contract, comply with applicable Laws. Unless otherwise stated in the Particular Conditions:

- (a) the Employer shall have obtained (or shall obtain) the planning, zoning, building permit or similar permission for the Permanent Works, and any other permissions described in the Specification as having been (or to be) obtained by the Employer; and the Employer shall indemnify and hold the Contractor harmless against and from the consequences of any failure to do so; and
- (b) the Contractor shall give all notices, pay all taxes, duties and fees, and obtain all permits, licences and approvals, as required by the Laws in relation to the execution and completion of the Works and the remedying of any defects; and the Contractor shall indemnify and hold the Employer harmless against and from the consequences of any failure to do so, unless the Contractor is impeded to accomplish these actions and shows evidence of its diligence.

1.14 Joint and Several Liability

If the Contractor constitutes (under applicable Laws) a joint venture or other unincorporated grouping of two or more persons:

- (a) these persons shall be deemed to be jointly and severally liable to the Employer for the performance of the Contract;
- (b) these persons shall notify the Employer of their leader who shall have authority to bind the Contractor and each of these persons; and
- (c) the Contractor shall not alter its composition or legal

status without the prior consent of the Employer.

**1.15 Inspections and
Audit by the Bank**

The Contractor shall permit the Bank and/or persons appointed by the Bank to inspect the Site and/or the accounts and records of the Contractor and its subcontractors relating to the performance of the Contract, and to have such accounts and records audited by auditors appointed by the Bank if required by the Bank. The Contractor's attention is drawn to Sub-Clause 15.6 [Corrupt or Fraudulent Practices] which provides, inter alia, that acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under Sub-Clause 1.15 constitute a prohibited practice subject to contract termination (as well as to a determination of ineligibility under the Procurement Guidelines).

2. The Employer

**2.1 Right of Access to
the Site**

The Employer shall give the Contractor right of access to, and possession of, all parts of the Site within the time (or times) stated in the Contract Data. The right and possession may not be exclusive to the Contractor. If, under the Contract, the Employer is required to give (to the Contractor) possession of any foundation, structure, plant or means of access, the Employer shall do so in the time and manner stated in the Specification. However, the Employer may withhold any such right or possession until the Performance Security has been received.

If no such time is stated in the Contract Data, the Employer shall give the Contractor right of access to, and possession of, the Site within such times as required to enable the Contractor to proceed without disruption in accordance with the programme submitted under Sub-Clause 8.3 [Programme].

If the Contractor suffers delay and/or incurs Cost as a result of a failure by the Employer to give any such right or possession within such time, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

However, if and to the extent that the Employer's failure was caused by any error or delay by the Contractor, including an

error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time, Cost or profit.

2.2 Permits, Licences or Approvals

The Employer shall provide, at the request of the Contractor, such reasonable assistance as to allow the Contractor to obtain properly:

- (a) copies of the Laws of the Country which are relevant to the Contract but are not readily available, and
- (b) any permits, licences or approvals required by the Laws of the Country:
 - (i) which the Contractor is required to obtain under Sub-Clause 1.13 [Compliance with Laws],
 - (ii) for the delivery of Goods, including clearance through customs, and
 - (iii) for the export of Contractor's Equipment when it is removed from the Site.

2.3 Employer's Personnel

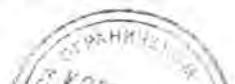
The Employer shall be responsible for ensuring that the Employer's Personnel and the Employer's other contractors on the Site:

- (a) co-operate with the Contractor's efforts under Sub-Clause 4.6 [Co-operation], and
- (b) take actions similar to those which the Contractor is required to take under sub-paragraphs (a), (b) and (c) of Sub-Clause 4.8 [Safety Procedures] and under Sub-Clause 4.18 [Protection of the Environment].

2.4 Employer's Financial Arrangements

The Employer shall submit, before the Commencement Date and thereafter within 28 days after receiving any request from the Contractor, reasonable evidence that financial arrangements have been made and are being maintained which will enable the Employer to pay the Contract Price punctually (as estimated at that time) in accordance with Clause 14 [Contract Price and Payment]. Before the Employer makes any material change to his financial arrangements, the Employer shall give notice to the Contractor with detailed particulars.

In addition, if the Bank has notified to the Borrower that the Bank has suspended disbursements under its loan, which finances in whole or in part the execution of the Works, the Employer shall give notice of such suspension to the Contractor with detailed particulars, including the date of such notification, with a copy to the Engineer, within 7 days of the Borrower having received the suspension notification from the Bank. If alternative funds will be available in appropriate currencies to the Employer to continue making payments to the



Contractor beyond a date 60 days after the date of Bank notification of the suspension, the Employer shall provide reasonable evidence in such notice of the extent to which such funds will be available.

2.5 Employer's Claims If the Employer considers himself to be entitled to any payment under any Clause of these Conditions or otherwise in connection with the Contract, and/or to any extension of the Defects Notification Period, the Employer or the Engineer shall give notice and particulars to the Contractor. However, notice is not required for payments due under Sub-Clause 4.19 [Electricity, Water and Gas], under Sub-Clause 4.20 [Employer's Equipment and Free-Issue Material], or for other services requested by the Contractor.

The notice shall be given as soon as practicable and no longer than 28 days after the Employer became aware, or should have become aware, of the event or circumstances giving rise to the claim. A notice relating to any extension of the Defects Notification Period shall be given before the expiry of such period.

The particulars shall specify the Clause or other basis of the claim, and shall include substantiation of the amount and/or extension to which the Employer considers himself to be entitled in connection with the Contract. The Engineer shall then proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) the amount (if any) which the Employer is entitled to be paid by the Contractor, and/or (ii) the extension (if any) of the Defects Notification Period in accordance with Sub-Clause 11.3 [Extension of Defects Notification Period].

This amount may be included as a deduction in the Contract Price and Payment Certificates. The Employer shall only be entitled to set off against or make any deduction from an amount certified in a Payment Certificate, or to otherwise claim against the Contractor, in accordance with this Sub-Clause.

3. The Engineer

3.1 Engineer's Duties and Authority The Employer shall appoint the Engineer who shall carry out the duties assigned to him in the Contract. The Engineer's staff shall include suitably qualified engineers and other professionals who are competent to carry out these duties.

The Engineer shall have no authority to amend the Contract.

The Engineer may exercise the authority attributable to the Engineer as specified in or necessarily to be implied from the Contract. If the Engineer is required to obtain the approval of

the Employer before exercising a specified authority, the requirements shall be as stated in the Particular Conditions. The Employer shall promptly inform the Contractor of any change to the authority attributed to the Engineer.

However, whenever the Engineer exercises a specified authority for which the Employer's approval is required, then (for the purposes of the Contract) the Employer shall be deemed to have given approval.

Except as otherwise stated in these Conditions:

- (a) whenever carrying out duties or exercising authority, specified in or implied by the Contract, the Engineer shall be deemed to act for the Employer;
- (b) the Engineer has no authority to relieve either Party of any duties, obligations or responsibilities under the Contract; and
- (c) any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by the Engineer (including absence of disapproval) shall not relieve the Contractor from any responsibility he has under the Contract, including responsibility for errors, omissions, discrepancies and non-compliances.
- (d) Any act by the Engineer in response to a Contractor's request except otherwise expressly specified shall be notified in writing to the Contractor within 28 days of receipt.

The following provisions shall apply:

The Engineer shall obtain the specific approval of the Employer before taking action under the following Sub-Clauses of these Conditions:

- (a) Sub-Clause 4.12 [Unforeseeable Physical Conditions]: Agreeing or determining an extension of time and/or additional cost.
- (b) Sub-Clause 13.1 [Right to Vary]: Instructing a Variation, except;
 - (i) in an emergency situation as determined by the Engineer, or
 - (ii) if such a Variation would increase the Accepted Contract Amount by less than the percentage



specified in the Contract Data.

- (c) Sub-Clause 13.3 [Variation Procedure]: Approving a proposal for Variation submitted by the Contractor in accordance with Sub Clause 13.1 [Right to Vary] or 13.2 [Value Engineering].
- (d) Sub-Clause 13.4 [Payment in Applicable Currencies]: Specifying the amount payable in each of the applicable currencies

Notwithstanding the obligation, as set out above, to obtain approval, if, in the opinion of the Engineer, an emergency occurs affecting the safety of life or of the Works or of adjoining property, he may, without relieving the Contractor of any of his duties and responsibility under the Contract, instruct the Contractor to execute all such work or to do all such things as may, in the opinion of the Engineer, be necessary to abate or reduce the risk. The Contractor shall forthwith comply, despite the absence of approval of the Employer, with any such instruction of the Engineer. The Engineer shall determine an addition to the Contract Price, in respect of such instruction, in accordance with Clause 13 [Variations and Adjustments] and shall notify the Contractor accordingly, with a copy to the Employer.

3.2 Delegation by the Engineer

The Engineer may from time to time assign duties and delegate authority to assistants, and may also revoke such assignment or delegation. These assistants may include a resident engineer, and/or independent inspectors appointed to inspect and/or test items of Plant and/or Materials. The assignment, delegation or revocation shall be in writing and shall not take effect until copies have been received by both Parties.

However, unless otherwise agreed by both Parties, the Engineer shall not delegate the authority to determine any matter in accordance with Sub-Clause 3.5 [Determinations].

Assistants shall be suitably qualified persons, who are competent to carry out these duties and exercise this authority, and who are fluent in the language for communications defined in Sub-Clause 1.4 [Law and Language].

Each assistant, to whom duties have been assigned or authority has been delegated, shall only be authorised to issue instructions to the Contractor to the extent defined by the delegation. Any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by an assistant, in accordance with the delegation, shall have the same effect as though the act had been an act of the Engineer. However:

- (a) any failure to disapprove any work, Plant or Materials shall not constitute approval, and shall therefore not prejudice the right of the Engineer to reject the work, Plant or Materials;
- (b) if the Contractor questions any determination or instruction of an assistant, the Contractor may refer the matter to the Engineer, who shall promptly confirm, reverse or vary the determination or instruction.

3.3 Instructions of the Engineer

The Engineer may issue to the Contractor (at any time) instructions and additional or modified Drawings which may be necessary for the execution of the Works and the remedying of any defects, all in accordance with the Contract. The Contractor shall only take instructions from the Engineer, or from an assistant to whom the appropriate authority has been delegated under this Clause. If an instruction constitutes a Variation, Clause 13 [Variations and Adjustments] shall apply.

The Contractor shall comply with the instructions given by the Engineer or delegated assistant, on any matter related to the Contract. Whenever practicable, their instructions shall be given in writing. If the Engineer or a delegated assistant:

- (a) gives an oral instruction,
- (b) receives a written confirmation of the instruction, from (or on behalf of) the Contractor, within two working days after giving the instruction, and
- (c) does not reply by issuing a written rejection and/or instruction within two working days after receiving the confirmation,

then the confirmation shall constitute the written instruction of the Engineer or delegated assistant (as the case may be).

3.4 Replacement of the Engineer

If the Employer intends to replace the Engineer, the Employer shall, not less than 21 days before the intended date of replacement, give notice to the Contractor of the name, address and relevant experience of the intended replacement Engineer. If the Contractor considers the intended replacement Engineer to be unsuitable, he has the right to raise objection against him by notice to the Employer, with supporting particulars, and the Employer shall give full and fair consideration to this objection.

3.5 Determinations

Whenever these Conditions provide that the Engineer shall proceed in accordance with this Sub-Clause 3.5 to agree or determine any matter, the Engineer shall consult with each Party in an endeavour to reach agreement. If agreement is not achieved, the Engineer shall make a fair determination in accordance with the Contract, taking due regard of all relevant circumstances.



The Engineer shall give notice to both Parties of each agreement or determination, with supporting particulars within 28 days from the receipt of the corresponding claim or request except when otherwise specified. Each Party shall give effect to each agreement or determination unless and until revised under Clause 20 [Claims, Disputes and Arbitration].

4. The Contractor

4.1 Contractor's General Obligations

The Contractor shall design (to the extent specified in the Contract), execute and complete the Works in accordance with the Contract and with the Engineer's instructions, and shall remedy any defects in the Works.

The Contractor shall provide the Plant and Contractor's Documents specified in the Contract, and all Contractor's Personnel, Goods, consumables and other things and services, whether of a temporary or permanent nature, required in and for this design, execution, completion and remedying of defects.

All equipment, material, and services to be incorporated in or required for the Works shall have their origin in any eligible source country as defined by the Bank.

The Contractor shall be responsible for the adequacy, stability and safety of all Site operations and of all methods of construction. Except to the extent specified in the Contract, the Contractor (i) shall be responsible for all Contractor's Documents, Temporary Works, and such design of each item of Plant and Materials as is required for the item to be in accordance with the Contract, and (ii) shall not otherwise be responsible for the design or specification of the Permanent Works.

The Contractor shall, whenever required by the Engineer, submit details of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works. No significant alteration to these arrangements and methods shall be made without this having previously been notified to the Engineer.

If the Contract specifies that the Contractor shall design any part of the Permanent Works, then unless otherwise stated in the Particular Conditions:

- (a) the Contractor shall submit to the Engineer the Contractor's Documents for this part in accordance with the procedures specified in the Contract;
- (b) these Contractor's Documents shall be in accordance with the Specification and Drawings, shall be written in the language for communications defined in Sub-Clause 1.4 [Law and Language], and shall include additional information required by the Engineer to add to the



Drawings for co-ordination of each Party's designs;

- (c) the Contractor shall be responsible for this part and it shall, when the Works are completed, be fit for such purposes for which the part is intended as are specified in the Contract; and
- (d) prior to the commencement of the Tests on Completion, the Contractor shall submit to the Engineer the "as-built" documents and, if applicable, operation and maintenance manuals in accordance with the Specification and in sufficient detail for the Employer to operate, maintain, dismantle, reassemble, adjust and repair this part of the Works. Such part shall not be considered to be completed for the purposes of taking-over under Sub-Clause 10.1 [Taking Over of the Works and Sections] until these documents and manuals have been submitted to the Engineer.

4.2 Performance Security

The Contractor shall obtain (at his cost) a Performance Security for proper performance, in the amount and currencies stated in the Contract Data. If an amount is not stated in the Contract Data, this Sub-Clause shall not apply.

The Contractor shall deliver the Performance Security to the Employer within 28 days after receiving the Letter of Acceptance, and shall send a copy to the Engineer. The Performance Security shall be issued by an entity and from within a country (or other jurisdiction) approved by the Employer, and shall be in the form annexed to the Particular Conditions or in another form approved by the Employer.

The Contractor shall ensure that the Performance Security is valid and enforceable until the Contractor has executed and completed the Works and remedied any defects. If the terms of the Performance Security specify its expiry date, and the Contractor has not become entitled to receive the Performance Certificate by the date 28 days prior to the expiry date, the Contractor shall extend the validity of the Performance Security until the Works have been completed and any defects have been remedied.

The Employer shall not make a claim under the Performance Security, except for amounts to which the Employer is entitled under the Contract.

The Employer shall indemnify and hold the Contractor harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from a claim under the Performance Security to the extent to which the Employer was not entitled to make the claim.

The Employer shall return the Performance Security to the Contractor within 21 days after receiving a copy of the Performance Certificate.

Without limitation to the provisions of the rest of this Sub-Clause, whenever the Engineer determines an addition or a reduction to the Contract Price as a result of a change in cost and/or legislation or as a result of a Variation amounting to more than 25 percent of the portion of the Contract Price payable in a specific currency, the Contractor shall at the Engineer's request promptly increase, or may decrease, as the case may be, the value of the Performance Security in that currency by an equal percentage.

4.3 Contractor's Representative

The Contractor shall appoint the Contractor's Representative and shall give him all authority necessary to act on the Contractor's behalf under the Contract.

Unless the Contractor's Representative is named in the Contract, the Contractor shall, prior to the Commencement Date, submit to the Engineer for consent the name and particulars of the person the Contractor proposes to appoint as Contractor's Representative. If consent is withheld or subsequently revoked in terms of Sub-Clause 6.9 [Contractor's Personnel], or if the appointed person fails to act as Contractor's Representative, the Contractor shall similarly submit the name and particulars of another suitable person for such appointment.

The Contractor shall not, without the prior consent of the Engineer, revoke the appointment of the Contractor's Representative or appoint a replacement.

The whole time of the Contractor's Representative shall be given to directing the Contractor's performance of the Contract. If the Contractor's Representative is to be temporarily absent from the Site during the execution of the Works, a suitable replacement person shall be appointed, subject to the Engineer's prior consent, and the Engineer shall be notified accordingly.

The Contractor's Representative shall, on behalf of the Contractor, receive instructions under Sub-Clause 3.3 [Instructions of the Engineer].

The Contractor's Representative may delegate any powers, functions and authority to any competent person, and may at any time revoke the delegation. Any delegation or revocation shall not take effect until the Engineer has received prior notice signed by the Contractor's Representative, naming the person and specifying the powers, functions and authority being delegated or revoked.

The Contractor's Representative shall be fluent in the language

for communications defined in Sub-Clause 1.4 [Law and Language]. If the Contractor's Representative's delegates are not fluent in the said language, the Contractor shall make competent interpreters available during all working hours in a number deemed sufficient by the Engineer.

4.4 Subcontractors

The Contractor shall not subcontract the whole of the Works.

The Contractor shall be responsible for the acts or defaults of any Subcontractor, his agents or employees, as if they were the acts or defaults of the Contractor. Unless otherwise stated in the Particular Conditions:

- (a) the Contractor shall not be required to obtain consent to suppliers solely of Materials, or to a subcontract for which the Subcontractor is named in the Contract;
- (b) the prior consent of the Engineer shall be obtained to other proposed Subcontractors;
- (c) the Contractor shall give the Engineer not less than 28 days' notice of the intended date of the commencement of each Subcontractor's work, and of the commencement of such work on the Site; and
- (d) each subcontract shall include provisions which would entitle the Employer to require the subcontract to be assigned to the Employer under Sub-Clause 4.5 [Assignment of Benefit of Subcontract] (if or when applicable) or in the event of termination under Sub-Clause 15.2 [Termination by Employer].

The Contractor shall ensure that the requirements imposed on the Contractor by Sub-Clause 1.12 [Confidential Details] apply equally to each Subcontractor.

Where practicable, the Contractor shall give fair and reasonable opportunity for contractors from the Country to be appointed as Subcontractors.

4.5 Assignment of Benefit of Subcontract

If a Subcontractor's obligations extend beyond the expiry date of the relevant Defects Notification Period and the Engineer, prior to this date, instructs the Contractor to assign the benefit of such obligations to the Employer, then the Contractor shall do so. Unless otherwise stated in the assignment, the Contractor shall have no liability to the Employer for the work carried out by the Subcontractor after the assignment takes effect.

4.6 Co-operation

The Contractor shall, as specified in the Contract or as instructed by the Engineer, allow appropriate opportunities for carrying out work to:

- (a) the Employer's Personnel,



- (b) any other contractors employed by the Employer, and
 - (c) the personnel of any legally constituted public authorities,
- who may be employed in the execution on or near the Site of any work not included in the Contract.

Any such instruction shall constitute a Variation if and to the extent that it causes the Contractor to suffer delays and/or to incur Unforeseeable Cost. Services for these personnel and other contractors may include the use of Contractor's Equipment, Temporary Works or access arrangements which are the responsibility of the Contractor.

If, under the Contract, the Employer is required to give to the Contractor possession of any foundation, structure, plant or means of access in accordance with Contractor's Documents, the Contractor shall submit such documents to the Engineer in the time and manner stated in the Specification.

4.7 Setting Out

The Contractor shall set out the Works in relation to original points, lines and levels of reference specified in the Contract or notified by the Engineer. The Contractor shall be responsible for the correct positioning of all parts of the Works, and shall rectify any error in the positions, levels, dimensions or alignment of the Works.

The Employer shall be responsible for any errors in these specified or notified items of reference, but the Contractor shall use reasonable efforts to verify their accuracy before they are used.

If the Contractor suffers delay and/or incurs Cost from executing work which was necessitated by an error in these items of reference, and an experienced contractor could not reasonably have discovered such error and avoided this delay and/or Cost, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) whether and (if so) to what extent the error could not reasonably have been discovered, and (ii) the matters described in sub-paragraphs (a) and (b) above related to this extent.

4.8 Safety Procedures The Contractor shall:

- (a) comply with all applicable safety regulations,
- (b) take care for the safety of all persons entitled to be on the Site,
- (c) use reasonable efforts to keep the Site and Works clear of unnecessary obstruction so as to avoid danger to these persons,
- (d) provide fencing, lighting, guarding and watching of the Works until completion and taking over under Clause 10 [Employer's Taking Over], and
- (e) provide any Temporary Works (including roadways, footways, guards and fences) which may be necessary, because of the execution of the Works, for the use and protection of the public and of owners and occupiers of adjacent land.

4.9 Quality Assurance

The Contractor shall institute a quality assurance system to demonstrate compliance with the requirements of the Contract. The system shall be in accordance with the details stated in the Contract. The Engineer shall be entitled to audit any aspect of the system.

Details of all procedures and compliance documents shall be submitted to the Engineer for information before each design and execution stage is commenced. When any document of a technical nature is issued to the Engineer, evidence of the prior approval by the Contractor himself shall be apparent on the document itself.

Compliance with the quality assurance system shall not relieve the Contractor of any of his duties, obligations or responsibilities under the Contract.

4.10 Site Data

The Employer shall have made available to the Contractor for his information, prior to the Base Date, all relevant data in the Employer's possession on sub-surface and hydrological conditions at the Site, including environmental aspects. The Employer shall similarly make available to the Contractor all such data which come into the Employer's possession after the Base Date. The Contractor shall be responsible for interpreting all such data.

To the extent which was practicable (taking account of cost and time), the Contractor shall be deemed to have obtained all necessary information as to risks, contingencies and other circumstances which may influence or affect the Tender or Works. To the same extent, the Contractor shall be deemed to have inspected and examined the Site, its surroundings, the



above data and other available information, and to have been satisfied before submitting the Tender as to all relevant matters, including (without limitation):

- (a) the form and nature of the Site, including sub-surface conditions,
- (b) the hydrological and climatic conditions,
- (c) the extent and nature of the work and Goods necessary for the execution and completion of the Works and the remedying of any defects,
- (d) the Laws, procedures and labour practices of the Country, and
- (e) the Contractor's requirements for access, accommodation, facilities, personnel, power, transport, water and other services.

4.11 Sufficiency of the Accepted Contract Amount

The Contractor shall be deemed to:

- (a) have satisfied himself as to the correctness and sufficiency of the Accepted Contract Amount, and
- (b) have based the Accepted Contract Amount on the data, interpretations, necessary information, inspections, examinations and satisfaction as to all relevant matters referred to in Sub-Clause 4.10 [Site Data].

Unless otherwise stated in the Contract, the Accepted Contract Amount covers all the Contractor's obligations under the Contract (including those under Provisional Sums, if any) and all things necessary for the proper execution and completion of the Works and the remedying of any defects.

4.12 Unforeseeable Physical Conditions

In this Sub-Clause, "physical conditions" means natural physical conditions and man-made and other physical obstructions and pollutants, which the Contractor encounters at the Site when executing the Works, including sub-surface and hydrological conditions but excluding climatic conditions.

If the Contractor encounters adverse physical conditions which he considers to have been Unforeseeable, the Contractor shall give notice to the Engineer as soon as practicable.

This notice shall describe the physical conditions, so that they can be inspected by the Engineer, and shall set out the reasons why the Contractor considers them to be Unforeseeable. The Contractor shall continue executing the Works, using such proper and reasonable measures as are appropriate for the physical conditions, and shall comply with any instructions



which the Engineer may give. If an instruction constitutes a Variation, Clause 13 [Variations and Adjustments] shall apply.

If and to the extent that the Contractor encounters physical conditions which are Unforeseeable, gives such a notice, and suffers delay and/or incurs Cost due to these conditions, the Contractor shall be entitled subject to notice under Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost, which shall be included in the Contract Price.

Upon receiving such notice and inspecting and/or investigating these physical conditions, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) whether and (if so) to what extent these physical conditions were Unforeseeable, and (ii) the matters described in sub-paragraphs (a) and (b) above related to this extent.

However, before additional Cost is finally agreed or determined under sub-paragraph (ii), the Engineer may also review whether other physical conditions in similar parts of the Works (if any) were more favourable than could reasonably have been foreseen when the Contractor submitted the Tender. If and to the extent that these more favourable conditions were encountered, the Engineer may proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the reductions in Cost which were due to these conditions, which may be included (as deductions) in the Contract Price and Payment Certificates. However, the net effect of all adjustments under sub-paragraph (b) and all these reductions, for all the physical conditions encountered in similar parts of the Works, shall not result in a net reduction in the Contract Price.

The Engineer shall take account of any evidence of the physical conditions foreseen by the Contractor when submitting the Tender, which shall be made available by the Contractor, but shall not be bound by the Contractor's interpretation of any such evidence.

4.13 Rights of Way and Facilities

Unless otherwise specified in the Contract the Employer shall provide access to and possession of the Site including special and/or temporary rights-of-way which are necessary for the Works. The Contractor shall obtain, at his risk and cost, any additional rights of way or facilities outside the Site which he may require for the purposes of the Works.



4.14 Avoidance of Interference

The Contractor shall not interfere unnecessarily or improperly with:

- (a) the convenience of the public, or
- (b) the access to and use and occupation of all roads and footpaths, irrespective of whether they are public or in the possession of the Employer or of others.

The Contractor shall indemnify and hold the Employer harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from any such unnecessary or improper interference.

4.15 Access Route

The Contractor shall be deemed to have been satisfied as to the suitability and availability of access routes to the Site at Base Date. The Contractor shall use reasonable efforts to prevent any road or bridge from being damaged by the Contractor's traffic or by the Contractor's Personnel. These efforts shall include the proper use of appropriate vehicles and routes.

Except as otherwise stated in these Conditions:

- (a) the Contractor shall (as between the Parties) be responsible for any maintenance which may be required for his use of access routes;
- (b) the Contractor shall provide all necessary signs or directions along access routes, and shall obtain any permission which may be required from the relevant authorities for his use of routes, signs and directions;
- (c) the Employer shall not be responsible for any claims which may arise from the use or otherwise of any access route;
- (d) the Employer does not guarantee the suitability or availability of particular access routes; and
- (e) Costs due to non-suitability or non-availability, for the use required by the Contractor, of access routes shall be borne by the Contractor.

4.16 Transport of Goods

Unless otherwise stated in the Particular Conditions:

- (a) the Contractor shall give the Engineer not less than 21 days' notice of the date on which any Plant or a major item of other Goods will be delivered to the Site;
- (b) the Contractor shall be responsible for packing, loading, transporting, receiving, unloading, storing and protecting all Goods and other things required for the Works; and
- (c) the Contractor shall indemnify and hold the Employer



harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from the transport of Goods, and shall negotiate and pay all claims arising from their transport.

4.17 Contractor's Equipment

The Contractor shall be responsible for all Contractor's Equipment. When brought on to the Site, Contractor's Equipment shall be deemed to be exclusively intended for the execution of the Works. The Contractor shall not remove from the Site any major items of Contractor's Equipment without the consent of the Engineer. However, consent shall not be required for vehicles transporting Goods or Contractor's Personnel off Site.

4.18 Protection of the Environment

The Contractor shall take all reasonable steps to protect the environment (both on and off the Site) and to limit damage and nuisance to people and property resulting from pollution, noise and other results of his operations.

The Contractor shall ensure that emissions, surface discharges and effluent from the Contractor's activities shall not exceed the values stated in the Specification or prescribed by applicable Laws.

4.19 Electricity, Water and Gas

The Contractor shall, except as stated below, be responsible for the provision of all power, water and other services he may require for his construction activities and to the extent defined in the Specifications, for the tests.

The Contractor shall be entitled to use for the purposes of the Works such supplies of electricity, water, gas and other services as may be available on the Site and of which details and prices are given in the Specification. The Contractor shall, at his risk and cost, provide any apparatus necessary for his use of these services and for measuring the quantities consumed.

The quantities consumed and the amounts due (at these prices) for such services shall be agreed or determined by the Engineer in accordance with Sub-Clause 2.5 [Employer's Claims] and Sub-Clause 3.5 [Determinations]. The Contractor shall pay these amounts to the Employer.

4.20 Employer's Equipment and Free-Issue Materials

The Employer shall make the Employer's Equipment (if any) available for the use of the Contractor in the execution of the Works in accordance with the details, arrangements and prices stated in the Specification. Unless otherwise stated in the Specification:

- (a) the Employer shall be responsible for the Employer's Equipment, except that
- (b) the Contractor shall be responsible for each item of

Employer's Equipment whilst any of the Contractor's Personnel is operating it, driving it, directing it or in possession or control of it.

The appropriate quantities and the amounts due (at such stated prices) for the use of Employer's Equipment shall be agreed or determined by the Engineer in accordance with Sub-Clause 2.5 [Employer's Claims] and Sub-Clause 3.5 [Determinations]. The Contractor shall pay these amounts to the Employer.

The Employer shall supply, free of charge, the "free-issue materials" (if any) in accordance with the details stated in the Specification. The Employer shall, at his risk and cost, provide these materials at the time and place specified in the Contract. The Contractor shall then visually inspect them, and shall promptly give notice to the Engineer of any shortage, defect or default in these materials. Unless otherwise agreed by both Parties, the Employer shall immediately rectify the notified shortage, defect or default.

After this visual inspection, the free-issue materials shall come under the care, custody and control of the Contractor. The Contractor's obligations of inspection, care, custody and control shall not relieve the Employer of liability for any shortage, defect or default not apparent from a visual inspection.

4.21 Progress Reports

Unless otherwise stated in the Particular Conditions, monthly progress reports shall be prepared by the Contractor and submitted to the Engineer in six copies. The first report shall cover the period up to the end of the first calendar month following the Commencement Date. Reports shall be submitted monthly thereafter, each within 7 days after the last day of the period to which it relates.

Reporting shall continue until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.

Each report shall include:

- (a) charts and detailed descriptions of progress, including each stage of design (if any), Contractor's Documents, procurement, manufacture, delivery to Site, construction, erection and testing; and including these stages for work by each nominated Subcontractor (as defined in Clause 5 [Nominated Subcontractors]),
- (b) photographs showing the status of manufacture and of progress on the Site;
- (c) for the manufacture of each main item of Plant and Materials, the name of the manufacturer, manufacture

location, percentage progress, and the actual or expected dates of:

- (i) commencement of manufacture,
 - (ii) Contractor's inspections,
 - (iii) tests, and
 - (iv) shipment and arrival at the Site;
- (d) the details described in Sub-Clause 6.10 [Records of Contractor's Personnel and Equipment];
- (e) copies of quality assurance documents, test results and certificates of Materials;
- (f) list of notices given under Sub-Clause 2.5 [Employer's Claims] and notices given under Sub-Clause 20.1 [Contractor's Claims];
- (g) safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations; and
- (h) comparisons of actual and planned progress, with details of any events or circumstances which may jeopardise the completion in accordance with the Contract, and the measures being (or to be) adopted to overcome delays.

4.22 Security of the Site

Unless otherwise stated in the Particular Conditions:

- (a) the Contractor shall be responsible for keeping unauthorised persons off the Site, and
- (b) authorised persons shall be limited to the Contractor's Personnel and the Employer's Personnel; and to any other personnel notified to the Contractor, by the Employer or the Engineer, as authorised personnel of the Employer's other contractors on the Site.

4.23 Contractor's Operations on Site

The Contractor shall confine his operations to the Site, and to any additional areas which may be obtained by the Contractor and agreed by the Engineer as additional working areas. The Contractor shall take all necessary precautions to keep Contractor's Equipment and Contractor's Personnel within the Site and these additional areas, and to keep them off adjacent land.

During the execution of the Works, the Contractor shall keep the Site free from all unnecessary obstruction, and shall store or dispose of any Contractor's Equipment or surplus materials. The Contractor shall clear away and remove from the Site any wreckage, rubbish and Temporary Works which are no longer

required.

Upon the issue of a Taking-Over Certificate, the Contractor shall clear away and remove, from that part of the Site and Works to which the Taking-Over Certificate refers, all Contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works. The Contractor shall leave that part of the Site and the Works in a clean and safe condition. However, the Contractor may retain on Site, during the Defects Notification Period, such Goods as are required for the Contractor to fulfil obligations under the Contract.

4.24 Fossils

All fossils, coins, articles of value or antiquity, and structures and other remains or items of geological or archaeological interest found on the Site shall be placed under the care and authority of the Employer. The Contractor shall take reasonable precautions to prevent Contractor's Personnel or other persons from removing or damaging any of these findings.

The Contractor shall, upon discovery of any such finding, promptly give notice to the Engineer, who shall issue instructions for dealing with it. If the Contractor suffers delay and/or incurs Cost from complying with the instructions, the Contractor shall give a further notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost, which shall be included in the Contract Price.

After receiving this further notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

5. Nominated Subcontractors

5.1 Definition of "nominated Subcontractor"

In the Contract, "nominated Subcontractor" means a Subcontractor:

- (a) who is stated in the Contract as being a nominated Subcontractor, or
- (b) whom the Engineer, under Clause 13 [Variations and Adjustments], instructs the Contractor to employ as a Subcontractor subject to Sub-Clause 5.2 [Objection to Notification].

5.2 Objection to Nomination

The Contractor shall not be under any obligation to employ a nominated Subcontractor against whom the Contractor raises reasonable objection by notice to the Engineer as soon as practicable, with supporting particulars. An objection shall be

deemed reasonable if it arises from (among other things) any of the following matters, unless the Employer agrees in writing to indemnify the Contractor against and from the consequences of the matter:

- (a) there are reasons to believe that the Subcontractor does not have sufficient competence, resources or financial strength;
- (b) the nominated Subcontractor does not accept to indemnify the Contractor against and from any negligence or misuse of Goods by the nominated Subcontractor, his agents and employees; or
- (c) the nominated Subcontractor does not accept to enter into a subcontract which specifies that, for the subcontracted work (including design, if any), the nominated Subcontractor shall:
 - (i) undertake to the Contractor such obligations and liabilities as will enable the Contractor to discharge his obligations and liabilities under the Contract;
 - (ii) indemnify the Contractor against and from all obligations and liabilities arising under or in connection with the Contract and from the consequences of any failure by the Subcontractor to perform these obligations or to fulfil these liabilities; and
 - (iii) be paid only if and when the Contractor has received from the Employer payments for sums due under the Subcontract referred to under Sub-Clause 5.3 [Payment to nominated Subcontractors].

5.3 Payments to nominated Subcontractors

The Contractor shall pay to the nominated Subcontractor the amounts shown on the nominated Subcontractor's invoices approved by the Contractor which the Engineer certifies to be due in accordance with the subcontract. These amounts plus other charges shall be included in the Contract Price in accordance with sub-paragraph (b) of Sub-Clause 13.5 [Provisional Sums], except as stated in Sub-Clause 5.4 [Evidence of Payments].

5.4 Evidence of Payments

Before issuing a Payment Certificate which includes an amount payable to a nominated Subcontractor, the Engineer may request the Contractor to supply reasonable evidence that the nominated Subcontractor has received all amounts due in accordance with previous Payment Certificates, less applicable deductions for retention or otherwise. Unless the Contractor:

- (a) submits this reasonable evidence to the Engineer, or

(b)

- (i) satisfies the Engineer in writing that the Contractor is reasonably entitled to withhold or refuse to pay these amounts, and
- (ii) submits to the Engineer reasonable evidence that the nominated Subcontractor has been notified of the Contractor's entitlement,

then the Employer may (at his sole discretion) pay, direct to the nominated Subcontractor, part or all of such amounts previously certified (less applicable deductions) as are due to the nominated Subcontractor and for which the Contractor has failed to submit the evidence described in sub-paragraphs (a) or (b) above. The Contractor shall then repay, to the Employer, the amount which the nominated Subcontractor was directly paid by the Employer.

6. Staff and Labour

6.1 Engagement of Staff and Labour

Except as otherwise stated in the Specification, the Contractor shall make arrangements for the engagement of all staff and labour, local or otherwise, and for their payment, feeding, transport, and, when appropriate, housing.

The Contractor is encouraged, to the extent practicable and reasonable, to employ staff and labour with appropriate qualifications and experience from sources within the Country.

6.2 Rates of Wages and Conditions of Labour

The Contractor shall pay rates of wages, and observe conditions of labour, which are not lower than those established for the trade or industry where the work is carried out. If no established rates or conditions are applicable, the Contractor shall pay rates of wages and observe conditions which are not lower than the general level of wages and conditions observed locally by employers whose trade or industry is similar to that of the Contractor.

The Contractor shall inform the Contractor's Personnel about their liability to pay personal income taxes in the Country in respect of such of their salaries, wages, allowances and any benefits as are subject to tax under the Laws of the Country for the time being in force, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such Laws.

6.3 Persons in the Service of Employer

The Contractor shall not recruit, or attempt to recruit, staff and labour from amongst the Employer's Personnel.

6.4 Labour Laws

The Contractor shall comply with all the relevant labour Laws

applicable to the Contractor's Personnel, including Laws relating to their employment, health, safety, welfare, immigration and emigration, and shall allow them all their legal rights.

The Contractor shall require his employees to obey all applicable Laws, including those concerning safety at work.

6.5 Working Hours

No work shall be carried out on the Site on locally recognised days of rest, or outside the normal working hours stated in the Contract Data, unless:

- (a) otherwise stated in the Contract,
- (b) the Engineer gives consent, or
- (c) the work is unavoidable, or necessary for the protection of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer.

6.6 Facilities for Staff and Labour

Except as otherwise stated in the Specification, the Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor's Personnel. The Contractor shall also provide facilities for the Employer's Personnel as stated in the Specification.

The Contractor shall not permit any of the Contractor's Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Permanent Works.

6.7 Health and Safety

The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's Personnel. In collaboration with local health authorities, the Contractor shall ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the Site and at any accommodation for Contractor's and Employer's Personnel, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics.

The Contractor shall appoint an accident prevention officer at the Site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the execution of the Works, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority.

The Contractor shall send, to the Engineer, details of any accident as soon as practicable after its occurrence. The Contractor shall maintain records and make reports concerning

health, safety and welfare of persons, and damage to property, as the Engineer may reasonably require.

HIV-AIDS Prevention. The Contractor shall conduct an HIV-AIDS awareness programme via an approved service provider, and shall undertake such other measures as are specified in this Contract to reduce the risk of the transfer of the HIV virus between and among the Contractor's Personnel and the local community, to promote early diagnosis and to assist affected individuals.

The Contractor shall throughout the contract (including the Defects Notification Period): (i) conduct Information, Education and Consultation Communication (IEC) campaigns, at least every other month, addressed to all the Site staff and labour (including all the Contractor's employees, all Sub-Contractors and Consultants' employees, and all truck drivers and crew making deliveries to Site for construction activities) and to the immediate local communities, concerning the risks, dangers and impact, and appropriate avoidance behavior with respect to Sexually Transmitted Diseases (STD)—or Sexually Transmitted Infections (STI) in general and HIV/AIDS in particular; (ii) provide male or female condoms for all Site staff and labour as appropriate; and (iii) provide for STI and HIV/AIDS screening, diagnosis, counseling and referral to a dedicated national STI and HIV/AIDS program, (unless otherwise agreed) of all Site staff and labour.

The Contractor shall include in the program to be submitted for the execution of the Works under Sub-Clause 8.3 [Programme] an alleviation program for Site staff and labour and their families in respect of Sexually Transmitted Infections (STI) and Sexually Transmitted Diseases (STD) including HIV/AIDS. The STI, STD and HIV/AIDS alleviation program shall indicate when, how and at what cost the Contractor plans to satisfy the requirements of this Sub-Clause and the related specification. For each component, the program shall detail the resources to be provided or utilized and any related sub-contracting proposed. The program shall also include provision of a detailed cost estimate with supporting documentation. Payment to the Contractor for preparation and implementation this program shall not exceed the Provisional Sum dedicated for this purpose.

- 6.8 Contractor's Superintendence** Throughout the execution of the Works, and as long thereafter as is necessary to fulfil the Contractor's obligations, the Contractor shall provide all necessary superintendence to plan, arrange, direct, manage, inspect and test the work.
- Superintendence shall be given by a sufficient number of persons having adequate knowledge of the language for communications (defined in Sub-Clause 1.4 [Law and Language]) and of the operations to be carried out (including the methods and techniques required, the hazards likely to be encountered and methods of preventing accidents), for the satisfactory and safe execution of the Works.
- 6.9 Contractor's Personnel** The Contractor's Personnel shall be appropriately qualified, skilled and experienced in their respective trades or occupations. The Engineer may require the Contractor to remove (or cause to be removed) any person employed on the Site or Works, including the Contractor's Representative if applicable, who:
- (a) persists in any misconduct or lack of care,
 - (b) carries out duties incompetently or negligently,
 - (c) fails to conform with any provisions of the Contract, or
 - (d) persists in any conduct which is prejudicial to safety, health, or the protection of the environment.
- If appropriate, the Contractor shall then appoint (or cause to be appointed) a suitable replacement person.
- 6.10 Records of Contractor's Personnel and Equipment** The Contractor shall submit, to the Engineer, details showing the number of each class of Contractor's Personnel and of each type of Contractor's Equipment on the Site. Details shall be submitted each calendar month, in a form approved by the Engineer, until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.
- 6.11 Disorderly Conduct** The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst the Contractor's Personnel, and to preserve peace and protection of persons and property on and near the Site.
- 6.12 Foreign Personnel** The Contractor may bring in to the Country any foreign personnel who are necessary for the execution of the Works to the extent allowed by the applicable Laws. The Contractor shall ensure that these personnel are provided with the required residence visas and work permits. The Employer will, if requested by the Contractor, use his best endeavours in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national, or government permission required for

bringing in the Contractor's personnel.

The Contractor shall be responsible for the return of these personnel to the place where they were recruited or to their domicile. In the event of the death in the Country of any of these personnel or members of their families, the Contractor shall similarly be responsible for making the appropriate arrangements for their return or burial.

6.13 Supply of Foodstuffs

The Contractor shall arrange for the provision of a sufficient supply of suitable food as may be stated in the Specification at reasonable prices for the Contractor's Personnel for the purposes of or in connection with the Contract.

6.14 Supply of Water

The Contractor shall, having regard to local conditions, provide on the Site an adequate supply of drinking and other water for the use of the Contractor's Personnel.

6.15 Measures against Insect and Pest Nuisance

The Contractor shall at all times take the necessary precautions to protect the Contractor's Personnel employed on the Site from insect and pest nuisance, and to reduce their danger to health. The Contractor shall comply with all the regulations of the local health authorities, including use of appropriate insecticide.

6.16 Alcoholic Liquor or Drugs

The Contractor shall not, otherwise than in accordance with the Laws of the Country, import, sell, give barter or otherwise dispose of any alcoholic liquor or drugs, or permit or allow importation, sale, gift barter or disposal thereto by Contractor's Personnel.

6.17 Arms and Ammunition

The Contractor shall not give, barter, or otherwise dispose of, to any person, any arms or ammunition of any kind, or allow Contractor's Personnel to do so.

- 6.18 Festivals and Religious Customs** The Contractor shall respect the Country's recognized festivals, days of rest and religious or other customs.
- 6.19 Funeral Arrangements** The Contractor shall be responsible, to the extent required by local regulations, for making any funeral arrangements for any of his local employees who may die while engaged upon the Works.
- 6.20 Prohibition of Forced or Compulsory Labour** The contractor shall not employ "forced or compulsory labour" in any form. "Forced or compulsory labour" consists of all work or service, not voluntarily performed, that is extracted from an individual under threat of force or penalty.
- 6.21 Prohibition of Harmful Child Labour** The Contractor shall not employ any child to perform any work that is economically exploitative, or is likely to be hazardous to, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development.
- 6.22 Employment Records of Workers** The Contractor shall keep complete and accurate records of the employment of labour at the Site. The records shall include the names, ages, genders, hours worked and wages paid to all workers. These records shall be summarized on a monthly basis and submitted to the Engineer, and these records shall be available for inspection by Auditors during normal working hours. These records shall be included in the details to be submitted by the Contractor under Sub-Clause 6.10 [Records of Contractor's Personnel and Equipment].

7. Plant, Materials and Workmanship

- 7.1 Manner of Execution** The Contractor shall carry out the manufacture of Plant, the production and manufacture of Materials, and all other execution of the Works:
- (a) in the manner (if any) specified in the Contract,
 - (b) in a proper workmanlike and careful manner, in accordance with recognised good practice, and
 - (c) with properly equipped facilities and non-hazardous Materials, except as otherwise specified in the Contract.
- 7.2 Samples** The Contractor shall submit the following samples of Materials, and relevant information, to the Engineer for consent prior to using the Materials in or for the Works:
- (a) manufacturer's standard samples of Materials and samples specified in the Contract, all at the Contractor's cost, and
 - (b) additional samples instructed by the Engineer as a Variation.

Each sample shall be labelled as to origin and intended use in



the Works.

7.3 Inspection

The Employer's Personnel shall at all reasonable times:

- (a) have full access to all parts of the Site and to all places from which natural Materials are being obtained, and
- (b) during production, manufacture and construction (at the Site and elsewhere), be entitled to examine, inspect, measure and test the materials and workmanship, and to check the progress of manufacture of Plant and production and manufacture of Materials.

The Contractor shall give the Employer's Personnel full opportunity to carry out these activities, including providing access, facilities, permissions and safety equipment. No such activity shall relieve the Contractor from any obligation or responsibility.

The Contractor shall give notice to the Engineer whenever any work is ready and before it is covered up, put out of sight, or packaged for storage or transport. The Engineer shall then either carry out the examination, inspection, measurement or testing without unreasonable delay, or promptly give notice to the Contractor that the Engineer does not require to do so. If the Contractor fails to give the notice, he shall, if and when required by the Engineer, uncover the work and thereafter reinstate and make good, all at the Contractor's cost.

7.4 Testing

This Sub-Clause shall apply to all tests specified in the Contract, other than the Tests after Completion (if any).

Except as otherwise specified in the Contract, the Contractor shall provide all apparatus, assistance, documents and other information, electricity, equipment, fuel, consumables, instruments, labour, materials, and suitably qualified and experienced staff, as are necessary to carry out the specified tests efficiently. The Contractor shall agree, with the Engineer, the time and place for the specified testing of any Plant, Materials and other parts of the Works.

The Engineer may, under Clause 13 [Variations and Adjustments], vary the location or details of specified tests, or instruct the Contractor to carry out additional tests. If these varied or additional tests show that the tested Plant, Materials or workmanship is not in accordance with the Contract, the cost of carrying out this Variation shall be borne by the Contractor, notwithstanding other provisions of the Contract.

The Engineer shall give the Contractor not less than 24 hours' notice of the Engineer's intention to attend the tests. If the Engineer does not attend at the time and place agreed, the Contractor may proceed with the tests, unless otherwise

instructed by the Engineer, and the tests shall then be deemed to have been made in the Engineer's presence.

If the Contractor suffers delay and/or incurs Cost from complying with these instructions or as a result of a delay for which the Employer is responsible, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

The Contractor shall promptly forward to the Engineer duly certified reports of the tests. When the specified tests have been passed, the Engineer shall endorse the Contractor's test certificate, or issue a certificate to him, to that effect. If the Engineer has not attended the tests, he shall be deemed to have accepted the readings as accurate.

7.5 Rejection

If, as a result of an examination, inspection, measurement or testing, any Plant, Materials or workmanship is found to be defective or otherwise not in accordance with the Contract, the Engineer may reject the Plant, Materials or workmanship by giving notice to the Contractor, with reasons. The Contractor shall then promptly make good the defect and ensure that the rejected item complies with the Contract.

If the Engineer requires this Plant, Materials or workmanship to be retested, the tests shall be repeated under the same terms and conditions. If the rejection and retesting cause the Employer to incur additional costs, the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay these costs to the Employer.

7.6 Remedial Work

Notwithstanding any previous test or certification, the Engineer may instruct the Contractor to:

- (a) remove from the Site and replace any Plant or Materials which is not in accordance with the Contract,
- (b) remove and re-execute any other work which is not in accordance with the Contract, and
- (c) execute any work which is urgently required for the safety of the Works, whether because of an accident,



unforeseeable event or otherwise.

The Contractor shall comply with the instruction within a reasonable time, which shall be the time (if any) specified in the instruction, or immediately if urgency is specified under subparagraph (c).

If the Contractor fails to comply with the instruction, the Employer shall be entitled to employ and pay other persons to carry out the work. Except to the extent that the Contractor would have been entitled to payment for the work, the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay to the Employer all costs arising from this failure.

7.7 Ownership of Plant and Materials

Except otherwise specified in the Contract, each item of Plant and Materials shall, to the extent consistent with the Laws of the Country, become the property of the Employer at whichever is the earlier of the following times, free from liens and other encumbrances:

- (a) when it is incorporated in the Works;
- (b) when the Contractor is paid the corresponding value of the Plant and Materials under Sub-Clause 8.10 [Payment for Plant and Materials in Event of Suspension].

7.8 Royalties

Unless otherwise stated in the Specification, the Contractor shall pay all royalties, rents and other payments for:

- (a) natural Materials obtained from outside the Site, and
- (b) the disposal of material from demolitions and excavations and of other surplus material (whether natural or man-made), except to the extent that disposal areas within the Site are specified in the Contract.

8. Commencement, Delays and Suspension

8.1 Commencement of Works

Except otherwise specified in the Particular Conditions, the Commencement Date shall be the date at which the following precedent conditions have all been fulfilled and the Engineer's instruction recording the agreement of both Parties on such fulfilment and instructing to commence the Works is received by the Contractor:

- (a) signature of the Contract Agreement by both Parties, and if required, approval of the Contract by relevant authorities in the Country;
- (b) delivery to the Contractor of reasonable evidence of the Employer's Financial arrangements (under Sub-Clause 2.4 [Employer's Financial Arrangements])

- (c) except if otherwise specified in the Contract Data, possession of the Site given to the Contractor together with such permission(s) under (a) of Sub-Clause 1.13 [Compliance with Laws] as required for the commencement of the Works; and
- (d) receipt by the Contractor of the Advance Payment under Sub-Clause 14.2 [Advance Payment] provided that the corresponding bank guarantee has been delivered by the Contractor.
- (e) If the said Engineer's instruction is not received by the Contractor within 180 days from his receipt of the Letter of Acceptance, the Contractor shall be entitled to terminate the Contract under Sub-Clause 16.2 [Termination by Contractor].

The Contractor shall commence the execution of the Works as soon as is reasonably practicable after the Commencement Date, and shall then proceed with the Works with due expedition and without delay.

8.2 Time for Completion

The Contractor shall complete the whole of the Works, and each Section (if any), within the Time for Completion for the Works or Section (as the case may be), including:

- (a) achieving the passing of the Tests on Completion, and
- (b) completing all work which is stated in the Contract as being required for the Works or Section to be considered to be completed for the purposes of taking-over under Sub-Clause 10.1 [Taking Over of the Works and Sections].

8.3 Programme

The Contractor shall submit a detailed time programme to the Engineer within 28 days after receiving the notice under Sub-Clause 8.1 [Commencement of Works]. The Contractor shall also submit a revised programme whenever the previous programme is inconsistent with actual progress or with the Contractor's obligations. Each programme shall include:

- (a) the order in which the Contractor intends to carry out the Works, including the anticipated timing of each stage of design (if any), Contractor's Documents, procurement, manufacture of Plant, delivery to Site, construction, erection and testing,
- (b) each of these stages for work by each nominated Subcontractor (as defined in Clause 5 [Nominated Subcontractors]),
- (c) the sequence and timing of inspections and tests specified in the Contract, and

- (d) a supporting report which includes:
 - (i) a general description of the methods which the Contractor intends to adopt, and of the major stages, in the execution of the Works, and
 - (ii) details showing the Contractor's reasonable estimate of the number of each class of Contractor's Personnel and of each type of Contractor's Equipment, required on the Site for each major stage.

Unless the Engineer, within 21 days after receiving a programme, gives notice to the Contractor stating the extent to which it does not comply with the Contract, the Contractor shall proceed in accordance with the programme, subject to his other obligations under the Contract. The Employer's Personnel shall be entitled to rely upon the programme when planning their activities.

The Contractor shall promptly give notice to the Engineer of specific probable future events or circumstances which may adversely affect the work, increase the Contract Price, or delay the execution of the Works. The Engineer may require the Contractor to submit an estimate of the anticipated effect of the future event or circumstances, and/or a proposal under Sub-Clause 13.3 [Variation Procedure].

If, at any time, the Engineer gives notice to the Contractor that a programme fails (to the extent stated) to comply with the Contract or to be consistent with actual progress and the Contractor's stated intentions, the Contractor shall submit a revised programme to the Engineer in accordance with this Sub-Clause.

8.4 Extension of Time for Completion

The Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to an extension of the Time for Completion if and to the extent that completion for the purposes of Sub-Clause 10.1 [Taking-Over of the Works and Sections] is or will be delayed by any of the following causes:

- (a) a Variation (unless an adjustment to the Time for Completion has been agreed under Sub-Clause 13.3 [Variation Procedure]) or other substantial change in the quantity of an item of work included in the Contract,
- (b) a cause of delay giving an entitlement to extension of time under a Sub-Clause of these Conditions,
- (c) exceptionally adverse climatic conditions,
- (d) Unforeseeable shortages in the availability of personnel or Goods caused by epidemic or governmental actions, or



- (e) any delay, impediment or prevention caused by or attributable to the Employer, the Employer's Personnel, or the Employer's other contractors.

If the Contractor considers himself to be entitled to an extension of the Time for Completion, the Contractor shall give notice to the Engineer in accordance with Sub-Clause 20.1 [Contractor's Claims]. When determining each extension of time under Sub-Clause 20.1, the Engineer shall review previous determinations and may increase, but shall not decrease, the total extension of time.

8.5 Delays Caused by Authorities

If the following conditions apply, namely:

- (a) the Contractor has diligently followed the procedures laid down by the relevant legally constituted public authorities in the Country,
- (b) these authorities delay or disrupt the Contractor's work, and
- (c) the delay or disruption was Unforeseeable,

then this delay or disruption will be considered as a cause of delay under sub-paragraph (b) of Sub-Clause 8.4 [Extension of Time for Completion].

8.6 Rate of Progress

If, at any time:

- (a) actual progress is too slow to complete within the Time for Completion, and/or
- (b) progress has fallen (or will fall) behind the current programme under Sub-Clause 8.3 [Programme],

other than as a result of a cause listed in Sub-Clause 8.4 [Extension of Time for Completion], then the Engineer may instruct the Contractor to submit, under Sub-Clause 8.3 [Programme], a revised programme and supporting report describing the revised methods which the Contractor proposes to adopt in order to expedite progress and complete within the Time for Completion.

Unless the Engineer notifies otherwise, the Contractor shall adopt these revised methods, which may require increases in the working hours and/or in the numbers of Contractor's Personnel and/or Goods, at the risk and cost of the Contractor. If these revised methods cause the Employer to incur additional costs, the Contractor shall subject to notice under Sub-Clause 2.5 [Employer's Claims] pay these costs to the Employer, in addition to delay damages (if any) under Sub-Clause 8.7 [Delay Damages] below.

Additional costs of revised methods, including acceleration measures, instructed by the Engineer to reduce delays resulting from causes listed under Sub-Clause 8.4 [Extension of Time for Completion] shall be paid by the Employer, without generating, however, any other additional payment benefit to the Contractor.

8.7 Delay Damages

If the Contractor fails to comply with Sub-Clause 8.2 [Time for Completion], the Contractor shall be subject to notice under Sub-Clause 2.5 [Employer's Claims] pay delay damages to the Employer for this default. These delay damages shall be the sum stated in the Contract Data, which shall be paid for every day which shall elapse between the relevant Time for Completion and the date stated in the Taking-Over Certificate. However, the total amount due under this Sub-Clause shall not exceed the maximum amount of delay damages (if any) stated in the Contract Data.

These delay damages shall be the only damages due from the Contractor for such default, other than in the event of termination under Sub-Clause 15.2 [Termination by Employer] prior to completion of the Works. These damages shall not relieve the Contractor from his obligation to complete the Works, or from any other duties, obligations or responsibilities which he may have under the Contract.

8.8 Suspension of Work

The Engineer may at any time instruct the Contractor to suspend progress of part or all of the Works. During such suspension, the Contractor shall protect, store and secure such part or the Works against any deterioration, loss or damage.

The Engineer may also notify the cause for the suspension. If and to the extent that the cause is notified and is the responsibility of the Contractor, the following Sub-Clauses 8.9 [Consequences of Suspension], 8.10 [Payment for Plant and Materials in Event of Suspension] and 8.11 [Prolonged Suspension] shall not apply.

8.9 Consequences of Suspension

If the Contractor suffers delay and/or incurs Cost from complying with the Engineer's instructions under Sub-Clause 8.8 [Suspension of Work] and/or from resuming the work, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or

determine these matters.

The Contractor shall not be entitled to an extension of time for, or to payment of the Cost incurred in, making good the consequences of the Contractor's faulty design, workmanship or materials, or of the Contractor's failure to protect, store or secure in accordance with Sub-Clause 8.8 [Suspension of Work].

8.10 Payment for Plant and Materials in Event of Suspension

The Contractor shall be entitled to payment of the value (as at the date of suspension) of Plant and/or Materials which have not been delivered to Site, if:

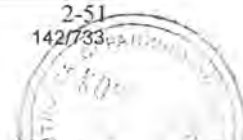
- (a) the work on Plant or delivery of Plant and/or Materials has been suspended for more than 28 days, and
- (b) the Contractor has marked the Plant and/or Materials as the Employer's property in accordance with the Engineer's instructions.

8.11 Prolonged Suspension

If the suspension under Sub-Clause 8.8 [Suspension of Work] has continued for more than 84 days, the Contractor may request the Engineer's permission to proceed. If the Engineer does not give permission within 28 days after being requested to do so, the Contractor may, by giving notice to the Engineer, treat the suspension as an omission under Clause 13 [Variations and Adjustments] of the affected part of the Works. If the suspension affects the whole of the Works, the Contractor may give notice of termination under Sub-Clause 16.2 [Termination by Contractor].

8.12 Resumption of Work

After the permission or instruction to proceed is given, the Contractor and the Engineer shall jointly examine the Works and the Plant and Materials affected by the suspension. The Contractor shall make good any deterioration or defect in or loss of the Works or Plant or Materials, which has occurred during the suspension after receiving from the Engineer an instruction to this effect under Clause 13 [Variations and Adjustments].



9. Tests on Completion

9.1 Contractor's Obligations

The Contractor shall carry out the Tests on Completion in accordance with this Clause and Sub-Clause 7.4 [Testing], after providing the documents in accordance with sub-paragraph (d) of Sub-Clause 4.1 [Contractor's General Obligations].

The Contractor shall give to the Engineer not less than 21 days' notice of the date after which the Contractor will be ready to carry out each of the Tests on Completion. Unless otherwise agreed, Tests on Completion shall be carried out within 14 days after this date, on such day or days as the Engineer shall instruct.

In considering the results of the Tests on Completion, the Engineer shall make allowances for the effect of any use of the Works by the Employer on the performance or other characteristics of the Works. As soon as the Works, or a Section, have passed any Tests on Completion, the Contractor shall submit a certified report of the results of these Tests to the Engineer.

9.2 Delayed Tests

If the Tests on Completion are being unduly delayed by the Employer, Sub-Clause 7.4 [Testing] (fifth paragraph) and/or Sub-Clause 10.3 [Interference with Tests on Completion] shall be applicable.

If the Tests on Completion are being unduly delayed by the Contractor, the Engineer may by notice require the Contractor to carry out the Tests within 21 days after receiving the notice. The Contractor shall carry out the Tests on such day or days within that period as the Contractor may fix and of which he shall give notice to the Engineer.

If the Contractor fails to carry out the Tests on Completion within the period of 21 days, the Employer's Personnel may proceed with the Tests at the risk and cost of the Contractor. The Tests on Completion shall then be deemed to have been carried out in the presence of the Contractor and the results of the Tests shall be accepted as accurate.

9.3 Retesting

If the Works, or a Section, fail to pass the Tests on Completion, Sub-Clause 7.5 [Rejection] shall apply, and the Engineer or the Contractor may require the failed Tests, and Tests on Completion on any related work, to be repeated under the same terms and conditions.

9.4 Failure to Pass Tests on Completion

If the Works, or a Section, fail to pass the Tests on Completion repeated under Sub-Clause 9.3 [Retesting], the Engineer shall be entitled to:

- (a) order further repetition of Tests on Completion under Sub-Clause 9.3;



- (b) if the failure deprives the Employer of substantially the whole benefit of the Works or Section, reject the Works or Section (as the case may be), in which event the Employer shall have the same remedies as are provided in sub-paragraph (c) of Sub-Clause 11.4 [Failure to Remedy Defects]; or
- (c) issue a Taking-Over Certificate, if the Employer so requests.

In the event of sub-paragraph (c), the Contractor shall proceed in accordance with all other obligations under the Contract, and the Contract Price shall be reduced by such amount as shall be appropriate to cover the reduced value to the Employer as a result of this failure. Unless the relevant reduction for this failure is stated (or its method of calculation is defined) in the Contract, the Employer may require the reduction to be (i) agreed by both Parties (in full satisfaction of this failure only) and paid before this Taking-Over Certificate is issued, or (ii) determined and paid under Sub-Clause 2.5 [Employer's Claims] and Sub-Clause 3.5 [Determinations].

10. Employer's Taking Over

10.1 Taking Over of the Works and Sections

Except as stated in Sub-Clause 9.4 [Failure to Pass Tests on Completion], the Works shall be taken over by the Employer when (i) the Works have been completed in accordance with the Contract, including the matters described in Sub-Clause 8.2 [Time for Completion] and except as allowed in sub-paragraph (a) below, and (ii) a Taking-Over Certificate for the Works has been issued, or is deemed to have been issued in accordance with this Sub-Clause.

The Contractor may apply by notice to the Engineer for a Taking-Over Certificate not earlier than 14 days before the Works will, in the Contractor's opinion, be complete and ready for taking over. If the Works are divided into Sections, the Contractor may similarly apply for a Taking-Over Certificate for each Section.

The Engineer shall, within 28 days after receiving the Contractor's application:

- (a) issue the Taking-Over Certificate to the Contractor, stating the date on which the Works or Section were completed in accordance with the Contract, except for any minor outstanding work and defects which will not substantially affect the use of the Works or Section for their intended purpose (either until or whilst this work is completed and these defects are remedied); or
- (b) reject the application, giving reasons and specifying the work required to be done by the Contractor to enable the Taking-Over Certificate to be issued. The Contractor shall

then complete this work before issuing a further notice under this Sub-Clause.

If the Engineer fails either to issue the Taking-Over Certificate or to reject the Contractor's application within the period of 28 days, and if the Works or Section (as the case may be) are substantially in accordance with the Contract, the Taking-Over Certificate shall be deemed to have been issued on the last day of that period.

10.2 Taking Over of Parts of the Works

The Engineer may, at the sole discretion of the Employer, issue a Taking-Over Certificate for any part of the Permanent Works.

The Employer shall not use any part of the Works (other than as a temporary measure which is either specified in the Contract or agreed by both Parties) unless and until the Engineer has issued a Taking-Over Certificate for this part. However, if the Employer does use any part of the Works before the Taking-Over Certificate is issued:

- (a) the part which is used shall be deemed to have been taken over as from the date on which it is used,
- (b) the Contractor shall cease to be liable for the care of such part as from this date, when responsibility shall pass to the Employer, and
- (c) if requested by the Contractor, the Engineer shall issue a Taking-Over Certificate for this part.

After the Engineer has issued a Taking-Over Certificate for a part of the Works, the Contractor shall be given the earliest opportunity to take such steps as may be necessary to carry out any outstanding Tests on Completion. The Contractor shall carry out these Tests on Completion as soon as practicable before the expiry date of the relevant Defects Notification Period.

If the Contractor incurs Cost as a result of the Employer taking over and/or using a part of the Works, other than such use as is specified in the Contract or agreed by the Contractor, the Contractor shall (i) give notice to the Engineer and (ii) be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to payment of any such Cost plus profit, which shall be included in the Contract Price. After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine this Cost and profit.

If a Taking-Over Certificate has been issued for a part of the Works (other than a Section), the delay damages thereafter for completion of the remainder of the Works shall be reduced. Similarly, the delay damages for the remainder of the Section (if any) in which this part is included shall also be reduced. For any



period of delay after the date stated in this Taking-Over Certificate, the proportional reduction in these delay damages shall be calculated as the proportion which the value of the part so certified bears to the value of the Works or Section (as the case may be) as a whole. The Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these proportions. The provisions of this paragraph shall only apply to the daily rate of delay damages under Sub-Clause 8.7 [Delay Damages], and shall not affect the maximum amount of these damages.

10.3 Interference with Tests on Completion

If the Contractor is prevented, for more than 14 days, from carrying out the Tests on Completion by a cause for which the Employer is responsible, the Employer shall be deemed to have taken over the Works or Section (as the case may be) on the date when the Tests on Completion would otherwise have been completed.

The Engineer shall then issue a Taking-Over Certificate accordingly, and the Contractor shall carry out the Tests on Completion as soon as practicable, before the expiry date of the Defects Notification Period. The Engineer shall require the Tests on Completion to be carried out by giving 14 days' notice and in accordance with the relevant provisions of the Contract.

If the Contractor suffers delay and/or incurs Cost as a result of this delay in carrying out the Tests on Completion, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

10.4 Surfaces Requiring Reinstatement

Except as otherwise stated in a Taking-Over Certificate, a certificate for a Section or part of the Works shall not be deemed to certify completion of any ground or other surfaces requiring reinstatement.

11. Defects Liability

11.1 Completion of Outstanding Work and Remedying Defects

In order that the Works and Contractor's Documents, and each Section, shall be in the condition required by the Contract (fair wear and tear excepted) by the expiry date of the relevant Defects Notification Period or as soon as practicable thereafter, the Contractor shall:

- (a) complete any work which is outstanding on the date stated in a Taking-Over Certificate, within such reasonable time as is instructed by the Engineer, and
- (b) execute all work required to remedy defects or damage, as may be notified by (or on behalf of) the Employer on or before the expiry date of the Defects Notification Period for the Works or Section (as the case may be).

If a defect appears or damage occurs, the Contractor shall be notified accordingly, by (or on behalf of) the Employer.

11.2 Cost of Remedying Defects

All work referred to in sub-paragraph (b) of Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects] shall be executed at the risk and cost of the Contractor, if and to the extent that the work is attributable to:

- (a) any design for which the Contractor is responsible,
- (b) Plant, Materials or workmanship not being in accordance with the Contract, or
- (c) failure by the Contractor to comply with any other obligation.

If and to the extent that such work is attributable to any other cause, the Contractor shall be notified promptly by (or on behalf of) the Employer and Sub-Clause 13.3 [Variation Procedure] shall apply.

11.3 Extension of Defects Notification Period

The Employer shall be entitled subject to Sub-Clause 2.5 [Employer's Claims] to an extension of the Defects Notification Period for the Works or a Section if and to the extent that the Works, Section or a major item of Plant (as the case may be, and after taking over) cannot be used for the purposes for which they are intended by reason of a defect or by reason of a damage attributable to the Contractor. However, a Defects Notification Period shall not be extended by more than two years.

If delivery and/or erection of Plant and/or Materials was suspended under Sub-Clause 8.8 [Suspension of Work] or Sub-Clause 16.1 [Contractor's Entitlement to Suspend Work], the Contractor's obligations under this Clause shall not apply to any defects or damage occurring more than two years after the

Defects Notification Period for the Plant and/or Materials would otherwise have expired.

11.4 Failure to Remedy Defects

If the Contractor fails to remedy any defect or damage within a reasonable time, a date may be fixed by (or on behalf of) the Employer, on or by which the defect or damage is to be remedied. The Contractor shall be given reasonable notice of this date.

If the Contractor fails to remedy the defect or damage by this notified date and this remedial work was to be executed at the cost of the Contractor under Sub-Clause 11.2 [Cost of Remedying Defects], the Employer may (at his option):

- (a) carry out the work himself or by others, in a reasonable manner and at the Contractor's cost, but the Contractor shall have no responsibility for this work; and the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay to the Employer the costs reasonably incurred by the Employer in remedying the defect or damage;
- (b) require the Engineer to agree or determine a reasonable reduction in the Contract Price in accordance with Sub-Clause 3.5 [Determinations]; or
- (c) if the defect or damage deprives the Employer of substantially the whole benefit of the Works or any major part of the Works, terminate the Contract as a whole, or in respect of such major part which cannot be put to the intended use. Without prejudice to any other rights, under the Contract or otherwise, the Employer shall then be entitled to recover all sums paid for the Works or for such part (as the case may be), plus financing costs and the cost of dismantling the same, clearing the Site and returning Plant and Materials to the Contractor.

11.5 Removal of Defective Work

If the defect or damage cannot be remedied expeditiously on the Site and the Employer gives consent, the Contractor may remove from the Site for the purposes of repair such items of Plant as are defective or damaged. This consent may require the Contractor to increase the amount of the Performance Security by the full replacement cost of these items, or to provide other appropriate security.

11.6 Further Tests

If the work of remedying of any defect or damage may affect the performance of the Works, the Engineer may require the repetition of any of the tests described in the Contract. The requirement shall be made by notice within 28 days after the defect or damage is remedied.

These tests shall be carried out in accordance with the terms applicable to the previous tests, except that they shall be carried out at the risk and cost of the Party liable, under Sub-Clause

11.2 [Cost of Remedying Defects], for the cost of the remedial work.

11.7 Right of Access

Until the Performance Certificate has been issued, the Contractor shall have such right of access to the Works as is reasonably required in order to comply with this Clause, except as may be inconsistent with the Employer's reasonable security restrictions.

11.8 Contractor to Search

The Contractor shall, if required by the Engineer, search for the cause of any defect, under the direction of the Engineer. Unless the defect is to be remedied at the cost of the Contractor under Sub-Clause 11.2 [Cost of Remedying Defects], the Cost of the search plus profit shall be agreed or determined by the Engineer in accordance with Sub-Clause 3.5 [Determinations] and shall be included in the Contract Price.

11.9 Performance Certificate

Performance of the Contractor's obligations shall not be considered to have been completed until the Engineer has issued the Performance Certificate to the Contractor, stating the date on which the Contractor completed his obligations under the Contract.

The Engineer shall issue the Performance Certificate within 28 days after the latest of the expiry dates of the Defects Notification Periods, or as soon thereafter as the Contractor has supplied all the Contractor's Documents and completed and tested all the Works, including remedying any defects. A copy of the Performance Certificate shall be issued to the Employer.

Only the Performance Certificate shall be deemed to constitute acceptance of the Works.

11.10 Unfulfilled Obligations

After the Performance Certificate has been issued, each Party shall remain liable for the fulfilment of any obligation which remains unperformed at that time. For the purposes of determining the nature and extent of unperformed obligations, the Contract shall be deemed to remain in force.

11.11 Clearance of Site

Upon receiving the Performance Certificate, the Contractor shall remove any remaining Contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works from the Site.

If all these items have not been removed within 28 days after receipt by the Contractor of the Performance Certificate, the Employer may sell or otherwise dispose of any remaining items. The Employer shall be entitled to be paid the costs incurred in connection with, or attributable to, such sale or disposal and restoring the Site.

Any balance of the moneys from the sale shall be paid to the Contractor. If these moneys are less than the Employer's costs,

the Contractor shall pay the outstanding balance to the Employer.

12. Measurement and Evaluation

12.1 Works to be Measured

The Works shall be measured, and valued for payment, in accordance with this Clause. The Contractor shall show in each application under Sub-Clauses 14.3 [Application for Interim Payment Certificates], 14.10 [Statement at Completion], and 14.11 [Application for Final Payment Certificate] the quantities and other particulars detailing the amounts which he considers to be entitled under the Contract.

Whenever the Engineer requires any part of the Works to be measured, reasonable notice shall be given to the Contractor's Representative, who shall:

- (a) promptly either attend or send another qualified representative to assist the Engineer in making the measurement, and
- (b) supply any particulars requested by the Engineer.

If the Contractor fails to attend or send a representative, the measurement made by (or on behalf of) the Engineer shall be accepted as accurate.

Except as otherwise stated in the Contract, wherever any Permanent Works are to be measured from records, these shall be prepared by the Engineer. The Contractor shall, as and when requested, attend to examine and agree the records with the Engineer, and shall sign the same when agreed. If the Contractor does not attend, the records shall be accepted as accurate.

If the Contractor examines and disagrees the records, and/or does not sign them as agreed, then the Contractor shall give notice to the Engineer of the respects in which the records are asserted to be inaccurate. After receiving this notice, the Engineer shall review the records and either confirm or vary them and certify the payment of the undisputed part. If the Contractor does not so give notice to the Engineer within 14 days after being requested to examine the records, they shall be accepted as accurate.

12.2 Method of Measurement

Except as otherwise stated in the Contract and notwithstanding local practice:

measurement shall be made of the net actual quantity of each item of the Permanent Works, and

the method of measurement shall be in accordance with the Bill of Quantities or other applicable Schedules.



12.3 Evaluation

Except as otherwise stated in the Contract, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the Contract Price by evaluating each item of work, applying the measurement agreed or determined in accordance with the above Sub-Clauses 12.1 [Works to be Measured] and 12.2 [Method of Measurement] and the appropriate rate or price for the item.

For each item of work, the appropriate rate or price for the item shall be the rate or price specified for such item in the Contract or, if there is no such item, specified for similar work.

Any item of work included in the Bill of Quantities for which no rate or price was specified shall be considered as included in other rates and prices in the Bill of Quantities and will not be paid for separately.

However, a new rate or price shall be appropriate for an item of work if:

(a)

- (i) the measured quantity of the item is changed by more than 25% from the quantity of this item in the Bill of Quantities or other Schedule,
- (ii) this change in quantity multiplied by such specified rate for this item exceeds 0.25% of the Accepted Contract Amount,
- (iii) this change in quantity directly changes the Cost per unit quantity of this item by more than 1%, and
- (iv) this item is not specified in the Contract as a "fixed rate item";

or

(b)

- (i) the work is instructed under Clause 13 [Variations and Adjustments],
- (ii) no rate or price is specified in the Contract for this item, and
- (iii) no specified rate or price is appropriate because the item of work is not of similar character, or is not executed under similar conditions, as any item in the Contract.

Each new rate or price shall be derived from any relevant rates or prices in the Contract, with reasonable adjustments to take

account of the matters described in sub-paragraph (a) and/or (b), as applicable. If no rates or prices are relevant for the derivation of a new rate or price, it shall be derived from the reasonable Cost of executing the work, together with profit, taking account of any other relevant matters.

Until such time as an appropriate rate or price is agreed or determined, the Engineer shall determine a provisional rate or price for the purposes of Interim Payment Certificates as soon as the concerned Works commences.

12.4 Omissions

Whenever the omission of any work forms part (or all) of a Variation, the value of which has not been agreed, if:

- (a) the Contractor will incur (or has incurred) cost which, if the work had not been omitted, would have been deemed to be covered by a sum forming part of the Accepted Contract Amount;
- (b) the omission of the work will result (or has resulted) in this sum not forming part of the Contract Price; and
- (c) this cost is not deemed to be included in the evaluation of any substituted work;

then the Contractor shall give notice to the Engineer accordingly, with supporting particulars. Upon receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine this cost, which shall be included in the Contract Price.

13. Variations and Adjustments

13.1 Right to Vary

Variations may be initiated by the Engineer at any time prior to issuing the Taking-Over Certificate for the Works, either by an instruction or by a request for the Contractor to submit a proposal.

The Contractor shall execute and be bound by each Variation, unless the Contractor promptly gives notice to the Engineer stating (with supporting particulars) that (i) the Contractor cannot readily obtain the Goods required for the Variation, or (ii) such Variation triggers a substantial change in the sequence or progress of the Works. Upon receiving this notice, the Engineer shall cancel, confirm or vary the instruction.

Each Variation may include:

- (a) changes to the quantities of any item of work included in the Contract (however, such changes do not necessarily constitute a Variation),
- (b) changes to the quality and other characteristics of any item

of work,

- (c) changes to the levels, positions and/or dimensions of any part of the Works,
- (d) omission of any work unless it is to be carried out by others,
- (e) any additional work, Plant, Materials or services necessary for the Permanent Works, including any associated Tests on Completion, boreholes and other testing and exploratory work, or
- (f) changes to the sequence or timing of the execution of the Works.

The Contractor shall not make any alteration and/or modification of the Permanent Works, unless and until the Engineer instructs or approves a Variation.

13.2 Value Engineering

The Contractor may, at any time, submit to the Engineer a written proposal which (in the Contractor's opinion) will, if adopted, (i) accelerate completion, (ii) reduce the cost to the Employer of executing, maintaining or operating the Works, (iii) improve the efficiency or value to the Employer of the completed Works, or (iv) otherwise be of benefit to the Employer.

The proposal shall be prepared at the cost of the Contractor and shall include the items listed in Sub-Clause 13.3 [Variation Procedure].

If a proposal, which is approved by the Engineer, includes a change in the design of part of the Permanent Works, then unless otherwise agreed by both Parties:

- (a) the Contractor shall design this part,
- (b) sub-paragraphs (a) to (d) of Sub-Clause 4.1 [Contractor's General Obligations] shall apply, and
- (c) if this change results in a reduction in the contract value of this part, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine a fee, which shall be included in the Contract Price. This fee shall be half (50%) of the difference between the following amounts:
 - (i) such reduction in contract value, resulting from the change, excluding adjustments under Sub-Clause 13.7 [Adjustments for Changes in Legislation] and Sub-Clause 13.8 [Adjustments for Changes in Cost], and
 - (ii) the reduction (if any) in the value to the Employer of

the varied works, taking account of any reductions in quality, anticipated life or operational efficiencies.

However, if amount (i) is less than amount (ii), there shall not be a fee.

13.3 Variation Procedure

If the Engineer requests a proposal, prior to instructing a Variation, the Contractor shall respond in writing as soon as practicable, either by giving reasons why he cannot comply (if this is the case) or by submitting:

- (a) a description of the proposed work to be performed and a programme for its execution,
- (b) the Contractor's proposal for any necessary modifications to the programme according to Sub-Clause 8.3 [Programme] and to the Time for Completion, and
- (c) the Contractor's proposal for evaluation of the Variation.

The Engineer shall, as soon as practicable after receiving such proposal (under Sub-Clause 13.2 [Value Engineering] or otherwise), respond with approval, disapproval or comments. The Contractor shall not delay any work whilst awaiting a response.

Each instruction to execute a Variation, with any requirements for the recording of Costs, shall be issued by the Engineer to the Contractor, who shall acknowledge receipt.

Each Variation shall be evaluated in accordance with Clause 12 [Measurement and Evaluation], unless the Engineer instructs or approves otherwise in accordance with this Clause.

13.4 Payment in Applicable Currencies

If the Contract provides for payment of the Contract Price in more than one currency, then whenever an adjustment is agreed, approved or determined as stated above, the amount payable in each of the applicable currencies shall be specified. For this purpose, reference shall be made to the actual or expected currency proportions of the Cost of the varied work, and to the proportions of various currencies specified for payment of the Contract Price.

13.5 Provisional Sums

Each Provisional Sum shall only be used, in whole or in part, in accordance with the Engineer's instructions, and the Contract Price shall be adjusted accordingly. The total sum paid to the Contractor shall include only such amounts, for the work, supplies or services to which the Provisional Sum relates, as the Engineer shall have instructed. For each Provisional Sum, the Engineer may instruct:

- (a) work to be executed (including Plant, Materials or services to be supplied) by the Contractor and valued under Sub-



Clause 13.3 [Variation Procedure]; and/or

- (b) Plant, Materials or services to be purchased by the Contractor, from a nominated Subcontractor (as defined in Clause 5 [Nominated Subcontractors]) or otherwise; and for which there shall be included in the Contract Price:
 - (i) the actual amounts paid (or due to be paid) by the Contractor, and
 - (ii) a sum for overhead charges and profit, calculated as a percentage of these actual amounts by applying the relevant percentage rate (if any) stated in the appropriate Schedule. If there is no such rate, the percentage rate stated in the Contract Data shall be applied.

The Contractor shall, when required by the Engineer, produce quotations, invoices, vouchers and accounts or receipts in substantiation.

13.6 Daywork

For work of a minor or incidental nature, the Engineer may instruct that a Variation shall be executed on a daywork basis. The work shall then be valued in accordance with the Daywork Schedule included in the Contract, and the following procedure shall apply. If a Daywork Schedule is not included in the Contract, this Sub-Clause shall not apply.

Before ordering Goods for the work, the Contractor shall submit quotations to the Engineer. When applying for payment, the Contractor shall submit invoices, vouchers and accounts or receipts for any Goods.

Except for any items for which the Daywork Schedule specifies that payment is not due, the Contractor shall deliver each day to the Engineer accurate statements in duplicate which shall include the following details of the resources used in executing the previous day's work:

- (a) the names, occupations and time of Contractor's Personnel,
- (b) the identification, type and time of Contractor's Equipment and Temporary Works, and
- (c) the quantities and types of Plant and Materials used.

One copy of each statement will, if correct, or when agreed, be signed by the Engineer and returned to the Contractor. The Contractor shall then submit priced statements of these resources to the Engineer, prior to their inclusion in the next Statement under Sub-Clause 14.3 [Application for Interim Payment Certificates].

13.7 Adjustments for Changes in Legislation

The Contract Price shall be adjusted to take account of any increase or decrease in Cost resulting from a change in the Laws of the Country (including the introduction of new Laws and the repeal or modification of existing Laws) or in the judicial or official governmental interpretation of such Laws, made after the Base Date, which affect the Contractor in the performance of obligations under the Contract.

If the Contractor suffers (or will suffer) delay and/or incurs (or will incur) additional Cost as a result of these changes in the Laws or in such interpretations, made after the Base Date, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

Notwithstanding the foregoing, the Contractor shall not be entitled to an extension of time if the relevant delay has already been taken into account in the determination of a previous extension of time and such Cost shall not be separately paid if the same shall already have been taken into account in the indexing of any inputs to the table of adjustment data in accordance with the provisions of Sub-Clause 13.8 [Adjustments for Changes in Cost].

13.8 Adjustments for Changes in Cost

In this Sub-Clause, "table of adjustment data" means the completed table of adjustment data for local and foreign currencies included in the Schedules. If there is no such table of adjustment data, this Sub-Clause shall not apply.

If this Sub-Clause applies, the amounts payable to the Contractor shall be adjusted for rises or falls in the cost of labour, Goods and other inputs to the Works, by the addition or deduction of the amounts determined by the formulae prescribed in this Sub-Clause. To the extent that full compensation for any rise or fall in Costs is not covered by the provisions of this or other Clauses, the Accepted Contract Amount shall be deemed to have included amounts to cover the contingency of other rises and falls in costs.

The adjustment to be applied to the amount otherwise payable to the Contractor, as valued in accordance with the appropriate Schedule and certified in Payment Certificates, shall be



determined from formulae for each of the currencies in which the Contract Price is payable. No adjustment is to be applied to work valued on the basis of Cost or current prices. The formulae shall be of the following general type:

$$P_n = a + b L_n / L_o + c E_n / E_o + d M_n / M_o + \dots \text{ where:}$$

“P_n” is the adjustment multiplier to be applied to the estimated contract value in the relevant currency of the work carried out in period “n”, this period being a month unless otherwise stated in the Contract Data ;

“a” is a fixed coefficient, stated in the relevant table of adjustment data, representing the non-adjustable portion in contractual payments;

“b”, “c”, “d”, ... are coefficients representing the estimated proportion of each cost element related to the execution of the Works, as stated in the relevant table of adjustment data; such tabulated cost elements may be indicative of resources such as labour, equipment and materials;

“L_n”, “E_n”, “M_n”, ... are the current cost indices or reference prices for period “n”, expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the date 49 days prior to the last day of the period (to which the particular Payment Certificate relates); and

“L_o”, “E_o”, “M_o”, ... are the base cost indices or reference prices, expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the Base Date.

The cost indices or reference prices stated in the table of adjustment data shall be used. If their source is in doubt, it shall be determined by the Engineer. For this purpose, reference shall be made to the values of the indices at stated dates (quoted in the fourth and fifth columns respectively of the table) for the purposes of clarification of the source; although these dates (and thus these values) may not correspond to the base cost indices.

In cases where the “currency of index” (stated in the table) is not the relevant currency of payment, each index shall be converted into the relevant currency of payment at the selling rate, established by the central bank of the Country, of this relevant currency on the above date for which the index is required to be applicable.

Until such time as each current cost index is available, the Engineer shall determine a provisional index for the issue of Interim Payment Certificates. When a current cost index is available, the adjustment shall be recalculated accordingly.

If the Contractor fails to complete the Works within the Time for Completion, adjustment of prices thereafter shall be made using either (i) each index or price applicable on the date 49 days prior to the expiry of the Time for Completion of the Works, or (ii) the current index or price: whichever is more favourable to the Employer.

The weightings (coefficients) for each of the factors of cost stated in the table(s) of adjustment data shall only be adjusted if they have been rendered unreasonable, unbalanced or inapplicable, as a result of Variations.

14. Contract Price and Payment

14.1 The Contract Price

Unless otherwise stated in the Particular Conditions:

- (a) the Contract Price shall be agreed or determined under Sub-Clause 12.3 [Evaluation] and be subject to adjustments in accordance with the Contract;
- (b) the Contractor shall pay all taxes, duties and fees required to be paid by him under the Contract, and the Contract Price shall not be adjusted for any of these costs except as stated in Sub-Clause 13.7 [Adjustments for Changes in Legislation];
- (c) any quantities which may be set out in the Bill of Quantities or other Schedule are estimated quantities and are not to be taken as the actual and correct quantities:
 - (i) of the Works which the Contractor is required to execute, or
 - (ii) for the purposes of Clause 12 [Measurement and Evaluation]; and
- (d) the Contractor shall submit to the Engineer, within 28 days after the Commencement Date, a proposed breakdown of each lump sum price in the Schedules. The Engineer may take account of the breakdown when preparing Payment Certificates, but shall not be bound by it.
- (e) Notwithstanding the provisions of subparagraph (b), Contractor's Equipment, including essential spare parts therefor, imported by the Contractor for the sole purpose of executing the Contract shall be exempt from the payment of import duties and taxes upon importation.

14.2 Advance Payment The Employer shall make an advance payment, as an interest-free loan for mobilisation and cash flow support, when the Contractor submits a guarantee in accordance with this Sub-Clause. The total advance payment, the number and timing of



instalments (if more than one), and the applicable currencies and proportions, shall be as stated in the Contract Data.

Unless and until the Employer receives this guarantee, or if the total advance payment is not stated in the Contract Data, this Sub-Clause shall not apply.

The Engineer shall deliver to the Employer and to the Contractor an Interim Payment Certificate for the advance payment or its first instalment after receiving a Statement (under Sub-Clause 14.3 [Application for Interim Payment Certificates]) and after the Employer receives (i) the Performance Security in accordance with Sub-Clause 4.2 [Performance Security] and (ii) a guarantee in amounts and currencies equal to the advance payment. This guarantee shall be issued by an entity and from within a country (or other jurisdiction) approved by the Employer, and shall be in the form annexed to the Particular Conditions or in another form approved by the Employer.

The Contractor shall ensure that the guarantee is valid and enforceable until the advance payment has been repaid, but its amount shall be progressively reduced by the amount repaid by the Contractor as indicated in the Payment Certificates. If the terms of the guarantee specify its expiry date, and the advance payment has not been repaid by the date 28 days prior to the expiry date, the Contractor shall extend the validity of the guarantee until the advance payment has been repaid.

Unless stated otherwise in the Contract Data, the advance payment shall be repaid through percentage deductions from the interim payments determined by the Engineer in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates], as follows:.

- (a) deductions shall commence in the next interim Payment Certificate following that in which the total of all certified interim payments (excluding the advance payment and deductions and repayments of retention) exceeds 30 percent (30%) of the Accepted Contract Amount less Provisional Sums; and
- (b) deductions shall be made at the amortisation rate stated in the Contract Data of the amount of each Interim Payment Certificate (excluding the advance payment and deductions for its repayments as well as deductions for retention money) in the currencies and proportions of the advance payment until such time as the advance payment has been repaid; provided that the advance payment shall be completely repaid prior to the time when 90 per cent (90%) of the Accepted Contract Amount less Provisional Sums has been certified for payment.

If the advance payment has not been repaid prior to the issue of the Taking-Over Certificate for the Works or prior to termination under Clause 15 [Termination by Employer], Clause 16 [Suspension and Termination by Contractor] or Clause 19 [Force Majeure] (as the case may be), the whole of the balance then outstanding shall immediately become due and in case of termination under Clause 15 [Termination by Employer] and Sub-Clause 19.6 [Optional Termination, Payment and Release], payable by the Contractor to the Employer.

14.3 Application for Interim Payment Certificates

The Contractor shall submit a Statement in six copies to the Engineer after the end of each month, in a form approved by the Engineer, showing in detail the amounts to which the Contractor considers himself to be entitled, together with supporting documents which shall include the report on the progress during this month in accordance with Sub-Clause 4.21 [Progress Reports].

The Statement shall include the following items, as applicable, which shall be expressed in the various currencies in which the Contract Price is payable, in the sequence listed:

- (a) the estimated contract value of the Works executed and the Contractor's Documents produced up to the end of the month (including Variations but excluding items described in sub-paragraphs (b) to (g) below);
- (b) any amounts to be added and deducted for changes in legislation and changes in cost, in accordance with Sub-Clause 13.7 [Adjustments for Changes in Legislation] and Sub-Clause 13.8 [Adjustments for Changes in Cost];
- (c) any amount to be deducted for retention, calculated by applying the percentage of retention stated in the Contract Data to the total of the above amounts, until the amount so retained by the Employer reaches the limit of Retention Money (if any) stated in the Contract Data;
- (d) any amounts to be added for the advance payment and (if more than one instalment) and to be deducted for its repayments in accordance with Sub-Clause 14.2 [Advance Payment];
- (e) any amounts to be added and deducted for Plant and Materials in accordance with Sub-Clause 14.5 [Plant and Materials intended for the Works];
- (f) any other additions or deductions which may have become due under the Contract or otherwise, including those under Clause 20 [Claims, Disputes and Arbitration]; and
- (g) the deduction of amounts certified in all previous Payment

Certificates.

14.4 Schedule of Payments

If the Contract includes a schedule of payments specifying the instalments in which the Contract Price will be paid, then unless otherwise stated in this schedule:

- (a) the instalments quoted in this schedule of payments shall be the estimated contract values for the purposes of sub-paragraph (a) of Sub-Clause 14.3 [Application for Interim Payment Certificates];
- (b) Sub-Clause 14.5 [Plant and Materials intended for the Works] shall not apply; and
- (c) if these instalments are not defined by reference to the actual progress achieved in executing the Works, and if actual progress is found to be less or more than that on which this schedule of payments was based, then the Engineer may proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine revised instalments, which shall take account of the extent to which progress is less or more than that on which the instalments were previously based.

If the Contract does not include a schedule of payments, the Contractor shall submit non-binding estimates of the payments which he expects to become due during each quarterly period. The first estimate shall be submitted within 42 days after the Commencement Date. Revised estimates shall be submitted at quarterly intervals, until the Taking-Over Certificate has been issued for the Works.

14.5 Plant and Materials intended for the Works

If this Sub-Clause applies, Interim Payment Certificates shall include, under sub-paragraph (e) of Sub-Clause 14.3, (i) an amount for Plant and Materials which have been sent to the Site for incorporation in the Permanent Works, and (ii) a reduction when the contract value of such Plant and Materials is included as part of the Permanent Works under sub-paragraph (a) of Sub-Clause 14.3 [Application for Interim Payment Certificates].

If the lists referred to in sub-paragraphs (b)(i) or (c)(i) below are not included in the Schedules, this Sub-Clause shall not apply.

The Engineer shall determine and certify each addition if the following conditions are satisfied:

- (a) the Contractor has:
 - (i) kept satisfactory records (including the orders, receipts, Costs and use of Plant and Materials) which are available for inspection, and
 - (ii) submitted a statement of the Cost of acquiring and delivering the Plant and Materials to the Site,

supported by satisfactory evidence;

and either:

- (b) the relevant Plant and Materials:
 - (i) are those listed in the Schedules for payment when shipped,
 - (ii) have been shipped to the Country, en route to the Site, in accordance with the Contract; and
 - (iii) are described in a clean shipped bill of lading or other evidence of shipment, which has been submitted to the Engineer together with evidence of payment of freight and insurance, any other documents reasonably required, and a bank guarantee in a form and issued by an entity approved by the Employer in amounts and currencies equal to the amount due under this Sub-Clause; this guarantee may be in a similar form to the form referred to in Sub-Clause 14.2 [Advance Payment] and shall be valid until the Plant and Materials are properly stored on Site and protected against loss, damage or deterioration;

or

- (c) the relevant Plant and Materials:
 - (i) are those listed in the Schedules for payment when delivered to the Site, and
 - (ii) have been delivered to and are properly stored on the Site, are protected against loss, damage or deterioration, and appear to be in accordance with the Contract.

The additional amount to be certified shall be the equivalent of eighty percent of the Engineer's determination of the cost of the Plant and Materials (including delivery to Site), taking account of the documents mentioned in this Sub-Clause and of the contract value of the Plant and Materials.

The currencies for this additional amount shall be the same as those in which payment will become due when the contract value is included under sub-paragraph (a) of Sub-Clause 14.3 [Application for Interim Payment Certificates]. At that time, the Payment Certificate shall include the applicable reduction which shall be equivalent to, and in the same currencies and proportions as, this additional amount for the relevant Plant and Materials.

14.6 Issue of Interim Payment Certificates

No amount will be certified or paid until the Employer has received and approved the Performance Security. Thereafter, the Engineer shall, within 28 days after receiving a Statement and

supporting documents, deliver to the Employer and to the Contractor an Interim Payment Certificate which shall state the amount which the Engineer fairly determines to be due, with all supporting particulars for any reduction or withholding made by the Engineer on the Statement if any.

However, prior to issuing the Taking-Over Certificate for the Works, the Engineer shall not be bound to issue an Interim Payment Certificate in an amount which would (after retention and other deductions) be less than the minimum amount of Interim Payment Certificates (if any) stated in the Contract Data. In this event, the Engineer shall give notice to the Contractor accordingly.

An Interim Payment Certificate shall not be withheld for any other reason, although:

- (a) if any thing supplied or work done by the Contractor is not in accordance with the Contract, the cost of rectification or replacement may be withheld until rectification or replacement has been completed; and/or
- (b) if the Contractor was or is failing to perform any work or obligation in accordance with the Contract, and had been so notified by the Engineer, the value of this work or obligation may be withheld until the work or obligation has been performed.

The Engineer may in any Payment Certificate make any correction or modification that should properly be made to any previous Payment Certificate. A Payment Certificate shall not be deemed to indicate the Engineer's acceptance, approval, consent or satisfaction.

14.7 Payment

The Employer shall pay to the Contractor:

- (a) the first instalment of the advance payment within 42 days after issuing the Letter of Acceptance or within 21 days after receiving the documents in accordance with Sub-Clause 4.2 [Performance Security] and Sub-Clause 14.2 [Advance Payment], whichever is later;
- (b) the amount certified in each Interim Payment Certificate within 56 days after the Engineer receives the Statement and supporting documents or, at a time when the Bank's loan or credit (from which part of the payments to the Contractor is being made) is suspended, the amount shown on any statement submitted by the Contractor, within 14 days after such statement is submitted, any discrepancy being rectified in the next payment to the Contractor; and
- (c) the amount certified in the Final Payment Certificate

within 56 days after the Employer receives this Payment Certificate or, at a time when the Bank's loan or credit (from which part of the payments to the Contractor is being made) is suspended, the undisputed amount shown in the Final Statement, within 56 days after the date of notification of the suspension in accordance with Sub-Clause 16.2.

Payment of the amount due in each currency shall be made into the bank account, nominated by the Contractor, in the payment country (for this currency) specified in the Contract.

14.8 Delayed Payment

If the Contractor does not receive payment in accordance with Sub-Clause 14.7 [Payment], the Contractor shall be entitled to receive financing charges compounded monthly on the amount unpaid during the period of delay. This period shall be deemed to commence on the date for payment specified in Sub-Clause 14.7 [Payment], irrespective (in the case of its sub-paragraph (b)) of the date on which any Interim Payment Certificate is issued.

Unless otherwise stated in the Particular Conditions, these financing charges shall be calculated at the annual rate of three percentage points above the discount rate of the central bank in the country of the currency of payment, or if not available, the interbank offered rate, and shall be paid in such currency.

The Contractor shall be entitled to this payment without formal notice or certification, and without prejudice to any other right or remedy.

14.9 Payment of Retention Money

When the Taking-Over Certificate has been issued for the Works, the first half of the Retention Money shall be certified by the Engineer for payment to the Contractor. If a

Taking-Over Certificate is issued for a Section or part of the Works, a proportion of the Retention Money shall be certified and paid. This proportion shall be half (50%) of the proportion calculated by dividing the estimated contract value of the Section or part, by the estimated final Contract Price.

Promptly after the latest of the expiry dates of the Defects Notification Periods, the outstanding balance of the Retention Money shall be certified by the Engineer for payment to the Contractor. If a Taking-Over Certificate was issued for a Section, a proportion of the second half of the Retention Money shall be certified and paid promptly after the expiry date of the Defects Notification Period for the Section. This proportion shall be half (50%) of the proportion calculated by dividing the estimated contract value of the Section by the estimated final Contract Price.

However, if any work remains to be executed under Clause 11 [Defects Liability], the Engineer shall be entitled to withhold certification of the estimated cost of this work until it has been executed.

When calculating these proportions, no account shall be taken of any adjustments under Sub-Clause 13.7 [Adjustments for Changes in Legislation] and Sub-Clause 13.8 [Adjustments for Changes in Cost].

Unless otherwise stated in the Particular Conditions, when the Taking-Over Certificate has been issued for the Works and the first half of the Retention Money has been certified for payment by the Engineer, the Contractor shall be entitled to substitute a guarantee, in the form annexed to the Particular Conditions or in another form approved by the Employer and provided by an entity approved by the Employer, for the second half of the Retention Money. The Contractor shall ensure that the guarantee is in the amounts and currencies of the second half of the Retention Money and is valid and enforceable until the Contractor has executed and completed the Works and remedied any defects, as specified for the Performance Security in Sub-Clause 4.2. On receipt by the Employer of the required guarantee, the Engineer shall certify and the Employer shall pay the second half of the Retention Money. The release of the second half of the Retention Money against a guarantee shall then be in lieu of the release under the second paragraph of this Sub-Clause. The Employer shall return the guarantee to the Contractor within 21 days after receiving a copy of the Performance Certificate.

If the Performance Security required under Sub-Clause 4.2 is in the form of a demand guarantee, and the amount guaranteed under it when the Taking-Over Certificate is issued is more than half of the Retention Money, then the Retention Money guarantee will not be required. If the amount guaranteed under the Performance Security when the Taking-Over Certificate is issued is less than half of the Retention Money, the Retention Money guarantee will only be required for the difference between half of the Retention Money and the amount guaranteed under the Performance Security.

14.10 Statement at Completion

Within 84 days after receiving the Taking-Over Certificate for the Works, the Contractor shall submit to the Engineer six copies of a Statement at completion with supporting documents, in accordance with Sub-Clause 14.3 [Application for Interim Payment Certificates], showing:

- (a) the value of all work done in accordance with the Contract up to the date stated in the Taking-Over Certificate for the Works,

- (b) any further sums which the Contractor considers to be due, and
- (c) an estimate of any other amounts which the Contractor considers will become due to him under the Contract. Estimated amounts shall be shown separately in this Statement at completion.

The Engineer shall then certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates].

14.11 Application for Final Payment Certificate

Within 56 days after receiving the Performance Certificate, the Contractor shall submit, to the Engineer, six copies of a draft final statement with supporting documents showing in detail in a form approved by the Engineer:

- (a) the value of all work done in accordance with the Contract, and
- (b) any further sums which the Contractor considers to be due to him under the Contract or otherwise.

If the Engineer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Engineer may reasonably require within 28 days from receipt of the said draft and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Engineer the final statement as agreed. This agreed statement is referred to in these Conditions as the "Final Statement".

However if, following discussions between the Engineer and the Contractor and any changes to the draft final statement which are agreed, it becomes evident that a dispute exists, the Engineer shall deliver to the Employer (with a copy to the Contractor) an Interim Payment Certificate for the agreed parts of the draft final statement. Thereafter, if the dispute is finally resolved under Sub-Clause 20.4 [Obtaining Dispute Board's Decision] or Sub-Clause 20.5 [Amicable Settlement], the Contractor shall then prepare and submit to the Employer (with a copy to the Engineer) a Final Statement.

14.12 Discharge

When submitting the Final Statement, the Contractor shall submit a discharge which confirms that the total of the Final Statement represents full and final settlement of all moneys due to the Contractor under or in connection with the Contract. This discharge may state that it becomes effective when the Contractor has received the Performance Security and the outstanding balance of this total, in which event the discharge shall be effective on such date.

14.13 Issue of Final Payment

Within 28 days after receiving the Final Statement and discharge in accordance with Sub-Clause 14.11 [Application for

Certificate

Final Payment Certificate] and Sub-Clause 14.12 [Discharge], the Engineer shall deliver to the Employer and to the Contractor, the Final Payment Certificate which shall state:

- (a) the amount which he fairly determines is finally due, and
- (b) after giving credit to the Employer for all amounts previously paid by the Employer and for all sums to which the Employer is entitled, the balance (if any) due from the Employer to the Contractor or from the Contractor to the Employer, as the case may be.

If the Contractor has not applied for a Final Payment Certificate in accordance with Sub-Clause 14.11 [Application for Final Payment Certificate] and Sub-Clause 14.12 [Discharge], the Engineer shall request the Contractor to do so. If the Contractor fails to submit an application within a period of 28 days, the Engineer shall issue the Final Payment Certificate for such amount as he fairly determines to be due.

14.14 Cessation of Employer's Liability

The Employer shall not be liable to the Contractor for any matter or thing under or in connection with the Contract or execution of the Works, except to the extent that the Contractor shall have included an amount expressly for it:

- (a) in the Final Statement and also
- (b) (except for matters or things arising after the issue of the Taking-Over Certificate for the Works) in the Statement at completion described in Sub-Clause 14.10 [Statement at Completion].

However, this Sub-Clause shall not limit the Employer's liability under his indemnification obligations, or the Employer's liability in any case of fraud, deliberate default or reckless misconduct by the Employer.

14.15 Currencies of Payment

The Contract Price shall be paid in the currency or currencies named in the Schedule of Payment Currencies. If more than one currency is so named, payments shall be made as follows:

- (a) if the Accepted Contract Amount was expressed in Local Currency only:
 - (i) the proportions or amounts of the Local and Foreign Currencies, and the fixed rates of exchange to be used for calculating the payments, shall be as stated in the Schedule of Payment Currencies, except as otherwise agreed by both Parties;
 - (ii) payments and deductions under Sub-Clause 13.5 [Provisional Sums] and Sub-Clause 13.7 [Adjustments for Changes in Legislation] shall be



made in the applicable currencies and proportions;
and

- (iii) other payments and deductions under sub-paragraphs (a) to (d) of Sub-Clause 14.3 [Application for Interim Payment Certificates] shall be made in the currencies and proportions specified in sub-paragraph (a)(i) above;
- (b) payment of the damages specified in the Contract Data, shall be made in the currencies and proportions specified in the Schedule of Payment Currencies;
- (c) other payments to the Employer by the Contractor shall be made in the currency in which the sum was expended by the Employer, or in such currency as may be agreed by both Parties;
- (d) if any amount payable by the Contractor to the Employer in a particular currency exceeds the sum payable by the Employer to the Contractor in that currency, the Employer may recover the balance of this amount from the sums otherwise payable to the Contractor in other currencies; and
- (e) if no rates of exchange are stated in the Schedule of Payment Currencies, they shall be those prevailing on the Base Date and determined by the central bank of the Country.



15. Termination by Employer

15.1 Notice to Correct If the Contractor fails to carry out any obligation under the Contract, the Engineer may by notice require the Contractor to make good the failure and to remedy it within a specified reasonable time.

15.2 Termination by Employer The Employer shall be entitled to terminate the Contract if the Contractor:

- (a) fails to comply with Sub-Clause 4.2 [Performance Security] or with a notice under Sub-Clause 15.1 [Notice to Correct],
- (b) abandons the Works or otherwise plainly demonstrates the intention not to continue performance of his obligations under the Contract,
- (c) without reasonable excuse fails:
 - (i) to proceed with the Works in accordance with Clause 8 [Commencement, Delays and Suspension], or
 - (ii) to comply with a notice issued under Sub-Clause 7.5 [Rejection] or Sub-Clause 7.6 [Remedial Work], within 28 days after receiving it,
- (d) subcontracts the whole of the Works or assigns the Contract without the required agreement,
- (e) becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events, or
- (f) gives or offers to give (directly or indirectly) to any person any bribe, gift, gratuity, commission or other thing of value, as an inducement or reward:
 - (i) for doing or forbearing to do any action in relation to the Contract, or
 - (ii) for showing or forbearing to show favour or disfavour to any person in relation to the Contract,

or if any of the Contractor's Personnel, agents or Subcontractors gives or offers to give (directly or indirectly) to any person any such inducement or reward as is described in this sub-paragraph (f). However, lawful inducements and rewards to Contractor's Personnel shall not entitle termination.



In any of these events or circumstances, the Employer may, upon giving 14 days' notice to the Contractor, terminate the Contract and expel the Contractor from the Site. However, in the case of sub-paragraph (e) or (f), the Employer may by notice terminate the Contract immediately.

The Employer's election to terminate the Contract shall not prejudice any other rights of the Employer, under the Contract or otherwise.

The Contractor shall then leave the Site and deliver any required Goods, all Contractor's Documents, and other design documents made by or for him, to the Engineer. However, the Contractor shall use his best efforts to comply immediately with any reasonable instructions included in the notice (i) for the assignment of any subcontract, and (ii) for the protection of life or property or for the safety of the Works.

After termination, the Employer may complete the Works and/or arrange for any other entities to do so. The Employer and these entities may then use any Goods, Contractor's Documents and other design documents made by or on behalf of the Contractor.

The Employer shall then give notice that the Contractor's Equipment and Temporary Works will be released to the Contractor at or near the Site. The Contractor shall promptly arrange their removal, at the risk and cost of the Contractor. However, if by this time the Contractor has failed to make a payment due to the Employer, these items may be sold by the Employer in order to recover this payment. Any balance of the proceeds shall then be paid to the Contractor.

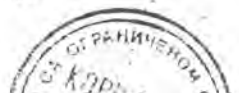
15.3 Valuation at Date of Termination

As soon as practicable after a notice of termination under Sub-Clause 15.2 [Termination by Employer] has taken effect, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the value of the Works, Goods and Contractor's Documents, and any other sums due to the Contractor for work executed in accordance with the Contract.

15.4 Payment after Termination

After a notice of termination under Sub-Clause 15.2 [Termination by Employer] has taken effect, the Employer may:

- (a) proceed in accordance with Sub-Clause 2.5 [Employer's Claims],
- (b) withhold further payments to the Contractor until the costs of execution, completion and remedying of any defects, damages for delay in completion (if any), and all other costs incurred by the Employer, have been established, and/or
- (c) recover from the Contractor any losses and damages



incurred by the Employer and any extra costs of completing the Works, after allowing for any sum due to the Contractor under Sub-Clause 15.3 [Valuation at Date of Termination]. After recovering any such losses, damages and extra costs, the Employer shall pay any balance to the Contractor.

15.5 Employer's Entitlement to Termination for Convenience

The Employer shall be entitled to terminate the Contract, at any time for the Employer's convenience, by giving notice of such termination to the Contractor. The termination shall take effect 28 days after the later of the dates on which the Contractor receives this notice or the Employer returns the Performance Security. The Employer shall not terminate the Contract under this Sub-Clause in order to execute the Works himself or to arrange for the Works to be executed by another contractor or to avoid a termination of the Contract by the Contractor under Sub-Clause 16.2 [Termination by Contractor].

After this termination, the Contractor shall proceed in accordance with Sub-Clause 16.3 [Cessation of Work and Removal of Contractor's equipment] and shall be paid in accordance with Sub-Clause 16.4 [Payment on Termination].

15.6 Corrupt or Fraudulent Practices

If the Employer determines that the Contractor and/or its subcontractors has engaged in corrupt, fraudulent, collusive coercive, or obstructive practices, in competing for or in executing the Contract, then the Employer may, after giving 14 days notice to the Contractor, terminate the Contractor's employment under the Contract and expel him from the Site, and the provisions of Clause 15 shall apply as if such expulsion had been made under Sub-Clause 15.2 [Termination by Employer].

Should any employee of the Contractor be determined to have engaged in corrupt, fraudulent, collusive, coercive, or obstructive practice during the execution of the Works, then that employee shall be removed in accordance with Sub-Clause 6.9 [Contractor's Personnel].

For the purposes of this Sub-Clause:

- (i) "corrupt practice"¹ is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

¹ "another party" refers to a public official acting in relation to the procurement process or contract execution]. In this context, "public official" includes World Bank staff and employees of other organizations taking or reviewing procurement decisions.

- (ii) “fraudulent practice”² is any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;
- (iii) “collusive practice”³ is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;
- (iv) “coercive practice”⁴ is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;
- (v) “obstructive practice” is
 - (aa) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or
 - (bb) acts intended to materially impede the exercise of the Bank’s inspection and audit rights provided for under Sub-Clause 1.15 [Inspections and Audits by the Bank].

16. Suspension and Termination by Contractor

16.1 Contractor’s Entitlement to Suspend Work

If the Engineer fails to certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates] or the Employer fails to comply with Sub-Clause 2.4 [Employer’s Financial Arrangements] or Sub-Clause 14.7 [Payment], the Contractor may, after giving not less than 21 days’ notice to the Employer, suspend work (or reduce the rate of work) unless and until the Contractor has received the Payment Certificate, reasonable evidence or payment, as the case may be and as described in the notice.

² a “party” refers to a public official; the terms “benefit” and “obligation” relate to the procurement process or contract execution; and the “act or omission” is intended to influence the procurement process or contract execution.

³ “parties” refers to participants in the procurement process (including public officials) attempting to establish bid prices at artificial, non competitive levels.

⁴ a “party” refers to a participant in the procurement process or contract execution.



Notwithstanding the above, if the Bank has suspended disbursements under the loan or credit from which payments to the Contractor are being made, in whole or in part, for the execution of the Works, and no alternative funds are available as provided for in Sub-Clause 2.4 [Employer's Financial Arrangements], the Contractor may by notice suspend work or reduce the rate of work at any time, but not less than 7 days after the Borrower having received the suspension notification from the Bank.

The Contractor's action shall not prejudice his entitlements to financing charges under Sub-Clause 14.8 [Delayed Payment] and to termination under Sub-Clause 16.2 [Termination by Contractor].

If the Contractor subsequently receives such Payment Certificate, evidence or payment (as described in the relevant Sub-Clause and in the above notice) before giving a notice of termination, the Contractor shall resume normal working as soon as is reasonably practicable.

If the Contractor suffers delay and/or incurs Cost as a result of suspending work (or reducing the rate of work) in accordance with this Sub-Clause, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

16.2 Termination by Contractor

The Contractor shall be entitled to terminate the Contract if:

- (a) the Contractor does not receive the reasonable evidence within 42 days after giving notice under Sub-Clause 16.1 [Contractor's Entitlement to Suspend Work] in respect of a failure to comply with Sub-Clause 2.4 [Employer's Financial Arrangements],
- (b) the Engineer fails, within 56 days after receiving a Statement and supporting documents, to issue the relevant Payment Certificate,
- (c) the Contractor does not receive the amount due under an Interim Payment Certificate within 42 days after the

expiry of the time stated in Sub-Clause 14.7 [Payment] within which payment is to be made (except for deductions in accordance with Sub-Clause 2.5 [Employer's Claims]),

- (d) the Employer substantially fails to perform his obligations under the Contract in such manner as to materially and adversely affect the economic balance of the Contract and/or the ability of the Contractor to perform the Contract,
- (e) the Employer fails to comply with Sub-Clause 1.6 [Contract Agreement] or Sub-Clause 1.7 [Assignment],
- (f) a prolonged suspension affects the whole of the Works as described in Sub-Clause 8.11 [Prolonged Suspension], or
- (g) the Employer becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events.
- (h) In the event the Bank suspends the loan or credit from which part of the payments to the Contractor are being made, if the Contractor has not received the sums due to him upon expiration of the 14 days referred to in Sub-Clause 14.7 [Payment] for payments under Interim Payment certificates, the Contractor may, without prejudice to the Contractor's entitlement to financing charges under Sub-Clause 14.8 [Delayed Payment], take one of the following actions, namely (i) suspend work or reduce the rate of work, or (ii) terminate his employment under the Contract by giving notice to the Employer, with a copy to the Engineer, such termination to take effect 14 days after the giving of the notice.
- (i) the Contractor does not receive the Engineer's instruction recording the agreement of both Parties on the fulfilment of the conditions for the Commencement of Works under Sub-Clause 8.1 [Commencement of Works].

In any of these events or circumstances, the Contractor may, upon giving 14 days' notice to the Employer, terminate the Contract. However, in the case of sub-paragraph (f) or (g), the Contractor may by notice terminate the Contract immediately.

The Contractor's election to terminate the Contract shall not prejudice any other rights of the Contractor, under the Contract



or otherwise.

16.3 Cessation of Work and Removal of Contractor's Equipment

After a notice of termination under Sub-Clause 15.5 [Employer's Entitlement to Termination for Convenience], Sub-Clause 16.2 [Termination by Contractor] or Sub-Clause 19.6 [Optional Termination, Payment and Release] has taken effect, the Contractor shall promptly:

- (a) cease all further work, except for such work as may have been instructed by the Engineer for the protection of life or property or for the safety of the Works,
- (b) hand over Contractor's Documents, Plant, Materials and other work, for which the Contractor has received payment, and
- (c) remove all other Goods from the Site, except as necessary for safety, and leave the Site.

16.4 Payment on Termination

After a notice of termination under Sub-Clause 16.2 [Termination by Contractor] has taken effect, the Employer shall promptly:

- (a) return the Performance Security to the Contractor,
- (b) pay the Contractor in accordance with Sub-Clause 19.6 [Optional Termination, Payment and Release], and
- (c) pay to the Contractor the amount of any loss or damage sustained by the Contractor as a result of this termination.

17. Risk and Responsibility

17.1 Indemnities

The Contractor shall indemnify and hold harmless the Employer, the Employer's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of:

- (a) bodily injury, sickness, disease or death, of any person whatsoever arising out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any defects, unless attributable to any negligence, wilful act or breach of the Contract by the Employer, the Employer's Personnel, or any of their respective agents, and
- (b) damage to or loss of any property, real or personal (other than the Works), to the extent that such damage or loss arises out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any defects, unless and to the extent that any such damage or loss is attributable to any negligence, wilful act or breach of the Contract by the



Employer, the Employer's Personnel, their respective agents, or anyone directly or indirectly employed by any of them.

The Employer shall indemnify and hold harmless the Contractor, the Contractor's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of (1) bodily injury, sickness, disease or death, which is attributable to any negligence, wilful act or breach of the Contract by the Employer, the Employer's Personnel, or any of their respective agents, and (2) the matters for which liability may be excluded from insurance cover, as described in sub-paragraphs (d)(i), (ii) and (iii) of Sub-Clause 18.3 [Insurance Against Injury to Persons and Damage to Property].

17.2 Contractor's Care of the Works

The Contractor shall take full responsibility for the care of the Works and Goods from the Commencement Date until the Taking-Over Certificate is issued (or is deemed to be issued under Sub-Clause 10.1 [Taking Over of the Works and Sections]) for the Works, when responsibility for the care of the Works shall pass to the Employer. If a Taking-Over Certificate is issued (or is so deemed to be issued) for any Section or part of the Works, responsibility for the care of the Section or part shall then pass to the Employer.

After responsibility has accordingly passed to the Employer, the Contractor shall take responsibility for the care of any work which is outstanding on the date stated in a Taking-Over Certificate, until this outstanding work has been completed.

If any loss or damage happens to the Works, Goods or Contractor's Documents during the period when the Contractor is responsible for their care, from any cause not listed in Sub-Clause 17.3 [Employer's Risks], the Contractor shall rectify the loss or damage at the Contractor's risk and cost, so that the Works, Goods and Contractor's Documents conform with the Contract.

The Contractor shall be liable for any loss or damage caused by any actions performed by the Contractor after a Taking-Over Certificate has been issued. The Contractor shall also be liable for any loss or damage which occurs after a Taking-Over Certificate has been issued and which arose from a previous event for which the Contractor was liable.

17.3 Employer's Risks

The risks referred to in Sub-Clause 17.4 [Consequences of Employer's Risks] below, insofar as they directly affect the execution of the Works in the Country, are:

- (a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,



- (b) rebellion, terrorism, sabotage by persons other than the Contractor's Personnel, revolution, insurrection, military or usurped power, or civil war, within the Country,
- (c) riot, commotion or disorder within the Country by persons other than the Contractor's Personnel,
- (d) munitions of war, explosive materials, ionising radiation or contamination by radio-activity, within the Country, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity,
- (e) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds,
- (f) use or occupation by the Employer of any part of the Permanent Works, except as may be specified in the Contract,
- (g) design of any part of the Works by the Employer's Personnel or by others for whom the Employer is responsible, and
- (h) any operation of the forces of nature which is Unforeseeable or against which an experienced contractor could not reasonably have been expected to have taken adequate preventative precautions.

17.4 Consequences of Employer's Risks

If and to the extent that any of the risks listed in Sub-Clause 17.3 above results in loss or damage to the Works, Goods or Contractor's Documents, the Contractor shall promptly give notice to the Engineer and shall rectify this loss or damage to the extent required by the Engineer.

If the Contractor suffers delay and/or incurs Cost from rectifying this loss or damage, the Contractor shall give a further notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost, which shall be included in the Contract Price. In the case of sub-paragraphs (f) and (g) of Sub-Clause 17.3 [Employer's Risks], Cost plus profit shall be payable.

After receiving this further notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

17.5 Intellectual and Industrial

In this Sub-Clause, "infringement" means an infringement (or alleged infringement) of any patent, registered design,

Property Rights

copyright, trade mark, trade name, trade secret or other intellectual or industrial property right relating to the Works; and "claim" means a claim (or proceedings pursuing a claim) alleging an infringement.

Whenever a Party does not give notice to the other Party of any claim within 28 days of receiving the claim, the first Party shall be deemed to have waived any right to indemnity under this Sub-Clause.

The Employer shall indemnify and hold the Contractor harmless against and from any claim alleging an infringement which is or was:

- (a) an unavoidable result of the Contractor's compliance with the Contract, or
- (b) a result of any Works being used by the Employer:
 - (i) for a purpose other than that indicated by, or reasonably to be inferred from, the Contract, or
 - (ii) in conjunction with any thing not supplied by the Contractor, unless such use was disclosed to the Contractor prior to the Base Date or is stated in the Contract.

The Contractor shall indemnify and hold the Employer harmless against and from any other claim which arises out of or in relation to (i) the manufacture, use, sale or import of any Goods, or (ii) any design for which the Contractor is responsible.

If a Party is entitled to be indemnified under this Sub-Clause, the indemnifying Party may (at its cost) conduct negotiations for the settlement of the claim, and any litigation or arbitration which may arise from it. The other Party shall, at the request and cost of the indemnifying Party, assist in contesting the claim. This other Party (and its Personnel) shall not make any admission which might be prejudicial to the indemnifying Party, unless the indemnifying Party failed to take over the conduct of any negotiations, litigation or arbitration upon being requested to do so by such other Party.

17.6 Limitation of Liability

Neither Party shall be liable to the other Party for loss of use of any Works, loss of profit, loss of any contract or for any indirect or consequential loss or damage which may be suffered by the other Party in connection with the Contract, other than as specifically provided in Sub-Clause 8.7 [Delay Damages]; Sub-Clause 11.2 [Cost of Remedying Defects]; Sub-Clause 15.4 [Payment after Termination]; Sub-Clause 16.4 [Payment on Termination]; Sub-Clause 17.1 [Indemnities]; Sub-Clause 17.4 (b) [Consequences of Employer's Risks] and Sub-Clause 17.5 [Intellectual and Industrial Property Rights].

The total liability of the Contractor to the Employer, under or in connection with the Contract other than under Sub-Clause 4.19 [Electricity, Water and Gas], Sub-Clause 4.20 [Employer's Equipment and Free-Issue Material], Sub-Clause 17.1 [Indemnities] and Sub-Clause 17.5 [Intellectual and Industrial Property Rights], shall not exceed the sum resulting from the application of a multiplier (less or greater than one) to the Accepted Contract Amount, as stated in the Contract Data, or (if such multiplier or other sum is not so stated), the Accepted Contract Amount.

This Sub-Clause shall not limit liability in any case of fraud, deliberate default or reckless misconduct by the defaulting Party.

17.7 Use of Employer's Accommodation/Facilities

The Contractor shall take full responsibility for the care of the Employer provided accommodation and facilities, if any, as detailed in the Specification, from the respective dates of hand-over to the Contractor until cessation of occupation (where hand-over or cessation of occupation may take place after the date stated in the Taking-Over Certificate for the Works).

If any loss or damage happens to any of the above items while the Contractor is responsible for their care arising from any cause whatsoever other than those for which the Employer is liable, the Contractor shall, at his own cost, rectify the loss or damage to the satisfaction of the Engineer.

18. Insurance

18.1 General Requirements for Insurances

In this Clause, "insuring Party" means, for each type of insurance, the Party responsible for effecting and maintaining the insurance specified in the relevant Sub-Clause.

Wherever the Contractor is the insuring Party, each insurance shall be effected with insurers and in terms acceptable to the Contractor. These terms shall be consistent with any terms agreed by both Parties before the date of the Letter of Acceptance. This agreement of terms shall take precedence over the provisions of this Clause.

Wherever the Employer is the insuring Party, each insurance



shall be effected with insurers and in terms acceptable to the Contractor. These terms shall be consistent with any terms agreed by both Parties before the date of the Letter of Acceptance. This agreement of terms shall take precedence over the provisions of this Clause.

If a policy is required to indemnify joint insured, the cover shall apply separately to each insured as though a separate policy had been issued for each of the joint insured. If a policy indemnifies additional joint insured, namely in addition to the insured specified in this Clause, (i) the Contractor shall act under the policy on behalf of these additional joint insured except that the Employer shall act for Employer's Personnel, (ii) additional joint insured shall not be entitled to receive payments directly from the insurer or to have any other direct dealings with the insurer, and (iii) the insuring Party shall require all additional joint insured to comply with the conditions stipulated in the policy.

Each policy insuring against loss or damage shall provide for payments to be made in the currencies required to rectify the loss or damage. Payments received from insurers shall be used for the rectification of the loss or damage.

The relevant insuring Party shall, within the respective periods stated in the Contract Data (calculated from the Commencement Date), submit to the other Party:

- (a) evidence that the insurances described in this Clause have been effected, and
- (b) copies of the policies for the insurances described in Sub-Clause 18.2 [Insurance for Works and Contractor's Equipment] and Sub-Clause 18.3 [Insurance against Injury to Persons and Damage to Property].

When each premium is paid, the insuring Party shall submit evidence of payment to the other Party. Whenever evidence or policies are submitted, the insuring Party shall also give notice to the Engineer.

Each Party shall comply with the conditions stipulated in each of the insurance policies. The insuring Party shall keep the insurers informed of any relevant changes to the execution of the Works and ensure that insurance is maintained in accordance with this Clause.

Neither Party shall make any material alteration to the terms of any insurance without the prior approval of the other Party. If an insurer makes (or attempts to make) any alteration, the Party first notified by the insurer shall promptly give notice to the

other Party.

If the insuring Party fails to effect and keep in force any of the insurances it is required to effect and maintain under the Contract, or fails to provide satisfactory evidence and copies of policies in accordance with this Sub-Clause, the other Party may (at its option and without prejudice to any other right or remedy) effect insurance for the relevant coverage and pay the premiums due. The insuring Party shall pay the amount of these premiums to the other Party, and the Contract Price shall be adjusted accordingly.

Nothing in this Clause limits the obligations, liabilities or responsibilities of the Contractor or the Employer, under the other terms of the Contract or otherwise. Any amounts not insured or not recovered from the insurers shall be borne by the Contractor and/or the Employer in accordance with these obligations, liabilities or responsibilities. However, if the insuring Party fails to effect and keep in force an insurance which is available and which it is required to effect and maintain under the Contract, and the other Party neither approves the omission nor effects insurance for the coverage relevant to this default, any moneys which should have been recoverable under this insurance shall be paid by the insuring Party.

Payments by one Party to the other Party shall be subject to Sub-Clause 2.5 [Employer's Claims] or Sub-Clause 20.1 [Contractor's Claims], as applicable.

The Contractor shall be entitled to place all insurance relating to the Contract (including, but not limited to the insurance referred to Clause 18) with insurers from any eligible source country.

18.2 Insurance for Works and Contractor's Equipment

The insuring Party shall insure the Works, Plant, Materials and Contractor's Documents for not less than the full reinstatement cost including the costs of demolition, removal of debris and professional fees and profit. This insurance shall be effective from the date by which the evidence is to be submitted under sub-paragraph (a) of Sub-Clause 18.1 [General Requirements for Insurances], until the date of issue of the Taking-Over Certificate for the Works.

The insuring Party shall maintain this insurance to provide cover until the date of issue of the Performance Certificate, for loss or damage for which the Contractor is liable arising from a cause occurring prior to the issue of the Taking-Over Certificate, and for loss or damage caused by the Contractor in the course of any other operations (including those under Clause 11 [Defects Liability]).

The insuring Party shall insure the Contractor's Equipment for not less than the full replacement value, including delivery to

Site. For each item of Contractor's Equipment, the insurance shall be effective while it is being transported to the Site and until it is no longer required as Contractor's Equipment.

Unless otherwise stated in the Particular Conditions, insurances under this Sub-Clause:

- (a) shall be effected and maintained by the Contractor as insuring Party,
- (b) shall be in the joint names of the Parties, who shall be jointly entitled to receive payments from the insurers, payments being held or allocated to the Party actually bearing the costs of rectifying the loss or damage,
- (c) shall cover all loss and damage from any cause not listed in Sub-Clause 17.3 [Employer's Risks],
- (d) shall also cover, to the extent specifically required in the bidding documents of the Contract, loss or damage to a part of the Works which is attributable to the use or occupation by the Employer of another part of the Works, and loss or damage from the risks listed in sub-paragraphs (c), (g) and (h) of Sub-Clause 17.3 [Employer's Risks], excluding (in each case) risks which are not insurable at commercially reasonable terms, with deductibles per occurrence of not more than the amount stated in the Contract Data (if an amount is not so stated, this sub-paragraph (d) shall not apply), and
- (e) may however exclude loss of, damage to, and reinstatement of:
 - (i) a part of the Works which is in a defective condition due to a defect in its design, materials or workmanship (but cover shall include any other parts which are lost or damaged as a direct result of this defective condition and not as described in sub-paragraph (ii) below),
 - (ii) a part of the Works which is lost or damaged in order to reinstate any other part of the Works if this other part is in a defective condition due to a defect in its design, materials or workmanship,
 - (iii) a part of the Works which has been taken over by the Employer, except to the extent that the Contractor is liable for the loss or damage, and
 - (iv) Goods while they are not in the Country, subject to Sub-Clause 14.5 [Plant and Materials intended for the

Works].

If, more than one year after the Base Date, the cover described in sub-paragraph (d) above ceases to be available at commercially reasonable terms, the Contractor shall (as insuring Party) give notice to the Employer, with supporting particulars. The Employer shall then (i) be entitled subject to Sub-Clause 2.5 [Employer's Claims] to payment of an amount equivalent to such commercially reasonable terms as the Contractor should have expected to have paid for such cover, and (ii) be deemed, unless he obtains the cover at commercially reasonable terms, to have approved the omission under Sub-Clause 18.1 [General Requirements for Insurances].

18.3 Insurance against Injury to Persons and Damage to Property

The insuring Party shall insure against each Party's liability for any loss, damage, death or bodily injury which may occur to any physical property (except things insured under Sub-Clause 18.2 [Insurance for Works and Contractor's Equipment]) or to any person (except persons insured under Sub-Clause 18.4 [Insurance for Contractor's Personnel]), which may arise out of the Contractor's performance of the Contract and occurring before the issue of the Performance Certificate.

This insurance shall be for a limit per occurrence of not less than the amount stated in the Contract Data, with no limit on the number of occurrences. If an amount is not stated in the Contract Data, this Sub-Clause shall not apply.

Unless otherwise stated in the Particular Conditions, the insurances specified in this Sub-Clause:

- (a) shall be effected and maintained by the Contractor as insuring Party,
- (b) shall be in the joint names of the Parties,
- (c) shall be extended to cover liability for all loss and damage to the Employer's property (except things insured under Sub-Clause 18.2) arising out of the Contractor's performance of the Contract, and
- (d) may however exclude liability to the extent that it arises from:
 - (i) the Employer's right to have the Permanent Works executed on, over, under, in or through any land, and to occupy this land for the Permanent Works,
 - (ii) damage which is an unavoidable result of the Contractor's obligations to execute the Works and remedy any defects, and



- (iii) a cause listed in Sub-Clause 17.3 [Employer's Risks], except to the extent that cover is available at commercially reasonable terms.

18.4 Insurance for Contractor's Personnel

The Contractor shall effect and maintain insurance against liability for claims, damages, losses and expenses (including legal fees and expenses) arising from injury, sickness, disease or death of any person employed by the Contractor or any other of the Contractor's Personnel.

The insurance shall cover the Employer and the Engineer against liability for claims, damages, losses and expenses (including legal fees and expenses) arising from injury, sickness, disease or death of any person employed by the Contractor or any other of the Contractor's Personnel, except that this insurance may exclude losses and claims to the extent that they arise from any act or neglect of the Employer or of the Employer's Personnel.

The insurance shall be maintained in full force and effect during the whole time that these personnel are assisting in the execution of the Works. For a Subcontractor's employees, the insurance may be effected by the Subcontractor, but the Contractor shall be responsible for compliance with this Clause.

19. Force Majeure

19.1 Definition of Force Majeure

In this Clause, "Force Majeure" means an exceptional event or circumstance:

- (a) which is beyond a Party's control,
- (b) which such Party could not reasonably have provided against before entering into the Contract,
- (c) which, having arisen, such Party could not reasonably have avoided or overcome, and
- (d) which is not substantially attributable to the other Party.

Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind listed below, so long as conditions (a) to (d) above are satisfied:

- (i) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,
- (ii) rebellion, terrorism, sabotage by persons other than the Contractor's Personnel, revolution, insurrection, military or usurped power, or civil war,
- (iii) riot, commotion, disorder, strike or lockout by persons other than the Contractor's Personnel,

- (iv) munitions of war, explosive materials, ionising radiation or contamination by radio-activity, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity, and
- (v) natural catastrophes such as earthquake, hurricane, typhoon or volcanic activity.

19.2 Notice of Force Majeure

If a Party is or will be prevented from performing its substantial obligations under the Contract by Force Majeure, then it shall give notice to the other Party of the event or circumstances constituting the Force Majeure and shall specify the obligations, the performance of which is or will be prevented. The notice shall be given within 14 days after the Party became aware, or should have become aware, of the relevant event or circumstance constituting Force Majeure.

The Party shall, having given notice, be excused performance of its obligations for so long as such Force Majeure prevents it from performing them.

Notwithstanding any other provision of this Clause, Force Majeure shall not apply to obligations of either Party to make payments to the other Party under the Contract.

19.3 Duty to Minimise Delay

Each Party shall at all times use all reasonable endeavours to minimise any delay in the performance of the Contract as a result of Force Majeure.

A Party shall give notice to the other Party when it ceases to be affected by the Force Majeure.

19.4 Consequences of Force Majeure

If the Contractor is prevented from performing its substantial obligations under the Contract by Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], and suffers delay and/or incurs Cost by reason of such Force Majeure, the Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) if the event or circumstance is of the kind described in sub-paragraphs (i) to (iv) of Sub-Clause 19.1 [Definition of Force Majeure] and, in the case of sub-paragraphs (ii) to (iv), occurs in the Country, payment of any such Cost, including the costs of rectifying or replacing the Works and/or Goods damaged or destroyed by Force Majeure, to the extent they are not indemnified through the insurance policy referred to in Sub-Clause 18.2 [Insurance for Works and Contractor's Equipment].

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

**19.5 Force Majeure
Affecting
Subcontractor**

If any Subcontractor is entitled under any contract or agreement relating to the Works to relief from force majeure on terms additional to or broader than those specified in this Clause, such additional or broader force majeure events or circumstances shall not excuse the Contractor's non-performance or entitle him to relief under this Clause.

**19.6 Optional
Termination,
Payment and
Release**

If the execution of substantially all the Works in progress is prevented for a continuous period of 84 days by reason of Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], or for multiple periods which total more than 140 days due to the same notified Force Majeure, then either Party may give to the other Party a notice of termination of the Contract. In this event, the termination shall take effect 7 days after the notice is given, and the Contractor shall proceed in accordance with Sub-Clause 16.3 [Cessation of Work and Removal of Contractor's Equipment].

Upon such termination, the Engineer shall determine the value of the work done and issue a Payment Certificate which shall include:

- (a) the amounts payable for any work carried out for which a price is stated in the Contract;
- (b) the Cost of Plant and Materials ordered for the Works which have been delivered to the Contractor, or of which the Contractor is liable to accept delivery: this Plant and Materials shall become the property of (and be at the risk of) the Employer when paid for by the Employer, and the Contractor shall place the same at the Employer's disposal;
- (c) other Costs or liabilities which in the circumstances were reasonably and necessarily incurred by the Contractor in the expectation of completing the Works;
- (d) the Cost of removal of Temporary Works and Contractor's Equipment from the Site and the return of these items to the Contractor's works in his country (or to any other destination at no greater cost); and
- (e) the Cost of repatriation of the Contractor's staff and labour employed wholly in connection with the Works at the date of termination.

19.7 Release from

Notwithstanding any other provision of this Clause, if any event or

Performance

circumstance outside the control of the Parties (including, but not limited to, Force Majeure) arises which makes it impossible or unlawful for either or both Parties to fulfil its or their contractual obligations or which, under the law governing the Contract, entitles the Parties to be released from further performance of the Contract, then upon notice by either Party to the other Party of such event or circumstance:

- (a) the Parties shall be discharged from further performance, without prejudice to the rights of either Party in respect of any previous breach of the Contract, and
- (b) the sum payable by the Employer to the Contractor shall be the same as would have been payable under Sub-Clause 19.6 [Optional Termination, Payment and Release] if the Contract had been terminated under Sub-Clause 19.6.

20. Claims, Disputes and Arbitration

20.1 Contractor's Claims

If the Contractor considers himself to be entitled to any extension of the Time for Completion and/or any additional payment, under any Clause of these Conditions or otherwise in connection with the Contract, the Contractor shall give notice to the Engineer, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and not later than 28 days after the Contractor became aware, or should have become aware, of the event or circumstance.

If the Contractor fails to give notice of a claim within such period of 28 days, the Time for Completion shall not be extended, the Contractor shall not be entitled to additional payment, and the Employer shall be discharged from all liability in connection with the claim. Otherwise, the following provisions of this Sub-Clause shall apply.

The Contractor shall also submit any other notices which are required by the Contract, and supporting particulars for the claim, all as relevant to such event or circumstance.

The Contractor shall keep such contemporary records as may be necessary to substantiate any claim, either on the Site or at another location acceptable to the Engineer. Without admitting the Employer's liability, the Engineer may, after receiving any notice under this Sub-Clause, monitor the record-keeping and/or instruct the Contractor to keep further contemporary records. The Contractor shall permit the Engineer to inspect all these records, and shall (if instructed) submit copies to the Engineer.

Within 42 days after the Contractor became aware (or should have become aware) of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the



Contractor and approved by the Engineer, the Contractor shall send to the Engineer a fully detailed claim which includes full supporting particulars of the basis of the claim and of the extension of time and/or additional payment claimed. If the event or circumstance giving rise to the claim has a continuing effect:

- (a) this fully detailed claim shall be considered as interim;
- (b) the Contractor shall send further interim claims at monthly intervals, giving the accumulated delay and/or amount claimed, and such further particulars as the Engineer may reasonably require; and
- (c) the Contractor shall send a final claim within 28 days after the end of the effects resulting from the event or circumstance, or within such other period as may be proposed by the Contractor and approved by the Engineer.

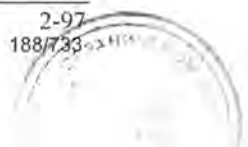
Within 42 days after receiving a claim or any further particulars supporting a previous claim, or within such other period as may be proposed by the Engineer and approved by the Contractor, the Engineer shall respond with approval, or with disapproval and detailed comments. He may also request any necessary further particulars, but shall nevertheless give his response on the principles of the claim within the above defined time period.

Within the above defined period of 42 days, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) the extension (if any) of the Time for Completion (before or after its expiry) in accordance with Sub-Clause 8.4 [Extension of Time for Completion], and/or (ii) the additional payment (if any) to which the Contractor is entitled under the Contract.

Each Payment Certificate shall include such additional payment for any claim as have been reasonably substantiated as due under the relevant provision of the Contract. Unless and until the particulars supplied are sufficient to substantiate the whole of the claim, the Contractor shall only be entitled to payment for such part of the claim as he has been able to substantiate.

If the Engineer does not respond within the timeframe defined in this Clause, either Party may consider that the claim is rejected by the Engineer and any of the Parties may refer it to the Dispute Board in accordance with Sub-Clause 20.4 [Obtaining Dispute Board's Decision].

The requirements of this Sub-Clause are in addition to those of any other Sub-Clause which may apply to a claim. If the Contractor fails to comply with this or another Sub-Clause in



relation to any claim, any extension of time and/or additional payment shall take account of the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim, unless the claim is excluded under the second paragraph of this Sub-Clause.

20.2 Appointment of the Dispute Board

Disputes shall be referred to a DB for decision in accordance with Sub-Clause 20.4 [Obtaining Dispute Board's Decision]. The Parties shall appoint a DB by the date stated in the Contract Data.

The DB shall comprise, as stated in the Contract Data, either one or three suitably qualified persons ("the members"), each of whom shall be fluent in the language for communication defined in the Contract and shall be a professional experienced in the type of construction involved in the Works and with the interpretation of contractual documents. If the number is not so stated and the Parties do not agree otherwise, the DB shall comprise three persons.

If the Parties have not jointly appointed the DB 21 days before the date stated in the Contract Data and the DB is to comprise three persons, each Party shall nominate one member for the approval of the other Party. The first two members shall recommend and the Parties shall agree upon the third member, who shall act as chairman.

However, if a list of potential members has been agreed by the Parties and is included in the Contract, the members shall be selected from those on the list, other than anyone who is unable or unwilling to accept appointment to the DB.

The agreement between the Parties and either the sole member or each of the three members shall incorporate by reference the General Conditions of Dispute Board Agreement contained in the Appendix to these General Conditions, with such amendments as are agreed between them.

The terms of the remuneration of either the sole member or each of the three members, including the remuneration of any expert whom the DB consults, shall be mutually agreed upon by the Parties when agreeing the terms of appointment. Each Party shall be responsible for paying one-half of this remuneration.

If at any time the Parties so agree, they may jointly refer a matter to the DB for it to give its opinion. Neither Party shall consult the DB on any matter without the agreement of the other Party.

If a member declines to act or is unable to act as a result of death, disability, resignation or termination of appointment, a

replacement shall be appointed in the same manner as the replaced person was required to have been nominated or agreed upon, as described in this Sub-Clause.

The appointment of any member may be terminated by mutual agreement of both Parties, but not by the Employer or the Contractor acting alone. Unless otherwise agreed by both Parties, the appointment of the DB (including each member) shall expire when the discharge referred to in Sub-Clause 14.12 [Discharge] shall have become effective.

20.3 Failure to Agree on the Composition of the Dispute Board

If any of the following conditions apply, namely:

- (a) the Parties fail to agree upon the appointment of the sole member of the DB by the date stated in the first paragraph of Sub-Clause 20.2, [Appointment of the Dispute Board],
- (b) either Party fails to nominate a member (for approval by the other Party), or fails to approve a member nominated by the other Party, of a DB of three persons by such date,
- (c) the Parties fail to agree upon the appointment of the third member (to act as chairman) of the DB by such date, or
- (d) the Parties fail to agree upon the appointment of a replacement person within 42 days after the date on which the sole member or one of the three members declines to act or is unable to act as a result of death, disability, resignation or termination of appointment,

then the appointing entity or official named in the Contract Data shall, upon the request of either or both of the Parties and after due consultation with both Parties, appoint this member of the DB. This appointment shall be final and conclusive. Each Party shall be responsible for paying one-half of the remuneration of the appointing entity or official.

20.4 Obtaining Dispute Board's Decision

If a dispute (of any kind whatsoever) arises between the Parties in connection with, or arising out of, the Contract or the execution of the Works, including any dispute as to any certificate, determination, instruction, opinion or valuation of the Engineer, either Party may refer the dispute in writing to the DB for its decision, with copies to the other Party and the Engineer. Such reference shall state that it is given under this Sub-Clause.

For a DB of three persons, the DB shall be deemed to have received such reference on the date when it is received by the chairman of the DB.

Both Parties shall promptly make available to the DB all such additional information, further access to the Site, and appropriate facilities, as the DB may require for the purposes of making a decision on such dispute. The DB shall be deemed to



be not acting as arbitrator(s).

Within 84 days after receiving such reference, or within such other period as may be proposed by the DB and approved by both Parties, the DB shall give its decision, which shall be reasoned and shall state that it is given under this Sub-Clause. The decision shall be binding on both Parties, who shall promptly give effect to it unless and until it shall be revised in an amicable settlement or an arbitral award as described below. Unless the Contract has already been abandoned, repudiated or terminated, the Contractor shall continue to proceed with the Works in accordance with the Contract.

If either Party is dissatisfied with the DB's decision, then either Party may, within 28 days after receiving the decision, give notice to the other Party of its dissatisfaction and intention to commence arbitration. If the DB fails to give its decision within the period of 84 days (or as otherwise approved) after receiving such reference, then either Party may, within 28 days after this period has expired, give notice to the other Party of its dissatisfaction and intention to commence arbitration.

In either event, this notice of dissatisfaction shall state that it is given under this Sub-Clause, and shall set out the matter in dispute and the reason(s) for dissatisfaction. Except as stated in Sub-Clause 20.7 [Failure to Comply with Dispute Board's Decision] and Sub-Clause 20.8 [Expiry of Dispute Board's Appointment], neither Party shall be entitled to commence arbitration of a dispute unless a notice of dissatisfaction has been given in accordance with this Sub-Clause.

If the DB has given its decision as to a matter in dispute to both Parties, and no notice of dissatisfaction has been given by either Party within 28 days after it received the DB's decision, then the decision shall become final and binding upon both Parties.

20.5 Amicable Settlement

Where notice of dissatisfaction has been given under Sub-Clause 20.4 above, both Parties shall attempt to settle the dispute amicably before the commencement of arbitration. However, unless both Parties agree otherwise, arbitration may be commenced on or after the fifty-sixth day after the day on which a notice of dissatisfaction and intention to commence arbitration was given, even if no attempt at amicable settlement has been made.

20.6 Arbitration

Unless indicated otherwise in the Particular Conditions, any dispute not settled amicably and in respect of which the DB's decision (if any) has not become final and binding shall be finally settled by arbitration. Unless otherwise agreed by both Parties:

- (a) For contracts with foreign contractors, international arbitration with proceedings administered by the

institution appointed in the Contract Data, conducted in accordance with the rules of arbitration of the appointed institution, if any, or in accordance with UNCITRAL arbitration rules, at the choice of the appointed institution,

- (b) the place of arbitration shall be the city where the headquarters of the appointed arbitration institution is located,
- (c) the arbitration shall be conducted in the language for communications defined in Sub-Clause 1.4 [Law and Language], and
- (d) For contracts with domestic contractors, arbitration with proceedings conducted in accordance with the laws of the Employer's country.

The arbitrators shall have full power to open up, review and revise any certificate, determination, instruction, opinion or valuation of the Engineer, and any decision of the DB, relevant to the dispute. Nothing shall disqualify representatives of the Parties and the Engineer from being called as a witness and giving evidence before the arbitrators on any matter whatsoever relevant to the dispute.

Neither Party shall be limited in the proceedings before the arbitrators to the evidence or arguments previously put before the DB to obtain its decision, or to the reasons for dissatisfaction given in its notice of dissatisfaction. Any decision of the DB shall be admissible in evidence in the arbitration.

Arbitration may be commenced prior to or after completion of the Works. The obligations of the Parties, the Engineer and the DB shall not be altered by reason of any arbitration being conducted during the progress of the Works.

20.7 Failure to Comply with Dispute Board's Decision

In the event that a Party fails to comply with a final and binding DB decision, then the other Party may, without prejudice to any other rights it may have, refer the failure itself to arbitration under Sub-Clause 20.6 [Arbitration]. Sub-Clause 20.4 [Obtaining Dispute Board's Decision] and Sub-Clause 20.5 [Amicable Settlement] shall not apply to this reference.

20.8 Expiry of Dispute Board's Appointment

If a dispute arises between the Parties in connection with, or arising out of, the Contract or the execution of the Works and there is no DB in place, whether by reason of the expiry of the DB's appointment or otherwise:

- (a) Sub-Clause 20.4 [Obtaining Dispute Board's Decision] and Sub-Clause 20.5 [Amicable Settlement] shall not apply, and



- (b) the dispute may be referred directly to arbitration under Sub-Clause 20.6 [Arbitration].

APPENDIX

A General Conditions of Dispute Board Agreement

1. Definitions

Each "Dispute Board Agreement" is a tripartite agreement by and between:

- (a) the "Employer";
- (b) the "Contractor"; and
- (c) the "Member" who is defined in the Dispute Board Agreement as being:
 - (i) the sole member of the "DB" and, where this is the case, all references to the "Other Members" do not apply, or
 - (ii) one of the three persons who are jointly called the "DB" (or "Dispute Board") and, where this is the case, the other two persons are called the "Other Members."

The Employer and the Contractor have entered (or intend to enter) into a contract, which is called the "Contract" and is defined in the Dispute Board Agreement, which incorporates this Appendix. In the Dispute Board Agreement, words and expressions which are not otherwise defined shall have the meanings assigned to them in the Contract.

2. General Provisions

Unless otherwise stated in the Dispute Board Agreement, it shall take effect on the latest of the following dates:

- (a) the Commencement Date defined in the Contract,
- (b) when the Employer, the Contractor and the Member have each signed the Dispute Board Agreement, or
- (c) when the Employer, the Contractor and each of the Other Members (if any) have respectively each signed a dispute board agreement.

This employment of the Member is a personal appointment. At any time, the Member may give not less than 70 days' notice of resignation to the Employer and to the Contractor, and the Dispute Agreement shall terminate upon the expiry of this period.

3. Warranties

The Member warrants and agrees that he/she is and shall be impartial and independent of the Employer, the Contractor and the Engineer. The Member shall promptly disclose, to each of them and to the Other Members (if any), any fact or circumstance which might appear inconsistent with his/her warranty and agreement of impartiality and independence.

When appointing the Member, the Employer and the Contractor relied upon the Member's representations that he/she is:

- (a) experienced in the work which the Contractor is to carry out under the Contract,
- (b) experienced in the interpretation of contract documentation, and
- (c) fluent in the language for communications defined in the Contract.

4. General Obligations of the Member

The Member shall:

- (a) have no interest financial or otherwise in the Employer, the Contractor or Engineer, nor any financial interest in the Contract except for payment under the Dispute Board Agreement;
- (b) not previously have been employed as a consultant or otherwise by the Employer, the Contractor or the Engineer, except in such circumstances as were disclosed in writing to the Employer and the Contractor before they signed the Dispute Board Agreement;
- (c) have disclosed in writing to the Employer, the Contractor and the Other Members (if any), before entering into the Dispute Board Agreement and to his/her best knowledge and recollection, any professional or personal relationships with any director, officer or employee of the Employer, the Contractor or the Engineer, and any previous involvement in the overall project of which the Contract forms part;
- (d) not, for the duration of the Dispute Board Agreement, be employed as a consultant or otherwise by the Employer, the Contractor or the Engineer, except as may be agreed in writing by the Employer, the Contractor and the Other Members (if any);
- (e) comply with the annexed procedural rules and with Sub-Clause 20.4 of the Conditions of Contract;
- (f) not give advice to the Employer, the Contractor, the Employer's Personnel or the Contractor's Personnel concerning the conduct of the Contract, other than in accordance with the annexed procedural rules;
- (g) not while a Member enter into discussions or make any agreement with the Employer, the Contractor or the Engineer regarding employment by any of them, whether as a consultant or otherwise, after ceasing to act under the Dispute Board Agreement;
- (h) ensure his/her availability for all site visits and hearings as are necessary;
- (i) become conversant with the Contract and with the progress of

the Works (and of any other parts of the project of which the Contract forms part) by studying all documents received which shall be maintained in a current working file;

- (j) treat the details of the Contract and all the DB's activities and hearings as private and confidential, and not publish or disclose them without the prior written consent of the Employer, the Contractor and the Other Members (if any); and
- (k) be available to give advice and opinions, on any matter relevant to the Contract when requested by both the Employer and the Contractor, subject to the agreement of the Other Members (if any).

**5. General
Obligations of the
Employer and the
Contractor**

The Employer, the Contractor, the Employer's Personnel and the Contractor's Personnel shall not request advice from or consultation with the Member regarding the Contract, otherwise than in the normal course of the DB's activities under the Contract and the Dispute Board Agreement. The Employer and the Contractor shall be responsible for compliance with this provision, by the Employer's Personnel and the Contractor's Personnel respectively.

The Employer and the Contractor undertake to each other and to the Member that the Member shall not, except as otherwise agreed in writing by the Employer, the Contractor, the Member and the Other Members (if any):

- (a) be appointed as an arbitrator in any arbitration under the Contract;
- (b) be called as a witness to give evidence concerning any dispute before arbitrator(s) appointed for any arbitration under the Contract; or
- (c) be liable for any claims for anything done or omitted in the discharge or purported discharge of the Member's functions, unless the act or omission is shown to have been in bad faith.

The Employer and the Contractor hereby jointly and severally indemnify and hold the Member harmless against and from claims from which he is relieved from liability under the preceding paragraph.

Whenever the Employer or the Contractor refers a dispute to the DB under Sub-Clause 20.4 of the Conditions of Contract, which will require the Member to make a site visit and attend a hearing, the Employer or the Contractor shall provide appropriate security for a sum equivalent to the reasonable expenses to be incurred by the Member. No account shall be taken of any other payments due or paid to the Member.

6. Payment

The Member shall be paid as follows, in the currency named in the

Dispute Board Agreement:

- (a) a retainer fee per calendar month, which shall be considered as payment in full for:
 - (i) being available on 28 days' notice for all site visits and hearings;
 - (ii) becoming and remaining conversant with all project developments and maintaining relevant files;
 - (iii) all office and overhead expenses including secretarial services, photocopying and office supplies incurred in connection with his duties; and
 - (iv) all services performed hereunder except those referred to in sub-paragraphs (b) and (c) of this Clause.

The retainer fee shall be paid with effect from the last day of the calendar month in which the Dispute Board Agreement becomes effective; until the last day of the calendar month in which the Taking-Over Certificate is issued for the whole of the Works.

With effect from the first day of the calendar month following the month in which the Taking-Over Certificate is issued for the whole of the Works, the retainer fee shall be reduced by one third. This reduced fee shall be paid until the first day of the calendar month in which the Member resigns or the Dispute Board Agreement is otherwise terminated.

- (b) a daily fee which shall be considered as payment in full for:
 - (i) each day or part of a day up to a maximum of two days' travel time in each direction for the journey between the Member's home and the site, or another location of a meeting with the Other Members (if any);
 - (ii) each working day on Site visits, hearings or preparing decisions; and
 - (iii) each day spent reading submissions in preparation for a hearing.
- (c) all reasonable expenses including necessary travel expenses (air fare in less than first class, hotel and subsistence and other direct travel expenses) incurred in connection with the Member's duties, as well as the cost of telephone calls, courier charges, faxes and telexes: a receipt shall be required for each item in excess of five percent of the daily fee referred to in sub-paragraph (b) of this Clause;
- (d) any taxes properly levied in the Country on payments made to the Member (unless a national or permanent resident of the



Country) under this Clause 6.

The retainer and daily fees shall be as specified in the Dispute Board Agreement. Unless it specifies otherwise, these fees shall remain fixed for the first 24 calendar months, and shall thereafter be adjusted by agreement between the Employer, the Contractor and the Member, at each anniversary of the date on which the Dispute Board Agreement became effective.

If the parties fail to agree on the retainer fee or the daily fee, the appointing entity or official named in the Contract Data shall determine the amount of the fees to be used.

The Member shall submit invoices for payment of the monthly retainer and air fares quarterly in advance. Invoices for other expenses and for daily fees shall be submitted following the conclusion of a site visit or hearing. All invoices shall be accompanied by a brief description of activities performed during the relevant period and shall be addressed to the Contractor.

The Contractor shall pay each of the Member's invoices in full within 56 calendar days after receiving each invoice and shall apply to the Employer (in the Statements under the Contract) for reimbursement of one-half of the amounts of these invoices. The Employer shall then pay the Contractor in accordance with the Contract.

If the Contractor fails to pay to the Member the amount to which he/she is entitled under the Dispute Board Agreement, the Employer shall pay the amount due to the Member and any other amount which may be required to maintain the operation of the DB; and without prejudice to the Employer's rights or remedies. In addition to all other rights arising from this default, the Employer shall be entitled to reimbursement of all sums paid in excess of one-half of these payments, plus all costs of recovering these sums and financing charges calculated at the rate specified in Sub-Clause 14.8 of the Conditions of Contract.

If the Member does not receive payment of the amount due within 70 days after submitting a valid invoice, the Member may (i) suspend his/her services (without notice) until the payment is received, and/or (ii) resign his/her appointment by giving notice under Clause 7.

7. Termination

At any time: (i) the Employer and the Contractor may jointly terminate the Dispute Board Agreement by giving 42 days' notice to the Member; or (ii) the Member may resign as provided for in Clause 2.

If the Member fails to comply with the Dispute Board Agreement, the Employer and the Contractor may, without prejudice to their other rights, terminate it by notice to the Member. The notice shall



take effect when received by the Member.

If the Employer or the Contractor fails to comply with the Dispute Board Agreement, the Member may, without prejudice to his other rights, terminate it by notice to the Employer and the Contractor. The notice shall take effect when received by them both.

Any such notice, resignation and termination shall be final and binding on the Employer, the Contractor and the Member. However, a notice by the Employer or the Contractor, but not by both, shall be of no effect.

8. Default of the Member

If the Member fails to comply with any of his obligations under Clause 4 (a) - (d) above, he shall not be entitled to any fees or expenses hereunder and shall, without prejudice to their other rights, reimburse each of the Employer and the Contractor for any fees and expenses received by the Member and the Other Members (if any), for proceedings or decisions (if any) of the DB which are rendered void or ineffective by the said failure to comply.

If the Member fails to comply with any of his obligations under Clause 4 (e) - (k) above, he shall not be entitled to any fees or expenses hereunder from the date and to the extent of the non-compliance and shall, without prejudice to their other rights, reimburse each of the Employer and the Contractor for any fees and expenses already received by the Member, for proceedings or decisions (if any) of the DB which are rendered void or ineffective by the said failure to comply.

9. Disputes

Any dispute or claim arising out of or in connection with this Dispute Board Agreement, or the breach, termination or invalidity thereof, shall be finally settled by institutional arbitration. If no other arbitration institute is agreed, the arbitration shall be conducted under the Rules of Arbitration of the International Chamber of Commerce by one arbitrator appointed in accordance with these Rules of Arbitration.

PROCEDURAL RULES

Unless otherwise agreed by the Employer and the Contractor, the DB shall visit the site at intervals of not more than 140 days, including times of critical construction events, at the request of either the Employer or the Contractor. Unless otherwise agreed by the Employer, the Contractor and the DB, the period between consecutive visits shall not be less than 70 days, except as required to convene a hearing as described below.

The timing of and agenda for each site visit shall be as agreed jointly by the DB, the Employer and the Contractor, or in the absence of agreement, shall be decided by the DB. The purpose of site visits is to enable the DB to become and remain acquainted with the progress of the Works and of any actual or potential problems or claims, and, as far as reasonable, to endeavour to prevent potential problems or claims from becoming disputes.

Site visits shall be attended by the Employer, the Contractor and the Engineer and shall be co-ordinated by the Employer in co-operation with the Contractor. The Employer shall ensure the provision of appropriate conference facilities and secretarial and copying services. At the conclusion of each site visit and before leaving the site, the DB shall prepare a report on its activities during the visit and shall send copies to the Employer and the Contractor.

The Employer and the Contractor shall furnish to the DB one copy of all documents which the DB may request, including Contract documents, progress reports, variation instructions, certificates and other documents pertinent to the performance of the Contract. All communications between the DB and the Employer or the Contractor shall be copied to the other Party. If the DB comprises three persons, the Employer and the Contractor shall send copies of these requested documents and these communications to each of these persons.

If any dispute is referred to the DB in accordance with Sub-Clause 20.4 of the Conditions of Contract, the DB shall proceed in accordance with Sub-Clause 20.4 and these Rules. Subject to the time allowed to give notice of a decision and other relevant factors, the DB shall:

- (a) act fairly and impartially as between the Employer and the Contractor, giving each of them a reasonable opportunity of putting his case and responding to the other's case, and
- (b) adopt procedures suitable to the dispute, avoiding unnecessary delay or expense.

The DB may conduct a hearing on the dispute, in which event it will decide on the date and place for the hearing and may request that written documentation and arguments from the Employer and the Contractor be presented to it prior to or at the hearing.

Except as otherwise agreed in writing by the Employer and the Contractor, the DB shall have power to adopt an inquisitorial procedure, to refuse admission to hearings or audience at hearings to any persons other than representatives of the Employer, the Contractor and the Engineer, and to proceed in the absence of any party who the DB is satisfied received notice of the hearing; but shall have discretion to decide whether and to what extent this power may be exercised.

The Employer and the Contractor empower the DB, among other things, to:

- (a) establish the procedure to be applied in deciding a dispute,
- (b) decide upon the DB's own jurisdiction, and as to the scope of any dispute referred to it.

- (c) conduct any hearing as it thinks fit, not being bound by any rules or procedures other than those contained in the Contract and these Rules,
- (d) take the initiative in ascertaining the facts and matters required for a decision,
- (e) make use of its own specialist knowledge, if any,
- (f) decide upon the payment of financing charges in accordance with the Contract,
- (g) decide upon any provisional relief such as interim or conservatory measures, and
- (h) open up, review and revise any certificate, decision, determination, instruction, opinion or valuation of the Engineer, relevant to the dispute.

The DB shall not express any opinions during any hearing concerning the merits of any arguments advanced by the Parties. Thereafter, the DB shall make and give its decision in accordance with Sub-Clause 20.4, or as otherwise agreed by the Employer and the Contractor in writing. If the DB comprises three persons:

- (a) it shall convene in private after a hearing, in order to have discussions and prepare its decision;
- (b) it shall endeavour to reach a unanimous decision: if this proves impossible the applicable decision shall be made by a majority of the Members, who may require the minority Member to prepare a written report for submission to the Employer and the Contractor; and
- (c) if a Member fails to attend a meeting or hearing, or to fulfil any required function, the other two Members may nevertheless proceed to make a decision, unless:
 - (i) either the Employer or the Contractor does not agree that they do so, or
 - (ii) the absent Member is the chairman and he/she instructs the other Members not to make a decision.



(11) Special Specification

The following Special Specification should be read in conjunction with the General Specifications and shall extend and modify them as appropriate.

List of Special Specifications:

Preamble to Bill of Quantities

Facilities for the Engineer

Environmental Management Plan

Special Specification

Preamble to Bill of Quantities

Preamble

Remark:

The following Preamble should be treated as a Special Specifications and should be read in conjunction with General Specifications and shall extend and modify them as appropriate.

1. The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, General and Special Conditions of Contract, Technical Specifications, and Drawings.
2. The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Engineer and valued at the rates and prices bid in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Engineer may fix within the terms of the Contract.
3. The rates and prices bid in the priced Bill of Quantities shall, except insofar as it is otherwise provided under the Contract, include all Constructional Plant, labour, supervision, materials, erection, maintenance, insurance, profit, taxes, and duties, together with all general risks, liabilities, and obligations set out or implied in the Contract.

The unit prices in this programme shall cover inter alia:

- costs of labour, used materials and equipment of the Contractor,
- costs of location for Contractor's facilities, plants, storage place, parking, offices etc.,
- costs of workers' camp, local transport to site and back, travel allowances to workers for trips home,
- costs of transport of materials and equipment of the Contractor to site,
- costs of possible rent of machinery, equipment and vehicles,
- costs of unloading, transshipment, storage, keeping, local deliveries of materials to places of use, equipment and plant of the Contractor,
- taxes, custom duties and levies related to the works pursuant to the contract provisions,
- cost of performance guarantee,
- insurance costs: for workers (health insurance included), for plants, structures and third parties pursuant to the relevant contract provisions,
- costs of electricity, water, heating, gas, telephone, fax during works,
- costs of waste disposal in city dump area,
- costs of construction and maintenance of temporary structures (stocks, workshops, worker's camp, offices for the Contractor, the Engineer, Employer, Consultant Supervision of the EMP and other) that are needed for smooth execution of the works under this contract,
- costs of laying and maintaining any temporary installations on the site, needed for the execution of works,
- costs of starting the operation,
- costs of "hard fence" for the site, if necessary,
- cost of supply and fixing of 3 official site boards in accordance with the laws of the Republic of Serbia,

- costs of working conditions for the Engineer and his team,
 - costs of temporary dumping of key material,
 - cost of any diversion roads and traffic control and maintenance of diversion roads,
 - cost of cleaning up the site on completion,
 - cost of the Environmental Management Plan implementation,
 - cost of the traffic management plan preparation and implementation (the Contractor has to prepare and present the Plan to relevant authorities for approval; the Works shall be executed under road traffic, as well as along the railway line),
 - other costs ensuing from the contract documents,
 - other direct and indirect costs for full completion, maintenance in the construction period and start of operation,
 - itemized unit rates shall include geodetic works if they are not specified as a separate item in the Bill of Quantities.
4. A rate or price shall be entered against each item in the priced Bill of Quantities. The cost of Items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.
 5. The Contractor shall not have the right to unit price adjustment on the basis of eventual difference between quantities of works stated in the Bill of Quantities and actually completed quantities, except in the case defined under the Particular Conditions of Contract.
 6. The whole cost of complying with the provisions of the Contract shall be included in the Items provided in the priced Bill of Quantities, and where no Items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related Items of Work.
 7. General conditions and descriptions of work and materials are not necessarily repeated nor summarized in the Bill of Quantities. References to the relevant sections of the Contract documentation shall be made before entering prices against each item in the priced Bill of Quantities.
 8. A Daywork Schedule should be included if the probability of unforeseen work, outside the items included in the Bill of Quantities, is relatively high. To facilitate checking by the Employer of the realism of rates quoted by the bidders, the Daywork Schedule should normally comprise:
 - (a) a list of the various classes of labour, materials, and Contractor's Equipment for which basic Daywork rates or prices are to be inserted by the bidder, together with a statement of the conditions under which the Contractor will be paid for work executed on a Daywork basis; and
 - (b) a percentage to be entered by the bidder against each basic Daywork Subtotal amount for labour, materials, and Plant representing the Contractor's profit, overheads, supervision, and other charges.
 9. Provisional Sums included and so designated in the Bill of Quantities shall be expended in whole or in part at the direction and discretion of the Engineer and previously approved by the Employer in accordance with the Conditions of Contract.
 10. The method of measurement of completed work for payment shall be in accordance with Technical Specifications. All items of work indicated in the Bill of Quantities shall be valued

by measuring net, in the units of the Bill of Quantities such actual quantities of the Permanent Works as have been executed strictly in accordance with the Bidding Documents or further instructions issued in writing by the Engineer. No works shall be valued which have been executed in excess of the dimensions shown on the Drawings or ordered by the Engineer. In particular, no allowances shall be made in the measurement or any excavation for working space, temporary works or the, temporary works or the operation of construction plant and such allowance shall be deemed to be included in the Bid Price.

11. In general, excavation shall be measured net. The Contractor is to allow for bulking, intermediate storage, double handling and backfill with compaction to lines and levels given on the drawings, and disposal of excess material. The rates for timbering or other measures to maintain the stability of the excavations and for keeping excavations free of water.
12. Proper drainage on the site must be maintained during construction and the Contractor shall be held responsible for any flood damage to life and properties due to his work in this Contract. The Contractor shall allow in his rate, inter alia, for all costs to maintain or divert flow in ditches, open channels and water sources during construction and other drainage work. No claims for additional payment will be considered in this regards.
13. The contractor shall be deemed to have allowed in his rates, inter alia for the following:
 - Maintaining the road signs in areas of works for times other than designated working periods,
 - Construction and maintenance of any diversion or access roads and all costs incurred in the passing or traffic through the site.
 - All charges and/or transport costs relating to extraction, preparation and haulage of Materials,
 - The eventual removal of the Contractor's site and reinstatement of such areas on completion of the contract,
 - Protection of the work from water from any source,
 - Provision and preservation of survey beacons,
 - Provision of all samples and test certificates,
 - Provision of all water supply, sanitation and services including electricity,
 - Providing and mixing water to earthworks and pavement operations in dry weather to achieve the optimum moisture content,
 - Scarification of surfaces and drying the earthworks and pavements to reduce the moisture content to the optimum and compaction or re-compaction subsequently, and repeating any such operation whenever necessary. All earthworks, for culverts, bridges and other structures, whereas not explicitly itemized, are deemed to be included in the costs for the structures as entered by the contractor in the Bill of Quantities,
 - Costs of acquiring and transport of materials from borrow pits or other sources as well as costs of transport and depositing material in deposit areas,
 - Costs of material sampling and testing and re-testing where required, and test certificates
 - Marking, signaling as appropriate of all equipment and facilities on site to provide safety in accordance with rules and regulations,
 - Scaffolding and shuttering to substructure and superstructures,
 - Protective coating, waterproofing and insulation of structures and culverts, as shown on the drawings, if not explicitly itemized,

- Elaboration and provision of detailed execution drawings for structure works, subject to approval of the Engineer,
 - The costs of acquiring and transport of materials from borrow pits or other sources as well as costs of transport and depositing material in deposit areas.
14. The Contractor shall be responsible for acquiring required qualities of bituminous Binder for asphalt concrete and bituminous Emulsion for prime and tack coat for the project from within Serbia or if necessary from other countries and shall meet the required specifications as outlined in the Contract Documents. Contractor's unit prices for bituminous works shall include all costs for acquiring bitumen and paraffin from abroad if necessary.
15. Any arithmetic errors in computation or summation will be corrected by the Employer as follows:
- (a) where there is a discrepancy between amounts in figures and in words, the amount in words will govern; and
 - (b) where there is a discrepancy between the unit rate and the total amount derived from the multiplication of the unit price and the quantity, the unit rate as quoted will govern, unless in the opinion of the Employer, there is an obviously gross misplacement of the decimal point in the unit price, in which event the total amount as quoted will govern and the unit rate will be corrected.
16. Rock is defined as all materials that, in the opinion of the Engineer, require blasting, or the use of metal wedges and sledgehammers, or the use of compressed air drilling for their removal, and that cannot be extracted by ripping with a tractor of at least 150 brake hp with a single, rear-mounted, heavy-duty ripper.
17. Mark CXX in the BoQ refers to the quality of concrete and corresponding label MB XX which is, in accordance with the standards of the Republic of Serbia, used in Detailed Design.
18. Contractor is responsible for providing all resources required for the works in accordance with his organization and the technology of works, including site plants, site offices and all access roads he needs. In the event that the same type of works is performed by different Contractors (transport and disposal of materials, etc), the Contractor will cover his costs (for construction and maintenance of a dumping area and access roads to it in proportion of material dumped, etc).
19. If any item in the BoQ refers to particular brand name, patent, type or manufacturer it shall be deemed that those brand name, patent, type or manufacturer are followed with wording "or equivalent" even if it is not written.

Facilities for the Engineer



FACILITIES FOR THE ENGINEER AND EMPLOYER'S REPRESENTATIVE

Remark:

The following Facilities for the Engineer and Employer's Representative should be treated as a Special Specifications and should be read in conjunction with General Specifications and shall extend and modify them as appropriate.

The Contractor shall provide site offices at the construction site for the use of the Engineer, Employer's representative and EMP supervisor, ready in all aspects for use and occupation as and when needed (before commencement of the permanent works).

The Contractor will be responsible for all utility costs for all facilities until completion of the Contract.

All facilities, vehicles and equipment are subject of the Employer's prior approval.

Upon completion of the Contract, all facilities, vehicles and equipment shall be retained by the Employer, free of charge.

The Contractor of LOT 2 shall provide the site offices.

Site offices

Contractor shall provide site offices on one location beside the alignment, provided by the Employer, as approved by the Engineer. Site office shall consist of 4 office rooms (1 office rooms No.1, 2 office rooms No.2 and 1 office room No.3) store room and 2 toilets, each. Each room shall be of minimum 15 m² and furnished as described below.

General requirements for offices

All offices shall have electric installation, heating and air conditioning, adequate natural lighting and ventilation, mosquito nets, fire prevention equipment, potable water and telephone lines.

Site offices shall be within fenced compound with outside lighting. The site offices shall include store room. The supervisory staff shall have access to toilet facilities, etc, of the Contractor and such facilities must be maintained in a suitable condition for senior staff use. 3 (three) car parking spaces shall be designated, per each site office as being for the use of the Engineer and the Employer's representative and the Contractor will make provision for washing down the vehicles of the Engineer and the Employer's representative.

If any item in the following text refers to particular brand name, patent, type or manufacturer it shall be deemed that those brand name, patent, type or manufacturer are followed with wording "or equivalent" even if it is not written.

Offices shall be furnished with a minimum of:

(a) Office room No. 1

- one work station, comprising of a 1,6 m x 0,80 m x 0,75 m executive desk with a 1,2 m x 0,6 m x 0,68 m computer table, a three-drawer lockable cabinet 0,45 m x 0,47 m x 0,57 m and an upholstered executive office chair with arm rests;
- one four-drawer lockable steel filing cabinet fitted for hanging files;
- one lockable double door cupboard 0,90 m x 0,45 m x 1,40 m with shelves (matching the desks);
- one lockable double door office closet 2,0 m x 0,80 m x 0,50 m with shelves on 40 cm distance;

- table 1,6 m x 0,80 m x 0,75 and four standard matching chairs for visitors;
- one computer with minimum characteristics: Graphics station (CAD) - HP Z210 (KK783EA) configuration: CPU Intel Xeon E31230 (3.2 GHz, 8MB L2), HDD 1TB SATA3 6Gbit/sec, RAM 8GB DDR3, DVDRW Super Multi, HP NVIDIA Quadro 600 1GB, Win7 Pro 64-bit, HP keyboard USB, HP optical mouse USB, Monitor HP ZR22w LCD, warranty 3 years (3-3-3);
- one UPS APC BE 700GI Back-UPS RS 700VA 230V;
- one telephone set with contact saving, re-dial and call-back functions;
- stationary (office supplies, one wall clock, one heavy duty document hole punch SAX 608 or equivalent, one stapler SAX 620 or equivalent, name plate on door, one paper tray-three tier, one waste basket, one pin board 2,4m x 1,2m, one set of coat hooks);
- one 50 m linen measuring tape and one 5 m steel pocket measuring tape.

(b) Office room No. 2

- three work stations, each comprising of a 1,6m x 0,80m x 0,75m executive desk with a 1,2m x 0,6m x 0,68m computer table, a three-drawer lockable cabinet 0,45m x 0,47m x 0,57m and an upholstered office chair with arm rests;
- three four-drawer lockable steel filing cabinet fitted for hanging files;
- two lockable double door office closets 2,0 m x 0,80 m x 0,50 m with shelves on 40 cm distance;
- one double door, lockable steel wardrobe cabinet 0,90 m x 0,45 m x 2,00 m;
- table 1,6 m x 0,80 m x 0,75 and four standard matching chairs for visitors;
- three computers with minimum characteristics: Office computer - HP 6200P (XY102EA) SFF configuration: CPU Intel i3 2100, HDD 500 GB SATA3 3Gbit/sec, RAM 2GB DDR3, DVDRW Super Multi, Win7 Pro 32-bit, HP keyboard PS2, HP optical mouse PS2, Monitor HP S2231a 21.5" WIDE, warranty 3 years (3-3-3);
- three UPS APC BE 700GI Back-UPS RS 700VA 230V;
- three computers with minimum characteristics: Laptop - HP ProBook 4530S (XY022EA) - configuration: - CPU i5-2410M, - HDD 640GB SATA 2, - RAM 4GB DDR3, DWDRW LS, Win 7 Pro 64-bit, display 15.6" HD LED, WebCam, warranty 1 year;
- one telephone set with contact saving, re-dial and call-back functions;
- stationary (office supplies, one wall clock, one heavy duty document hole punch SAX 608 or equivalent, one stapler SAX 620 or equivalent, name plate on door, three paper trays-three tier, three waste baskets, one pin board 2,4 m x 1,2 m, one set of coat hooks);
- three 50 m linen measuring tape and three 5 m steel pocket measuring tape.

(c) Office room No. 3

- two work stations, each comprising of a 1,6 m x 0,80 m x 0,75 m executive desk with a 1,2 m x 0,6 m x 0,68 m computer table, a three-drawer lockable cabinet 0,45 m x 0,47 m x 0,57 m and an upholstered office chair with arm rests;
- two four-drawer lockable steel filing cabinet fitted for hanging files;
- one double door, lockable steel cabinet with shelves 0,90 m x 0,45 m x 2,00 m;
- two lockable double door office closets 2,0 m x 0,80 m x 0,50 m with shelves on 40 cm distance;
- two standard, matching chairs for visitors;
- one computer with minimum characteristics: Office computer - HP 6200P (XY102EA) SFF configuration: CPU Intel i3 2100, HDD 500 GB SATA3 3Gbit/sec, RAM 2GB



- DDR3, DVDRW Super Multi, Win7 Pro 32-bit, HP keyboard PS2, HP optical mouse PS2, Monitor HP S2231a 21.5" WIDE, warranty 3 years (3-3-3);
- one UPS APC BE 700GI Back-UPS RS 700VA 230V;
- one laser printer HP LaserJet P2055dn or equivalent with USB cable;
- one multifunctional device HP LaserJet M1536dnf or equivalent;
- one photocopier Canon IR2520 Duplex + ADF + Finisher + cassette Feeding Module + Ethernet or equivalent;
- stationary (office supplies, one document shredder bis Rabbit or equivalent, one document binding machine Letz CB600 DL or equivalent, one heavy duty document hole punch SAX 608 or equivalent, one stapler SAX 620 or equivalent, name plate on door, two paper trays-three tier, one waste basket, one pin board 2,4 m x 1,2 m, one set of coat hooks);
- thermometer;
- two first aid sets;
- secretary office shall be arranged to provide the reception and control of visitors into the foyer and their admittance into the offices.

All computers must be installed with the following licensed software: OS Win7 pro, MS Office XP Professional 2007 and AutoCAD dwg True View. Six computers must additionally have licensed Adobe Acrobat, Adobe Photoshop, AutoCAD and Microsoft Project (latest versions). The computers must be networked with connection to a broadband.

The general requirements include, as follows:

- preparing a plan of the layout of the offices, work stations and furnishing to the satisfaction of the Engineer;
- supply and fitting of split air conditioners for all rooms (1.5T), with heating as well as cooling capability;
- supply and fitting of triple electric sockets, convenient to work stations;
- supply of two telephone lines and connections to the site offices (either as ground lines or GSM lines with GPRS, and Internet Domain with e-mails for all users at the local provider);
- fire extinguishers, smoke alarms and fire exit signs according to the Fire Authority regulations or, otherwise, as directed by the Engineer;
- doormats in the entrances, a boot scraper and 6 lever security locks on the entrance doors.

The Contractor will be responsible for maintaining, cleaning and security all of the offices of the Engineer, Employer's representative and EMP supervisor. This includes cleaning of rooms, and inter alia provision of all necessary cleaning equipment, rubbish bins and materials as well as provision of liquid soap for hand washing, dish washing, etc, lavatory cleaner and brushes, toilet paper, daily provision of clean hand towels, fly spray, extermination of any rodents and any other such incidentals as the Engineer, Employer's representative and EMP supervisor may reasonably require for maintaining decent conditions for the operations of the offices. Eventual repair works for the facilities are also included.

The Contractor shall also provide to the Engineer, Employer's representative and EMP supervisor 20 mobile phones in order to have permanent contact with the staff present on the site. The billing shall be for Serbia only.

The mobile phone, telephone, e-mail and facsimile calls made by the Engineer, Employer's representative and EMP supervisor and their staff are included in the Contractor's Lump Sum (to be included in BoQ, General Items, Provisions and consumables for the Engineer, Employer's representative and EMP supervisor) as well as reasonable office consumables.

Maintenance for the running of the below to be included in BoQ, General Items, Maintain facilities in compound for the Engineer and Employer's representative during works and up to the issue of the Taking over Certificate.

Vehicles for the Engineer

The Contractor will provide the Employer's representative, Engineer and EMP Supervisor with:

- 3 new off-road cars (4WD) acceptable to the Engineer, 5-door, with 5 seats, digital air-conditioning, 4 air-bags, ABS, ESP, central locking, radio CD with speakers, with diesel engine capacity minimum 1900 cm³ (Skoda Yeti or similar),
- 2 new pick-ups acceptable to the Engineer, having the following characteristics: diesel engine with approximate 2.500 cm³, 5 seats, double cab, 4WD, ABS, ESP, air-conditioning, 4 air-bags radio CD with speakers (Toyota Hilux or similar),
- 1 new car acceptable to the Engineer, having the following characteristics: C class, diesel engine with at least 1.900 cm³, 5-door, 5 seats, ABS, ESP, digital air-conditioning, tempomat, 4 air-bags radio, CD with speakers (Skoda Superb or similar).

The cars shall be delivered (with registration plates, vehicle licence, and be fully and comprehensively (full kasko) insured) prior to the commencement of Works on site or later if instructed by the Employer. The Contractor will be responsible for provision of fuel, lubricants, servicing, repair, maintenance, cleaning fluid, summer and winter tires, triangle, first aid package, pulling cable, fire fighting apparatus, and others. The Contractor will also make provision for washing down the vehicles. In the case of accidental damage, the Contractor shall be responsible for reinstatement of the damaged vehicle to its original condition. The Contractor shall supply temporary replacement vehicles during periods when the cars are immobilised.

When no longer required by the Engineer for the Services, but no later than the end of the Defect Notification Period, the ownership of the above vehicles shall be transferred to the Employer who will then become responsible for fuel servicing, repair, maintenance, insurance and miscellaneous costs.

Precise Survey Equipment

Two complete sets of equipment are to be provided, according to the following list. One set shall be provided for the initial survey works and the second set shall be provided in accordance with instructions issued by the Engineer:

- (a) 1 x Leica TC2002 precision Total Station or similar type including Tribrach and Internal Battery and Battery Charger
- (b) 1 x additional Internal Battery
- (c) 4 x Tripods
- (d) 2 x additional Tribrachs
- (e) 3 x Target Carriers
- (f) 3 x Precision Reflectors
- (g) 1 x Container for precision reflectors, tribrachs and carriers
- (h) 1 x NA3000 Precise Digital Level or similar type
- (i) 1 x Invar Stave
- (j) 1 x Ground Plate
- (k) 2 x 3m Levelling Staff
- (l) 3 x Moveable Bench Marks (levelling staff bases)

- (m) 2 x Levelling Staff Stands
- (n) 2 x each of Measuring Tapes made of Fibron 50m and 25m
- (o) 1 x Notebook Satellite Pro S300M or similar type

Protective Equipment for the Employer's representative, Engineer and EMP Supervisor

General

The Contractor shall initially provide the Employer's representative, Engineer and EMP Supervisor with protective clothing and equipment, as follows, and, as the Engineer considers necessary, provide replacement items under the provisions for maintenance of the Engineer's facilities. Prior to making this provision, the Contractor shall obtain a list of appropriate sizes from the Employer's representative, Engineer and EMP Supervisor. As and where the Contractor's methodology, activities or planned testing programme may require additional protective equipment (such as gloves, ear plugs, goggles, torches etc), the Contractor shall make these available to the Employer's representative, Engineer and EMP Supervisor as and when the need arises.

List of Protective Equipment

- a) 10 Weatherproof jacket and trouser sets with reflective panels or strips
- b) 10 Safety helmets, white
- c) 10 Pairs of protective leather boots
- d) 10 Pairs of rubber or PVC boots with steel toe caps, slip resistant soles and steel mid soles (Wellington or equivalent)
- e) 20 Pairs of heavy socks for boots
- f) 10 Lightweight fluorescent waistcoats with reflective strips / panels
- g) 10 Winter weight fluorescent anoraks with removable thermal lining and reflective strips / panels
- h) 5 First Aid pack :

Item :	No. in First Aid Pack
Bandages : 3cm width	3
Bandages : 5cm width	3
Elastoplast (assorted)	2 boxes
Adhesive plaster (rolls) 3 cm width	5m
Absorbent cotton wool (packs)	2
Sterilised eye pads in separate packets	3
Safety pins	12
Rubber bandage or pressure bandage	2m
Eye wash (bottles)	2
Iodine	1
Disinfectant (Dettol)	50ml
Antiseptic cream	1
Aspirin (pack of 50)	1

The First Aid pack will be replenished, as necessary, together with the office supplies.

Labor and equipment on site

The Contractor will provide the Engineer and the EMP Supervisor on a day to day basis with all necessary labor to assist in the survey of works, sampling and testing of materials and of the works and the measurement of the works.

From the commencement date until the taking over of works, the Contractor shall be obliged to provide to the Engineer, in any moment, at his request, all necessary equipment and conditions for inspecting the quality of materials and performed works. After taking over of works, the Contractor will retain all the equipment.

Laboratory

Regular daily asphalt, geomechanical and concrete testing will be performed in the Employer's laboratory in the vicinity of Predejane or Dzep (provided by the Employer through contract with the Contractor of LOT 1).



Environmental Management Plan



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ABBREVIATIONS AND ACRONYMS

EIB	European Investment Bank
EIA	Environmental Impact Assessment
EIS	Environmental Impact Study / Environmental Impact Statement
EMP	Environmental Management Plan
HSE	Health, Safety and Environment
INP	Institute for Nature Protection of the Republic of Serbia
IPCM	Institute for Protection of Cultural Monuments of the Republic of Serbia
KS	Koridori Srbije Društvo sa Ogranicenom Odgovornoscu (“Corridors of Serbia”)
MOESP	Ministry of Environment and Spatial Planning
NCA	Natural Cultural Assets
PAP	Project Affected Person
PEPS	Public Enterprise “Putevi Srbije” (Roads of Serbia)
PMC	Project Management Consultant
SSIP	Site Specific Implementation Plan
WB	The World Bank Group
WMP	Waste Management Plan



INTRODUCTION

Corridor X is one of the ten pan-European corridors and Serbia's main transport route. It provides vital links to Bulgaria in the east, FYR Macedonia and Greece in the south and to Croatia, Hungary and Western Europe in the north. The construction of the E-75 motorway, running from Nis to the Border of FYR Macedonia, will allow Serbia to capitalize further on its location as a transit country for international transport.

The second section of the E-75 motorway, from Nis to Grabovnica, has already been built. The missing Corridor Xd highway section from Grabovnica to Levosoje is approximately 74 km long. The ending point in Levosoje corresponds to the starting point of the 22 km long, already constructed highway section, finished with domestic budget support. The EIB funds together with loans from the World Bank and the HIPERB will be used to finance the construction of the remaining sections of the new four lane motorway.

The EIB has been approached by the "Corridors of Serbia" (former Corridor 10 Company) for a long term senior loan to co-finance the construction of E-75 and E-80 motorway, which forms part of the larger Trans-European Corridor X project in Serbia. Other co-financing sources include the World Bank (WB) and the European Bank for Reconstruction and Development (EBRD). Specifically, the E-75 is a new 4-lane motorway, that will link Nis, located in south east Serbia, to the border with FYR Macedonia.

Republic of Serbia intends using the proceeds of a loan from the EIB (the Bank) for a project "Corridor X Motorway Project". The proposed Project's Objective is to facilitate sustainable economic development and ensure that the country capitalizes on its geographical position to continue its development as a key transit country on the Trans-European Network as well as to increase transport efficiency and improve traffic safety on sections of Corridor X, and to improve road management and road safety in Serbia.

The Project will be carried out by the Project Implementing Entity: "Corridors of Serbia" Limited Liability Company (KS).

Civil works on construction of motorway from Nis to border of FYRM on Corridor X, E-75, with the EIB financing covering:

- o Section 2 from Grdelica (Gornje Polje) to Caricina Dolina (cca 11.8km) and
- o Section 3 from Caricina Dolina to Vladicin Han (cca 14.1km)

Contracts to be financed with the proceeds of a loan from the Bank are subject to the Bank's Procurement Policies and Rules and will be open to firms from any country.

This Environmental Management Plan (EMP) is related to 11.8 km long E-75 Motorway section from Grdelica (Gornje Polje) to Caricina Dolina.

1. PROJECT DESCRIPTION

The subject of this Environmental Management Plan (EMP) is 11.8 km long E-75 motorway section from Grdelica (Gornje Polje) to Caricina Dolina. This motorway section consists of two sub-sections:

LOT 1 - Road and bridges from Grdelica to tunnel Predejane, approximately 6.1 km

LOT 2 - Road and bridges from tunnel Predejane to Caricina Dolina, approximately 4.7 km

LOT 3 - Tunnel "Predejane"

Commencement of the motorway section is on km 873+720, close to settlement named Gornje Polje. End of the Section is located on km 885+523, close to settlement Susevlje in Caricina Valley. This component involves the construction of cca 11.8 km of new motorway, bridges and one long tunnel ("Predejane") which is divided into two separated tunnel tubes (1110 m long right tube and 865 m long left tube).

Motorway will be tolled and be part of the closed system encompassing the whole Serbian motorway network.



Picture 1: Corridor Xd Highway Project with marked Grdelica – Caricina Dolina highway section

According to the Bank Environmental Policy, this project is classified as Category "A" because the project could result in potentially significant adverse future environmental impacts.



Picture 2: Grdelica (Gornje Polje) – Caricina Dolina highway section

Just after the new constructed bridge over Southern Morava river (chainage km 874+286), motorway alignment enter the Grdelica gorge and take completely new alignment, leaving existing M-1 arterial road to serve as an alternative road for local transport. On one part of the alignment (km 883+800.00 to km 884+400.00), existing road will be moved on separate alignment, close to the railway and S. Morava river.

Based on above facts, during motorway construction, all local transport will be enabled by using existing M-1 road. After completing works, M-1 road will stay as non-commercial, alternative road for local transport.

The studied area is located in the basin of the Southern Morava and its tributaries, which more or less flow directly into it (Palojska River, Licindolska River and Predejanska River). The remaining smaller flows and streams are oriented towards these waterways and all together belong to the Black Sea Basin. In the observed area there are no registered water supply wells.

Two forms of relief are characteristic, conditioning use of appropriate elements of horizontal and vertical projection. The highway route on this section passes through two types of different topographic characteristics. Flat – highway route is located on the Southern Morava river draft; Hilly – mountainous – with the route located in a cut or deep cut with steep slopes on the left bank of the Southern Morava.

With the beginning of the section, the route enters into Grdelica Gorge and follows the railroad Nis – Skopje, main road M-1 and regional road R-214 in a parallel manner. Grdelica gorge is one of the biggest gorges in Serbia (30 km long and 550 m wide). Due to topographic and infrastructure constraints the route follows the valley and crosses the river Southern Morava for seven times, by means of structures of different lengths. In the zone of Predejane, the highway route is located in a tunnel due to the hilly terrain in the area.

The expanded area of the analyzed corridor encompasses rural settlements. The cadaster parcels which are covered by the belt of expropriation for the construction of the highway are: CM Bojimska, CM Graovo, CM Bocevic, CM Paloje, CM Licin Do, CM Koracevac, CM Predejane Varos, CM Bricevlje and CM Susevlje.

EIA procedure prescribed by the Serbian Law on EIA ("Official Gazette of RS" No. 135/2004, 36/2009) is completed. Public Consultation and Public Disclosure for the Draft Environmental Impact Study (EIS) is finished (see chapter 7 – Public Consultations). The Technical Commission evaluated the EIS, together with the systematized report on the consultations of the authorities, organisations and the public concerned and the report on the completed impact assessment procedure, and evaluated the suitability of the measures envisaged to prevent, reduce or eliminate the likely harmful effects of the project on the environment.

Final Environmental Approval for E-75 Highway section from Gornje Polje to Caricina Dolina is obtained from the Ministry of Environment and Spatial Planning.

Final environmental approval of the EIS set out specifically the conditions and measures, which should be undertaken to prevent, reduce or eliminate the adverse effects on the environment. All conditions and measures are presented in this EMP.

Additionally, for all five E-75 Highway sub-sections between Grabovnica and Levosoje existing section specific EIS were integrated into the Corridor level EIA Report for section E-75 covering the proposed highway alignment. The Corridor level EIA Report for section E-75 can be found at the following web sites:

- The EIB web site:

<http://www.eib.org/projects/pipeline/2008/20080546.htm>

- KS web site:

http://www.koridor10.rs/doc/33/WB_E-80_REVISSED_CLEIA_20101110_ENG.pdf

Impacts for each component of the biophysical and social environment were identified and assessed. For each impact that cannot be avoided, mitigation measures have been developed and a detailed action plan, including responsibilities for implementation and monitoring indicators, is presented as part of the publicly available Corridor Level EIA.

Finally, as a part of Project documentation, PEPS has prepared a detailed design of environmental protection for Grdelica (Gornje Polje) – Caricina Dolina, as a regulatory instrument in Serbian law. This document is one of the basic documents which are used in process of preparation of this EMP and can be obtained in the PEPS main office, Belgrade, Bulevar kralja Aleksandra 282.

The Corridor Level EIA and detailed design of environmental protection for Grdelica (Gornje Polje) – Caricina Dolina Project provides a platform, on which Site-Specific Environmental Management Plan (EMP) and Checklist, for this sub-section, are prepared. Detailed design of environmental protection contains concrete mitigations and monitoring measures which are relevant to this Project. This EMP reflects the additional baseline refinement data work required prior to works commencing, such as data contained in site-specific implementation plan, prepared by the contractors and approved prior to commencing works. This EMP and Checklist should be a part of the bidding documents, to ensure the contractors are aware and meet their formal obligations in this respect. The bidders are obliged to prepare their own site specific implementation plan (SSIP), to be approved by KS, containing the detailed information on meeting the requirements detailed in this EMP. The SSIP will be highly site-specific and be compiled as part of the construction planning for aspects such as fuel stores, plant selection and performance and material sourcing and sub-contracting.

EMP and Check List are produced to point at the essential environmental requirements during the construction of cca 11.8 km of motorway on a section of the corridor between Gornje Polje and Caricina Dolina and guide the potential bidders in preparation of SSIP in order to eliminate, offset, or reduce potentially adverse environmental impacts to acceptable levels. Description of mitigation measures and Description of monitoring program are key parts of this document.

For the purpose of drafting the preliminary design of the E-75 Highway, Nis–FYR Macedonian border, section Gornje Polje - Caricina Dolina, preliminary works were carried out in the established corridor of the highway.

The elements of the highway cross-section have been dimensioned for a calculated speed of 100 km/h (total width of the plane 26.1 m) and an AADT for 2021 amounting to 10,715 vehicles every 24 hours on average.

In accordance with the TOR, a concept of water drainage has been adopted. The principle of an open system for water drainage is characterized by the free (uncontrolled) flow of water from the highway down the slope of the embankment. The main hydrographic characteristic of the region in which the analyzed section of the highway is located is the Southern Morava River. From the very beginning of the section of the E-75 Highway, the Southern Morava follows along within the direct vicinity of the alignment. All tributaries more or less flow directly into the Southern Morava and for the most part are of a stream-like character with spacious proluvial fans at the confluence into the main recipient.

In the observed area there are no registered water supply wells.

On the alignment of the analyzed section of the highway there are several engineered structures which may be significant in the sense of defining certain effects from the domain of the environment. On the analyzed section, there are 13 bridges, 2 galleries, 9 culverts, 1 overpass.

Tunel "Predejane" is designed with separated tunnel tubes. Length of the left tube is 943.92m (km 879+895 to km 880+835). Length of the right tube is 1112.41m (km 879+789.31 to km 880+903.84).

„Predejane“ Interchange on km 883+250 is part of this motorway section too.

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1. Relevant Institutions

During the construction and operation of motorways in the Republic of Serbia, the issue of environmental protection is managed by mutual cooperation of the several statutory government institutions. The Ministry for Environment and Spatial Planning is the key institution in Serbia responsible for formulation and implementation of environmental policy matters. The Ministry is responsible for the protection against noise and vibration, hazardous and toxic material, air pollution, ionic and non-ionic radiation, nature protection and international co-operation. The other aspects of natural resources management related to issues of construction and operation of motorways in the Republic of Serbia, are dealt with several other institutions, among which are the Ministry of Economy and Regional Development; the Ministry of Infrastructure; the Ministry of Agriculture, Forestry and Water management; the Ministry of Culture; the Public

Enterprise 'Putevi Srbije' (PEPS); the Institute for Nature Protection of Serbia (INP); the Institute for Protection of Cultural Monuments of the Republic of Serbia (IPCM), and KS.

2.2. Existing Serbian legislation

Environmental protection in Serbia is regulated by many republic and municipal laws and by-laws. The environmental legislation in force in Serbia is summarized in Appendix III.

2.3. Main steps of national procedure on EIA in the Republic of Serbia

In the juridical system of the Republic of Serbia, the Environmental Impact Assessment procedure is regulated by the Law on Environmental Impact Assessment, along with appropriate sublegal enactments which determine particular issues within the Impact Assessment procedure in more detail. One of the significant elements in the procedure itself is public involvement (see chapter 7.) and the duty of forming the Technical Committee. Environmental Impact Assessments are required for the projects which are being planned and conducted, technology improvements, reconstructions, capacity expansion, work termination and removal of projects which significantly influence the environment.

The procedure of Environmental Impact Assessment consists of three phases (depending on the List containing a certain project, there can be one, two or more phases):

- Phase I: Decision-making on the necessity of Environmental Impact Assessment of the project
- Phase II: Specification of scope and contents of the EIS – Screening Phase
- Phase III: EIS

Entities which have participated in this Environmental Impact Assessment procedure are the following: Project contractor (PEPS), relevant authority (Ministry for Environment and Spatial Planning), and elaborators of the study, interested authorities, organizations and general public.

According to the Law on EIA ("Official Gazette of RS", 135/04, 36/09), KS may not commence the project implementation without having previously completed the impact assessment procedure and obtained the approval of the EIS from the competent authority (MOESP).

2.4. Relevant EIB and European environmental policy

E-75 Motorway section from Gornje Polje to Caricina Dolina is financed from the EIB Loan.

The EIB's policy towards the formal process commonly known as "Environmental Impact Assessment" (EIA) is summarized in its Environmental Statement (2004). The EIA Directive outlines which project categories shall require an EIA, which procedure shall be followed and the content of the assessment. Article 5(1) of the Directive requires the project promoter to provide information to the competent authority relating to the environmental impact of the project. Also, this EMP document is composed by respecting the EIB Statement of Environmental and Social Principles and Standards (2008). The requirements of the Statement are translated into the operations of the Bank through sector lending policies, such as those for energy, transport, water, waste, and research, development and innovation.

The EIB requires that all projects, irrespective of location, comply with the requirements (principles and practices) of the European Union's EIA Directive in terms of the requirements for and scope and form of a formal EIA.

Also, according to the SOURCEBOOK ON EU ENVIRONMENTAL LAW (prepared by Institute for European Environmental Policy for the EPE Banks), the construction of motorways and (express) roads is subject to the EIA requirements of Directive on the assessment of the effects of certain public and private projects on the environment Directive (85/337/EC as amended by 97/11/EC and 2003/35/EC3), is one of the items of EU environmental legislation with the most wide-ranging implications for project developers. It requires a systematic assessment of the likely environmental impacts of projects in a wide range of sectors.

The construction of motorways and express roads is listed under Annex I of the EIA Directive and consequently an EIA must always be undertaken as part of the consent procedure for the planned development. This holds too for the construction of a new road of four or more lanes, or realignment and/or widening of an existing road of two lanes or less so as to provide four or more lanes, where such new road, or realigned and/or widened section of road, would be 10 km or more in a continuous length.

The EIA process mandated by the Directive seeks to help ensure that project development and planning decisions take environmental impacts into account by incorporating adequate measures to avoid or reduce and if possible offset potential impacts from the planning stage; selecting lower impact projects and rejecting projects whose likely impacts are considered unacceptable by the competent national authorities.

Public Disclosure

Public participation within the EIA procedure launched for this motorway project is also ensured by respecting EIB Public Disclosure Policy (Principles, Rules, and Procedures, 17 July 2007).

Obligations with respect to nature conservation

The construction of roads may lead to habitat fragmentation and therefore any such infrastructure projects need to be planned with due regard to the relevant provisions of Directives 79/409/EEC and 92/43/EEC.

Other relevant books

EIB ENVIRONMENTAL AND SOCIAL PRACTICES HANDBOOK, Environment and Social Office Projects Directorate Version 2 of 24/02/2010

3. BASELINE CONDITIONS ASSESSED DURING ALIGNMENT SURVEY

3.1. Geology and soil

For the studied area of the section Gornje Polje - Caricina Dolina, E – 75 Highway Belgrade - Nis–FYR Macedonian border there are no available data on the presence of polluting material in the soil. Empirically, it can be expected that the intensification of traffic and agricultural activities may lead to excessive pollution of the environment, including the soil.

Recent Exodynamic Processes and Phenomena

Surface erosion and line erosion processes are especially obvious in the Grdelica gorge.

Ravines are the most common in the area of the Grdelica gorge, where 200 of them have been registered. They are partly repaired by dykes after catastrophic torrents.

Landslides have been registered in the valley of the South Morava river in the valleys of rivers, brooks and ravines which flow into it and along their very banks, whereas sliding terrain away from the waterways do not occur so frequently. The most common are the old, currently calmed Landslides, and special attention has to be given to sliding area Susevlje.

3.2. Surface and ground water

In order to define the existing condition of the quality of surface waters, more specifically the rivers in the corridor of the future highway (Southern Morava River, Palojska River, Licindolska River and Predejanska River), data was used from the Republic Hydro-meteorological Bureau (hydrological yearbook - 2005) and that only for the Southern Morava River, with consideration for the fact that measurements are not taken for the remaining waterways in the studied area.

In the observed area there are no registered water supply wells.

Main water bodies on proposed motorway section are:

1. Creek Vasiljkovac km 874+120
2. Cerje km 875+750
3. Terzinci km 876+760
4. Palojska river km 877+380
5. Licindolska river km 878+300
6. Crnogorski creek km 878+600
7. Predejanska river km 882+630
8. Creek Bratez km 882+630
9. Creek Planiste km 884+500
10. Creek Caricina dolina km 885+590

A review of the existing condition of water of the Southern Morava River indicates a low level of quality. By analyzing the data on measurements of the concentration of the physical-chemical parameters in the waters of the aforementioned river collected at the measurement stations, it can be concluded that there is a deviation from Maximum Permitted Concentrations (MDK) for second class waterways, which the Southern Morava belongs to according to the Regulation on Categorization of Waterways (Official Gazette RS, No. 5/68).

The value of dissolved O₂ as well as the percentage of oxygen saturated water occasionally corresponded to class III, class IV and VK condition of water quality. Furthermore, the measured values of suspended materials at all locations corresponded to class III. By reviewing the results of the conducted analysis, one can notice that in one case there was the occurrence of excess values of ammonium nitrate (class III/IV).

Of dangerous and harmful materials there were individual cases at individual locations of excess concentrations of manganese (Mn) and hexavalent chromium (Cr⁶⁺).

A study of the quality of surface waters in the sense of a more detailed definition of the existing condition in the corridor of the planned section of the highway was performed for the Southern Morava River. Data on the quality of water of the Southern Morava River is displayed in table T 3.2.

T 3.2. Results of the analysis of the quality of water for the Southern Morava River

No.	Dangerous material	MDK for class II	S. Morava
1	BPK5	4	19.01
2	HPK	12	25.44
3	Suspended material	30	24.80
4	Dissolvable material	1000	154.59
5	Ammonia	0.1	0.65
6	Nitrites	0.05	0.039
7	Nitrates	10	3.22
8	Phenol	0.001	0.009
9	Detergents	0.4	0.37
10	Mineral oil	0.05	0.00
11	Iron	0.3	0.07
12	Chromium (Cr ⁺⁶)	0.1	0.00

13	Zinc	0.2	0.00
14	Copper	0.1	0.07
15	Sulphides	0.00	0.01
16	Cadmium	0.005	0.00
17	Nickel	0.05	0.002
18	Chromium (Cr ⁺³)	0.1	0.00
19	Cyanide	0.1	0.01

3.3. Air

Within the corridor of the future highway section between Gornje Polje and Caricina Dolina there are no significant non-point or point sources of air pollution. The major road M-1, as well as the regional road R-214, is linear sources which could potentially cause an increased concentration of air pollutants. Due to no industrial structures being marked within the studied area which could cause increased levels of concentrations of pollutants in the atmosphere, it can be justifiably assumed that the quality of the air is at a satisfactory level.

Data on the measured values of air pollution in the observed corridor were not available. It is presumed that the planned section of the highway will become the dominant linear air polluter within the observed area.

3.4. Climate factors

The entire area along the planned alignment of the highway is characterized by a mild - continental climate. It is especially evident in the valley of the Southern Morava and along its banks, characterized by mild summers, cold winters with heavy precipitation and clearly defined transitional seasons of which autumn is exceptionally long. There is a relatively small volume of precipitation during the summer, but there are strong wind currents. The annual mean air temperature for the period of 1931 - 1970 at meteorological station Predejane is 10.8° C. The annual mean temperature amplitude is 20.8° C. Average precipitation is 693.3mm.

The Grdelica gorge has a climate which is somewhere between moderately continental and Mediterranean climate, with certain peculiarities conditioned by its geographic position, and especially its orographic (topographically induced rain) and hydrographic characteristics.

3.5. Ecosystems (Flora and Fauna)

Preconditions obtained from INP, related to whole E-80 Motorway from Nis to Bulgarian border, including motorway section Gornje Polje - Caricina Dolina, and are given in the document No 03-853/2 from 29.06.2006, and No 03-237/2 from 27.02.2008 (see Annex IV).

The key comments from INP noted: There is no statutory protected natural resources along the motorway route between Gornje Polje and Caricina Dolina.

However, one section of the E-75 highway passes through the Grdelica Gorge, which while not a formally protected area is a refugium for tertiary flora, rare endangered herbal species and mixed relic vegetation and thus its preserve which is found in Derven Gorge, is included in The Red Data Book of Flora of Serbia I. Since this plant grows on ploughlands near roads, assumptions are that this plant could be found in Grdelica Gorge itself (on the highway section Caricina Dolina - Vladicin Han). In case of continued negative impacts, these habitats would become ecologically unstable and vulnerable. The Grdelica Gorge contains some endangered and protected birds of prey, such as golden eagle *Aquila chrysaetos* and The Peregrine Falcon *Falco peregrinus*. These two species were identified by the Institute for Nature Protection as are highly sensitive, and it will be necessary to protect them from excessive anthropogenic impacts during construction and operation of the Highway. Further studies are required during detailed design to identify specific habitat areas and resources required by the birds which should not be disturbed.

Besides these, other characteristic species of haemophilic, rocky habitats in this area should be also mentioned. Other notable species include Eurasian Eagle Owl *Bubo Bubo*, Rock Partridge *Alectoris graeca*, The Rufous-tailed Rock Thrush *Monticola saxatilis*, The Black-eared Wheatear

Oenanthe hispanica, Red Rumped Swallow *Hirundo daurica*. Specific recommendations of the INP include the need for conservation of agro-ecosystems along the Southern Morava and remains of habitats that are used as foraging areas for birds, and the positioning of culverts and other underpasses to serve as animal crossings.

INP checked final EIS and confirmed that Study incorporated all nature protection requests prescribed within the preconditions No 03-853/2 from 29.06.2006, and No 03-237/2 from 27.02.2008 (see Annex IV for details).

Within the area of Gornje Polje - Caricina Dolina Highway section, the diversity of plants is above all conditioned by the presence of waterways. They further influence the regime of moisture in the ground and as such also the composition of phytocoenosis which find more or less suitable conditions for life. Various plant communities can be found in the waterways and that being in the form of free floating or submerged hygrophilous species. They are mutually characterized by various needs for sunlight and content of mineral and organic components which are dissolved in the water.

Full list of animal and plant species which habitats are located within the area of E-75 Highway section between Gornje Polje and Caricina Dolina is presented within the EIS for proposed Highway section.

None of aforementioned plant or animal species are rare, vulnerable, endangered or protected.

3.6. Inhabitants

The territory which belongs to the Gornje Polje– Caricina Dolina Highway section encompasses 4 settlements which belong to the municipality of Leskovac. A majority of those are rural settlements. Data which relates to the basic characteristics of the inhabitants and their activities is displayed in table T3.6.

T 3.6. Comparison of inhabitants' characteristics

Settlement	Year of census	No. of residents
Bojisna	1991.	265
	2002.	245
Bocevica	1991.	193
	2002.	151
Bricevlje	1991.	231
	2002.	241
Palojce	1991.	512
	2002.	502
Predejane (town)	1991.	1396
	2002.	1222
Graovo	1991.	356
	2002.	277
Koracevac	1991.	199
	2002.	192
Licin Dol	1991.	198
	2002.	139
Predejane (village)	1991.	456
	2002.	495
Susevlje	1991.	258
	2002.	228
Garinje	1991.	530
	2002.	554

3.7. Immovable cultural assets

Preconditions obtained from IPCM, related to E-75 Highway section from Gornje Polje to Caricina Dolina are given in the document No 10/2233 from 24th September 2008. This document is available in Appendix IV of this EMP Document, and recorded cultural assets in the zone of proposed highway section are listed within the Table T 3.7..

Table T 3.7. Recorded cultural assets

Place	Name of locality
Bocevci	Latin Graveyard
Bocevci	Seliste
Predejane	Old Graveyard
Predejane	Seliste
Predejane	Gradac
Susevlje	Latin Graveyard

No statutorily protected archaeological sites will be directly affected by the construction works.

At all locations is **not necessary** to carry out preliminary archeological excavation.

At all locations is **necessary** to carry out archaeological supervision during earthworks.

Before beginning any kind of earthworks on the aforementioned locations, it is necessary to inform the Institute for the Protection of Cultural Monuments of Serbia – Belgrade.

In case of chance finds, The Contractor is required to immediately, without delay, halt works and inform the authorized Institution for Protection of Cultural Monuments and to undertake measures to ensure the findings are not destroyed or damaged and to protect the area and position in which they are discovered.

Assets may be vulnerable to indirect impacts such as vibrations and air pollution. In some cases the precise locations and boundaries are not known (e.g. Bocevci and Predejane). Overall, the knowledge regarding these sites is very limited.

3.8. Landscape

The most remarkable morphological form in the relief of the analyzed area is the Grdelica gorge whose creation was related to the influence of many different factors through a long period of time.

During the lake phase in the basins, the Grdelica gorge did not have the form it has today. In that period, above the today gorge, there was a kind of strait connecting Vranjsko and Leskovacko lakes.

The relief forms which were created in the Grdelica gorge through the erosion of the above said strait, and through a subsequent outlet of the lake and finally the South Morava river exist in the form of terraces, capes and terraced flooded soil.

Above the Grdelica gorge (1100 - 1200 mas) a large valley of the «lake straits» is located. There are river terraces in the gorge which correspond to the lake terraces of the basin. Fans of flooded terraces are situated on the confluences of big tributaries, and the South Morava river has carved terraces tall more than 10 meters in them, and the tributaries themselves carved in terraces in their flooded grounds.

4. SUMMARY OF ENVIRONMENTAL IMPACTS

The environmental impact which will be caused by the construction, operation and maintenance of the section Gornje Polje - Caricina Dolina of the highway Beograd - Nis - FYR Macedonian border indicate qualitative and quantitative changes in the environment during the construction phase, and the subsequent opening to traffic, as well as the additional exceptional risks engendered by an accident.

4.1. Geology and soils

The construction of the E-75 highway could lead to soil degradation due to the opening of borrow pits or formation of dump sites along the alignment. On the Gornje Polje-Caricina Dolina section, the proposed alignment does not require high cuts and side cuts, and thus any deficit in the required materials for embankments may be met from existing borrow pits in the immediate vicinity of the highway alignment (at the distance of up to 30 km), rather than the opening of new ones.

4.1.1. Construction Phase

Pollution of the soil in this phase may be caused as a result of improper manipulation of petroleum and petroleum derivatives which are used for construction machinery and other devices during construction, cleaning of vehicles and machinery outside of the prescribed and arranged areas, inadequate arrangement of the construction site and other activities which are not carried out according to recommended technical mitigation measures during construction.

Pollution of soil during construction is an aspect which affects the soil, as a factor of the environment, which may be reduced to a minimum or be completely eliminated by adhering to the technical mitigation measures which are stated in a special chapter which describes the measure for reducing the effects of the project.

Works on clearing away the existing soil, vegetation and structures, and then removal of the surface layer of earth commence construction works on the new highway. During the carrying out of those works, the greatest changes to the topography occur.

The process of road construction itself is characterized by extensive mechanical stabilization in the corridor of the roadbed and in places where temporary access roads are formed, which, in individual sensitive sections, could have an influence on the entire system of parameters of soil, primarily in the sense of its water permeability, air content, etc.

4.1.2. Operational Phase

During the phase of operation of the road, pollution of soil will mostly be the consequence of the following processes:

- pollution from atmospheric waters from the highway;
- settling of exhaust gases;
- discarding organic and non-organic rubbish;
- spilling of loads;
- settling of atmospheric particles carried by wind; and
- dispersal due to movement of vehicles.

The catchment area of the South Morava River in the sector of Grdelica gorge is one of the best known erosive areas in Serbia. Erosive processes in the catchment areas of torrential tributaries of the South Morava River on the given motorway section are mainly within the range of medium and high erosion. All tributaries of the South Morava River in the given sector are of extremely torrential character. The basic characteristic of the hydrological regime of water courses are torrential waves with sudden onset and of short duration. These waves bring the major part (70 - 80 %) of total annual production of erosion deposit.

The dynamics of torrential processes in the catchment areas of these water courses is very marked. After intensive precipitation in the catchment areas, torrential waves are formed, bringing large amounts of erosion deposit.

Taking into consideration the concept of drainage (open system) of atmospheric waters on the analyzed section of the newly planned highway, it can be concluded that the most significant level of soil pollution occurs in the area 5.0 to 10.0 m from a road with a heavy traffic load. The greatest effect of cadmium is in the zones of 1.0 to a maximum of 5.0 m along the length of the road, which is within the protective belt of the road.

Soil pollution which may appear as a consequence of the destruction of hazardous loads also is relevant considering the characteristics of the soil in the analyzed area. An analysis of a case of accidental pollution will be analyzed in a separate chapter.

The engineering-geological and hydrological characteristics of the soil, as well as the planned earthworks on the position of the overpasses create the conditions for the occurrence of settling of the road bed which could in certain circumstances reflect in the permeability of the soil. Regardless of settling of soil below the embankment, and with consideration for the local hydrogeological characteristics and time lapse of consolidation, negative effects are not expected.

Degradation of soil which may occur by forming dumping areas and borrow pits for construction material in the specific conditions is limited by the category of the borrow pits, being that the planned carriageway is planned on an embankment. For forming the embankment, the necessary quantity of material shall be provided from the alluvial deposits (but not from the river bed) and local borrow pits.

Table T 4.1.2. Expected content of heavy metals in soil(ppm)

Element	MPC*	min	max
Ag	50	91	136
B		136	181
Ba		363	408
Be		54	91
V		135	181
Ga		45	64
Co		27	45
Cu	100	181	227
Cr	100	227	272
Mn		136	181
Ni	50	103	136
Sc		45	73
Zn	300	163	181
Zr		Zr	227
Sr		Sr	227
Y		118	163

*Defined in the Rules on permissible quantities of dangerous and harmful substances in soil and irrigation water, and methods for their testing (Official Gazette of RS, No.23/94)

4.2. Air quality

4.2.1. Construction Phase

The carrying out of construction works, according to its nature, represents a significant source of pollution to the atmosphere due to the use of construction machinery which uses mostly fossil fuels for propulsion. The moving of large earth masses during construction of the road (cut, embankment) also results in large quantities of dust being lifted into the atmosphere which may trigger negative consequences in the populace and vegetation. The operation of asphalt bases, as well as the placement of asphalt masses in the road bed, carries with it the emission of volatile organic compounds (VOC), of which a significant percentage are polycyclic aromatic hydrocarbons (PAH) which are proven carcinogens, i.e. have been confirmed to cause cancer in humans.

In this case, the space in which construction works are to be executed is at more than 100m distance from the populated area and thus no negative effects on health of the population are expected. The asphalt plants will be located outside the project impact zone.

4.2.2. Operational Phase

The calculation of concentrations of air pollutants for characteristic cross-sections of the planned highway was done using an advanced computer program based on the procedures of modeling defined in the directives for calculation of air pollution on roads (Merkblatt über Luftverunreinigungen an Strassen, MLuS-90).

Based on data on wind frequency, speed, and directions, from the meteorological station Predejane, the average wind speed of 3.0 m/s, north by direction, was derived. For these meteorological conditions, concentrations of pollutants were calculated for AADT in 2021 as the final year of operation period, and for the traffic flow speed of 80 km/h.

Based on the data obtained from the analysis of characteristic conditions and the limit values defined by the Rulebook on Limit Values, Methods of Measuring Emissions, and Criteria for Setting Up Measuring Locations and Recording Data (Official Gazette RS 54/92), the following conclusions were made:

- in conditions of a dominant wind (N), the concentrations of all polluting materials, except for NO₂max, are below the limit values of emissions;
- generally, during a dominant wind (N), concentrations of polluting materials in the air are greater on the right side of the section of the highway;
- the limit for exceeding values of LVE for NO₂max is 5.5 m on the left and 18 m on the right side of the road, measured from the edge of the highway; and
- in periods without wind, the LVE for all polluting materials are exceeded as follows: carbon monoxide at 6 m for



the mean and 10 m for the maximum values, nitrogen dioxide 45 m for the mean and 68 m for the maximum values, sulfur dioxide 35 m for the mean and 14 m for the maximum values and solid particles 6 m for the maximum values.

4.3. Noise

4.3.1. Construction Phase

The sources of noise during the construction are heavy construction machines and their traffic in connection with the execution of works. The organization of the construction of a linear structure, such as a road, is characterized by the arrangement of construction machines over a relatively large area, which makes it more difficult to intervene with regard to the protection of environment from elevated noise levels in this phase. Exposure to these impacts is limited both in time and nature and as such it is considered in the mitigation measures during the construction phase.

4.3.2. Operational Phase

During the operational phase, Road traffic plays a dominant role if compared with other types of traffic and is predicted to continue to grow. This results in an increase in the level of noise in the zones around roads.

The noise impact analysis implies the definition of the parameters of traffic noise on a spatially and functionally defined road. The status which is defined in this way is compared with current legal regulations with regard to the maximum permissible levels for particular facilities. Exceeding the permissible levels implies the need for additional protection measures.

For the concrete calculation of the authoritative level at any point of a section, special computer programs were used which were developed on the basis of the instructions titled: "Richtlinien für den Lärmschutz und StrassenRLS-90" (ref. 15).

On the basis of the numerical data obtained through the calculation of traffic noise in the planned period at the characteristic cross-sections which are presented in the corresponding tables, it can be concluded that excessive levels of noise are expected to be present.

The obtained authoritative levels indicate that in the planned period the levels of noise expected at the referenced distance of 25 m, during the day should stay around 76 dB(A) and during the night around 70 dB(A). The difference between levels at individual places is a consequence of physical restrictions in the cross-section which cause the reduction in level. If the limit value of a permitted level of 55 dB(A) is adopted for nighttime conditions, which applies to structures along major highways, under the conditions of free distance of sound, this value would be reached at the closest distance of around 100 m and at the furthest distance of around 280 m from the axis of the planned highway.

Being that along the planned highway there are structures which could be analyzed for negative effects, the previously obtained values serve as the criteria for identification of those residential structures which are potentially in danger of being affected by noise from the highway.

Based on the numerical data obtained by calculation and the relevant levels defined by law, a conclusion may be drawn that limit noise levels are exceeded in the several zones in which the registered structures are located and appropriate mitigation measures are planned by using noise protection barriers (see chapter 5 – Description of mitigation measures).

4.4. Flora, Fauna and visual impact

4.4.1. Impact on flora

Based on the analyzed impacts of the planned alignment in the sphere of air and water pollution, and soil pollution, occupancy of surfaces and division of space, it is possible to derive conclusions in respect of possible impacts on ecosystems of areas across which the road alignment shall pass. It is also essential to pay particular attention to the comments and requirements of the INP, who provided detailed comments on the individual road sections.

Preconditions obtained from INP, related to E-75 Highway section from Gornje Polje to Caricina Dolina are given in the document No 03-853/2 from 29.06.2006 and No 03-237/2 from 27.02.2008. This document is available in Appendix IV of this EMP and also as a part of EIA for Gornje Polje – Caricina Dolina Highway section.

INP comments included notes on the conservation status of ecosystems and species of flora and fauna, general mitigation measures and the need to undertake additional investigations during the detailed design stage, so as to minimize potential adverse impacts. For this reason an allowance for such studies has been made in the EMP.

The facts which have been introduced within the framework of the existing conditions indicate that, with consideration for local conditions and plant diversity of the area, especially negative effects should not be expected.

The effect of air pollution on plant life is spatially limited to a narrow belt along the road itself being that the concentrations which are permitted by the limit values, with consideration for the possible negative effects, are reached only at the edge of the road for a majority of components. This is a consequence, as was also included in the chapter on air pollution, of traffic load and the conditions of transmission of pollutants on roads located outside of cities.

Another important fact which must be highlighted is that the spatial and operational elements of the planned carriageway do not contribute significant possible negative effects because this concerns with a relatively low traffic load and modest width, with no fencing which would affect the spatial division.

4.4.2. Impacts on fauna

Construction Phase

Impacts on fauna in the given area are related to the occupancy of land, since this is when some habitats, breeding ponds, and refugia are destroyed, and traditional animal paths are cut off. Any pollution of soil, ground and surface waters can negatively impact fauna in the study area. In the course of highway construction, the area will be modified through the

alteration of physical characteristics of the space, transformation of land by the highway construction and preparation of the ground, and there are also certain forms of pollution. The modification of the area reflects through the modification of habitats (change in geometry, floors, mosaic like nature, and general conditions of refuge and food chain), the removal of soil cover (the removal, erosion, or destruction of top layers of rock and soil), the change in hydrological regimes (changes in the composition and structure of habitats, so as to affect soil moisture of the area), noise and vibrations.

Studies of the terrain covered by the corridor of the planned section of the highway which was carried out for the purpose of defining the possible negative effects on wildlife have indicated that for the most part exceptional negative effects should not be expected because there is simply no significant wildlife elements registered in the area.

By reviewing the official register for the analyzed area which is the subject of the study, it has been confirmed that there are no registered habitats of rare or protected species so possible effects within these categories are not expected.

Operational Phase

Modern linear traffic infrastructure facilities, such as highway and railway lines, have a multiple negative impact on the living world. This negative impact shows up directly. The intensity and consequences of unfavorable impacts are specific, to some extent, for each animal group particularly, while the general effects most often show through:

- Direct devastation of habitats,
- Degradation of quality of habitats along the road,
- Fragmentation of habitats, alteration of their form and geometry,
- Intersection of ecological corridors and traditional migratory paths,
- Hindered access to vital parts of habitats,
- Fragmentation of population due to the effect of road barrier, and impossibility of constant and unobstructed communication,
- Higher hunting and poaching pressure due to an easier access,
- Higher mortality rate of animals due to running over,
- Disturbed regime of surface and ground waters,
- Accumulation of liquid, solid, chemical and other waste
- Intensified light and noise pollution of the area around the road.

Most of the fauna will temporarily migrate out of the highway corridor during construction. The newly designed road may destroy a habitat, if its remaining parts are not self-sustainable. Consequences of such effects are: a disturbed normal life cycle of animal species, behavioral changes, reduced ecological stability, and disappearance of local populations, changes in composition and structure of animal habitats due to avoidance of the road by some species, all of which has, as the final result, a substantially impoverished bio-diversity on all levels (genetic, species, eco-system).

Since the road alignment passes through the river alluvium in some places, it is assumed that new structures will have the highest impact on animals that depend on water as eco-system. Since the project envisages river control, it is necessary to avoid this type of works in the period of fish spawning. This will be elaborated in the site-specific EMPs.

On-site investigations for the highway corridor, conducted in terms of identifying possible negative impacts on fauna, showed that salient negative impacts should not be expected in most of the area, simply because no significant faunal elements were registered. Potential impacts on fauna which are present will be reduced by implementation of the conditions provided by the INP.

In order to allow free movement of animals from one to another side of the motorway, 20 box culverts and bridges will be constructed as underpasses for big animals too. Longest distance between two neighbor passes is 2685m.

4.4.3. Visual impact

The problems of visual pollution have been considered on two basic levels: The first level implies the problems of spatial relations of the alignment itself and elements of the homogeneity of its projection are encompassed in the concept of so-called geometric shaping. The second level encompasses the relation of the alignment, as a construction, towards the space in the sense of defining the effect on the landscape.

For quantification of the relations of the transit construction towards the landscape, the methodology of breaking things down into individual components has been used (morphology, vegetation, surface water, structures and general appearance). For the characteristics of the planned highway and local conditions, the only component which has an effect on the landscape characteristics is the morphological characteristics.

The zone of altered landscape characteristics can be defined on the basis of the medical threshold of visibility accepting the visible angle of 10° as the measure for reviewing the maximum height difference in the section of the line perpendicular to the line of the terrain. This kind of relation entails that the width of the zone of possibly jeopardized landscape is $700H$ (H is the maximum height difference in the transversal profile). The largest multi-level sections in the cross section (overpass across railway line and roads) would be realized with a distance of 5.5 kilometers. Based on the aforementioned consideration, it is possible to conclude that in the specific conditions, grade-separated interchanges have the dominant shape which gives the fundamental morphological form to the entire area.

In the morphological sense, the alignment of the planned highway does not excessively burden the landscape. Local effects are present in the zone of overpasses over the existing regional road R-214 and railway line and in the zone of multi-level junctions.

Finally, it can be considered that the spatial entirety which the planned highway belongs to is predominantly characterized by cultivated landscape without especially significant forms and that the dominant form is represented by future grade-separated interchange structures.



4.5. Surface and ground water

Construction Phase

Pollution during the construction phase is of a temporary character, and is limited in both volume and intensity, but individual cases of damage could lead to serious consequences.

We separate two aspects of effects which are caused by construction of the transit structure:

- Pollution of the water; and
- Changes to the regime of surface and underground waters.

Changes in the physical and chemical characteristics of water, under the condition that the organization of the construction site and procedures during works follow the environmental protection conditions prescribed by this study, can be triggered by accidental pollution from leakage of dangerous and hazardous materials into open flows. For that reason, it is necessary to provide a controlled access of machinery to the waterways and other surface waters

Changes in the circulation speed and flow of surface water occurs due to changes in the morphology of the terrain when carrying out earthworks and during construction of bridges and culverts.

During the construction phase, surface water may be seriously endangered by pollution or physical destruction of the river bank.

The effects on the regime of surface waters (waterways), on the section Gornje Polje - Caricina Dolina of the newly planned alignment of the highway, are not directly conditioned by construction of the section, except in the part which is related to restricting highway construction works around the river regulation structures.

The justification of works on arrangement of the riverbeds lies in the prevention of landslides and erosion, but on the other hand those same works may have a negative effect on the environment, most of all on plants and wildlife in and around those waterways.

Conflicts may arise with aquatic plants and wildlife due to increased retention of sediments as a result of construction works. Destroying the bank and vegetation of the bank will significantly diminish the value of these areas in the sense of plants and wildlife.

Changes in the regime of underground water could occur as a result of construction of columns for bridges, settling of soil underneath high embankments and in parts of the section of the highway where a limited regulation of the flow of the Southern Morava River has been envisaged. Changes in the regime of underground water could occur as a result of construction of bridge columns, settling of soil underneath high embankments, etc. Construction of engineered structures will require the level of underground water to be temporarily lowered. As a consequence of lowering underground water through draining, effects on vegetation could arise. All of these changes to the regime of underground water and effects on vegetation will be of a temporary character.

Operational Phase

The main sources of pollutants during operation of the observed section are: vehicles, precipitation and dust.

During the phase of operation of the road, pollution of water will mostly be the consequence of the following processes: settling of exhaust gases, wearing of tires, spilling of loads, discarding organic and non-organic waste, settling from atmosphere, carrying by wind, dispersal due to passing vehicles, etc.

Pollution as a consequence of the aforementioned processes, according the characteristics of its duration, may be constant, seasonal and incidental (accidental).

A series of harmful materials are present in the water which runs off from the surface of the highway. This mostly concerns the components of fuel such as hydrocarbons, organic and non-organic carbon, and nitrogen compounds (nitrates, nitrites, ammonia).

A special group of elements is composed of heavy metals such as cadmium, copper, zinc, mercury, iron, nickel and many different fuel additives. A significant portion is also made up of solid materials of varying structures and characteristics which appear in the form of settled, suspended or dissolved particles. It is also possible to register materials which are the consequence of using corrosion protection substances. Another group of very carcinogenic materials is polyaromatic hydrocarbons (benzopyrene, fluoranthene) which are the product of the uncompleted combustion of fuel and used motor oil.

For indication of present pollutants which appear in dissolved or undissolved form, there is a series of macro indicators such as: pH, electrical conductivity, suspended and sediment materials, COD, BOD, grease and oil, etc.

In accordance with the stated positions, and based on foreign experiences acquired from 20-year studies, an estimation has been done for emissions of polluting materials which appear during operation of the observed section for the traffic load in the planned period, the results are displayed in the table 4.5.

Table 4.5 Quantity of polluting materials, by unit of surface area, which forecasted traffic emits during one year

Polluting materials	(kg/ha/yr)
Suspended particles	178.33
total organic carbon	52.87
Nitrates	1.205
total phosphorus	0.27
oil and grease	2.77
Copper	0.01

Polluting materials	(kg/ha/yr)
Iron	5.28
Zinc	0.097

The concept of water removal for the analyzed sections of the highway represents a significant element from the viewpoint of possible influences in the sense of both water and soil pollution.

Water removal is realized through free flow over the shoulder and slope of the embankment where it is freely dispersed across the terrain. On parts of the section with smaller radii, water collected along the median is drained through a closed system to natural recipients outside of the road base.

The terrain on which the alignment is located is water permeable, partially-permeable, partially-impermeable and impermeable.

The problem of accidental pollution is impossible to quantify in this way because it primarily concerns individual cases spread out according to location and time.

Bridges represent a significant risk for the issue of waterway pollution, especially in cases of accidents. When damages have already occurred, the possibilities of rehabilitation are very small. Such locations on the observed section Gornje Polje - Caricina Dolina, E-75 Highway Belgrade - Nis - FYR Macedonian border are bridges crossing rivers and streams at chainages:

- km 874+286, bridge across S.Morava river, 138m
- km 874+075, overpass
- km 875+423, bridge across S.Morava river, 227m
- km 876+319, viaduct, creek, 164m
- km 876+973, bridge across S.Morava river, 428m
- km 877+386, bridge across Palojska river, 350m
- km 878+394, bridge across S.Morava river, 143m
- km 881+705, bridge across S.Morava river, 106m
- km 0+085, most, Predejane interchange, 124m
- km 0+702,594 DIZ, 0+079,202 LUL, S.Morava, interchange Predejane, 127m
- km 881+930, bridge across S.Morava river, 203m
- km 883+305, bridge across S.Morava river, railway, 495m
- km 883+576, most, creek, 11m
- km 884+958, most, creek, 11m
- km 885+445, most, creek, 11m
- km 885+335, viaduct, creek, 139m
- km 878+778, gallery, 80m
- km 882+605, galery, 190m
- km 876+527, slab culvert, creek Terzinci, 6m
- km 877+460, slab culvert, underpass, 6m
- km 884+090, slab culvert, creek, 6m
- km 884+567, slab culvert, creek, 6m
- km 885+020, slab culvert, creek, 6m
- km 885+550, slab culvert, creek, 6m
- km 885+649, slab culvert, creek, 6m
- km 885+020, slab culvert, creek, 6m
- km 885+649, slab culvert, 6m

4.6. Impacts on social /cultural environment

4.6.1. Impact on population

The impact of the planned motorway E-75 Nis - FYRM Border on the health of the population includes the impact on the population in settlements along the motorway as well as on drivers and other participants in the traffic (assistant drivers, passengers, pedestrians). These impacts include exposure to noise, vibrations and air pollution (oil combustion and exhaust fumes).

The construction of the Gornje Polje - Caricina Dolina Highway section, as a part of E-75 Nis - FYRM border highway, will have a stimulating effect on a better traffic and economic connection of the Republic of Serbia with its surroundings, as well as on faster development of the region served by this corridor.

From the perspective of the interests of certain social groups as users of the space and the structures within that space, the construction of the highway may have a twofold effect on the socio-economic and commercial development of the specific area.

Two basic populations of interest stand out for the section of the highway Gornje Polje - Caricina Dolina. The first group is made up of users of the highway, while the second is owners of the land on which the analyzed section is built. With the construction of the planned highway, the conditions for travel are improved while simultaneously decreasing expenses and increasing the safety of users from the aforementioned first group.

However, the construction of the road may lead to worsened living conditions in a particular settlement and its zones. These negative effects appear in the case when the corridor of the road cuts off (divides) development of parts of settlements.

Comparing the effects of construction, positive and negative, in both cases leads to the conclusion that the benefits to social circumstances in the case of construction of the planned section of the highway are much greater than the damage which also occurs as a consequence of construction.

4.6.2. Impact on cultural monuments

Preconditions obtained from IPCM, related to E-75 Highway section from Gornje Polje to Caricina Dolina are given in the document No 10/2233 from 24th September 2008. This document is available in Appendix IV of this EMP Document. No statutorily protected archaeological sites will be directly affected by the construction works. On the marked highway section, during systematic archeological reconnaissance carried out in 2003, the following archeological findings were recorded:

Table 4.6.2. Recorded cultural assets

Place	Name of locality
Bocevcı	Latin Graveyard
Bocevcı	Seliste
Predejane	Old Graveyard
Predejane	Seliste
Predejane	Gradac
Susevlje	Latin Graveyard

No statutorily protected archaeological sites will be directly affected by the construction works.

The Law on Cultural Resources requires that the investor and contractor, in the case of the discovery of new, unrecorded locations, must enable and provide for archeological intervention. That consists of the momentary halting of works and informing the authorized IPCM of the discovery. This of course requires occasional archeological monitoring during construction. The investor is required to provide the financial means for all envisaged works - occasional archeological monitoring, protective archeological interventions, etc.

The Contractor will prepare action plan as a part of the bidding document, and update it periodically in accordance with the new findings (if any). The initial plan will consider the whole section (Gornje Polje - Caricina Dolina Highway section) to be subject of actions relevant to chance finds, in addition to specific measures to deal with above mentioned sites/locations. The updated action plans will be subject to obtaining consent from the IPCM and any other relevant authority, as may be instructed by the K.S.

In case of locations that may be of interest (chance finds), K.S will provide funds for - occasional archeological supervision, protection of the archeological intervention, etc. The effective protection measures in case of chance finds will include immediate stop of all works in progress around the new finds, adequate fencing to prevent unauthorized access and immediate notification of IPCM.

The preconditions of the IPCM are summarized as:

No excavation, demolition, alteration or any works that may harm the properties of the cultural monument may be carried out. IPCM and authorized expert must be timely notified of the commencement of earth and other works at the archaeological site or in its immediate vicinity, in order to timely perform all the necessary preparations until the archeological exploration license is obtained. Identified sites must be marked and secured (with a protective railing or other means of protection) to avoid damage in the course of road construction.

4.6.3. Impact on natural resources

According to the preconditions obtained from INP (No 03-853/2 from 29.06.2006, and No 03-237/2 from 27.02.2008 (see Annex IV), none of plant or animal species which habitats belong to the zone of the E-75 Highway section from Gornje Polje to Caricina Dolina are rare, vulnerable, endangered or protected.

Upon reviewing the registry of protected natural resources, it was established that within the analyzed area there are no registered locations which fall under this category. The fact is however that within the analysis of the existing condition, spatial units stand out for which there are proposals regarding their arrangement and placement under special protection.

4.7. Construction camps

The nature and extent of the construction works will require establishment of a number of Construction Camps, which will house workers, equipment, machinery, fuels and materials. The number, size and location of camps are not currently known and can and will only be determined following mobilization of Contractors to country.

From the environmental and social viewpoint, construction camps pose potentially adverse impacts, due to: Additional land requirement; Storage and use of hazardous material, fuels and oils; The need for services including water, electricity, sanitation and wastewater; Potential interference with community harmony and/or community tension resulting from the presence of large numbers of workers, particularly from an influx of foreign workers, who may also be a source of sexually transmitted infections (STIs) or HIV.

As the number, size and location of camps are not known at this stage, the most effective way to address the potentially adverse impacts is through contractor's adoption of the guidelines as contractual requirements. These are presented in the EMP in Appendix I of this report. The Contractor's SSIP - Camp Management Plan should contain, but not be limited to,

procedures for establishing and operating construction camps in order to safeguard nearby communities and environmental resources.

Work camps will be required to conform to international Health, Safety and Environment (HSE) standards and will thus be furnished with sanitary and wastewater collection and disposal/treatment facilities and will operate fully compliant waste systems, involving storage of waste by waste category. These requirements will be included within the contracts for construction, which should ensure that contractors include sufficient budget for effective HSE management. Contractors teams will reflect these provisions, by including HSE staff and independent environmental specialists to provide advice and to undertake monitoring and auditing.

4.8. Cumulative impacts

The existence of other structures in the study area as well as possible construction and operation of new facilities may exacerbate impacts when combined with those resulting from operation of the proposed highway. In such circumstances it may be possible for the combined impacts to exceed environmental limits or standards. Therefore, as part of the fieldwork for the EIAs, data on the possibility of occurrence of these cumulative impacts were collected by noting the presence of these structures within the impact zone of the road.

Due to the terrain for most of the alignment from Gornje Polje to Caricina Dolina the existing road and communication infrastructure is confined in a corridor and thus the highway is located roughly parallel to the existing main railroad Nis – Skopje, at a distance of 50 – 300 m. This type of mutual positioning results in cumulative noise impacts. This fact was taken into consideration during the EIA modeling of noise levels in the impact zone.

Emissions of gases and dust due to excavation and grinding of stone aggregate, together with emissions of pollutants from traffic operation in the air, represent a cumulative impact that may be mitigated by appliance of stricter regulations in relation to operation of the stone quarry. Construction of highway maintenance centers is envisaged for zone of the Grdelica interchange. There is a possibility that cumulative impacts of these facilities and the road exceed the permitted values of pollutants concentrations in the air as well as noise limits, which will be tested through EIAs prepared for these structures.

Major new induced development along the alignment of the highway *per se* is not anticipated, as new highway accesses to only existing facilities and connecting roads will be constructed as part of the Project. The Project highway aims, *inter alia*, to stimulate economic development and improve communication both regionally and internationally.

However, the majority of the areas through which the highway is alignment is predominantly rural in nature and continues to suffer from out-migration, as people move to the larger cities and towns in search of work etc. The socio-economic studies to be undertaken in the context of preparing RAPs will explore this issue further, but it is not expected that the improved highway connection resulting from the project will have a significant impact on this overall demographic trend, such as stimulating large in-migrations or substantial new development.

5. DESCRIPTION OF MITIGATION MEASURES

5.1. Site-specific mitigation measures

5.1.1. Soil

Construction phase

- Strict protection of all areas outside the immediate zone of the agreed work sites, such that no additional areas may be used as a permanent or temporary disposal sites for materials, as borrow pits, or for machine parking or repair;
- Removal, storage and handling of topsoil in such a manner that it can be used in final reinstatement, bio-restoration and stabilization of slopes;
- Storage and handling of fuels, oils and other hydrocarbons in a controlled process, involving measures to prevent soil and water contamination. Work camps should include storage on sealed surfaces and within secondary containment; refueling of all plants, vehicles and machinery should not be allowed within 50m of any watercourse, drain or channel leading to a water course.
- Forbidding any opening of non-controlled access roads to any part of the construction sites;
- Temporary storage of construction waste will be limited to within the site, and within areas approved by the Engineer.
- The Contractor shall not dispose of any waste and/or construction debris by burning, or by burying. All waste shall be disposed of offsite at an approved landfill site.
- The Contractor will be responsible to remove and transport all waste material off site to an approved landfill.
- The Contractor is advised that cement and concrete will be regarded as materials that are potentially damaging to the natural environment on account of the very high pH of the material, and the chemicals contained therein. The Contractor shall ensure that all operations that involve the use of cement and concrete are carefully controlled.
- Concrete mixing, in the purpose of pre-stress girders, shall only take place in the construction camp or in dedicated plateau. Water and slurry from concrete mixing operations shall be contained to prevent pollution of the ground surrounding the mixing points. Old cement bags shall be placed in wind and spill proof containers as soon as they are empty. The Contractor shall not allow closed, open or empty bags to lie around the site.
- All unsuitable and surplus spoil rock shall be removed from the site to an alternative recycling opportunity. Last alternative is to transport it to a dumping site or sites where it shall be dumped, spread and leveled.

- No dumpsite shall be used without the prior written approval of the Contractor and the owner of the property.
- No spoil material shall be stockpiled in violation of any legal requirement or to obstruct any watercourse or drainage channel.
- Concrete remains will be crashed into pieces of cca 20cm diameter and will be used for the backfilling.
- All visible remains of excess concrete shall be physically removed immediately and disposed of as waste. Washing the visible signs into the ground is not acceptable. All excess aggregate shall also be removed.
- The process of separating rock material into acceptable grades for backfilling and layer works material will result in noise and dust. The Contractor shall suppress dust caused by the screening process. The screening process shall be positioned so as not to cause any disturbance to surrounding villages.
- Waste steel will be sent to steel recycling facility, which will provide transport service;
- Wastewater from the WWTF facilities and sedimentation ponds/tanks on site will be reused for dust suppression and vehicle wash down as a priority over discharging the water to stormwater or creek.
- The Contractor shall dispose of all refuse generated by his staff and Sub-Contractors on a weekly basis at a registered Domestic Waste Disposal Site. Contractor will engage specialized utility company for removal and disposal of domestic waste.
- In a purpose of temporary waste disposal, Contractor will ensure scavenger, water and windproof containers, for collected waste until disposed of.
- The Contractor shall supply waste bins/skips throughout the site at locations where construction personnel are working. The bins shall be provided with lids and an external closing mechanism to prevent their contents blowing out and shall be scavenger-proof to prevent baboons and other animals that may be attracted to the waste.
- The Contractor shall ensure that all personnel immediately deposit all waste in the waste bins for removal by the Contractor. Bins shall be emptied on a daily basis at waste containers.
- No waste to be buried or burnt onsite and litter and gross pollutants to be removed as part of ongoing maintenance operations;
- The bins shall not be used for any purposes other than domestic waste collection.
- All hazardous materials have to be stored at the fenced and secured area. All hazardous and dangerous material will be undertaken
- Liquid hazardous materials have to be kept on the waterproof surface, supplied with WWTF.
- All areas used as storage of the liquid hazardous materials, must be supplied with the adsorbent, such as prefabricated peat, sand or cutting, which has to be used in the accidents to collect liquid.
- Collected liquid hazardous waste will be kept in specialized liquid waste containers, which will be carried out by the licensed company engaged by the Contractor.
- All content from the separator and coalescent filters are dangerous waste and handling requires well-trained persons. Extracting and temporary storage will be done using specialized liquid waste containers.
- Used tires, or other rubber parts of equipment will also be treated as hazardous waste.
- The Contractor shall ensure that he is familiar with the requirements for the safe storage, handling and disposal of petroleum, chemical, harmful and hazardous materials.
- The Contractor shall be responsible for establishing an emergency procedure for dealing with spills or release of these substances. He shall also ensure that the relevant construction personnel are familiar with these emergency procedures.
- Petroleum, fuel and oil throughout the site shall be stored in enclosed separated areas at reservoirs with double shield, at the location of which shall be determined on site in conjunction with the Engineer. The enclosed areas shall be clearly marked.
- Usage of oil and fuel will be allowed only to the training persons, who will be nominated by the Contractor. All activities with fuel and oils will be at the dedicated areas.
- Special care will be taken during deliveries, especially when fuels and hazardous materials are being handled. A responsible person, who will check storage tank levels, before delivery to prevent overfilling, supervises all deliveries and that the product is delivered to the correct tank.
- Tanks containing fuels shall have lids and shall remain firmly shut. Only empty and externally clean tanks may be stored on the bare ground. All empty but externally dirty tanks shall be stored on an area where the ground is protected (e.g. concrete slab, covered store house, etc.).
- Fuel stores shall be placed on a concrete, or similar, base surrounded by a brick bund. The bund shall have a volume of 10% of the volume of the largest tank in the storage area plus 10% of the volume of all other tanks. The slab shall be sloped towards a sump to enable any spilled fuel and water to be removed. Any wastewater collected at the sump shall be disposed of as hazardous waste.
- Gas and liquid fuel shall not be stored in the same storage area.
- The Contractor shall take all the necessary precautions to prevent fires or spills at the fuel stores. No smoking shall be allowed inside the stores and within 3m of a bund.
- The Contractor shall ensure that there is adequate fire-fighting equipment at the fuel stores.
- Lubricants will be stored in drums or tins that are either sealed or have tightly fitting caps. All containers must be closed unless in use. Decanting of lubricants must be carried out in a specific area that has been previously identified and suitably protected.



- The floor of any storage of decanting area shall be impervious (such as concrete) to lubricants and kept clean at all times. The floor shall slope towards a central sump, all liquids collected in the sump shall be disposed of as hazardous waste.
- Lubricants shall be stored under cover in a no smoking area.
- All lubricant impregnated cotton waste and rags shall be promptly disposed of and handled as hazardous waste.
- The Contractor shall ensure that all servicing and/or refueling of vehicles and equipment takes place within the construction camp. The ground under the servicing and refueling areas shall be protected against pollution caused by spills and/or tank overfills. The method of protecting the ground shall be identified by the Contractor and approved by Engineer;
- All waste shall be collected, contained on site and stored in water-tight containers prior to disposal off-site as hazardous waste at approved site. All equipment that leaks shall be repaired immediately or removed from the site;
- The Contractor shall only change oil or lubricants at agreed and designated locations, except if there is a breakdown or an emergency repair. In such instances, the Contractor, shall ensure that he has sorbent (sand, cutting or Similar) and/or drip trays available to collect any oil or fluid. The only permitted method of refueling and refilling lubricants is by means of a pump;
- In the purpose of smaller interventions for re-fueling it will be used small fuel delivery vehicle. It will be supplied with Spill-Kit equipment.
- Parking of machines and equipment only at designated sites, which should be provided with specific measures for protection against soil pollution with fuel, oil, or oil derivatives. In the event that soil is contaminated by spillage, the affected layer should be removed and disposed of at approved dump sites, in accordance with the Contractors waste management plans (WMP);
- Systematic collection of solid waste during construction (including food and material packaging, and other types of waste) should be undertaken and should be disposed of two agreed licensed facilities, in accordance with the WMP (see Appendix I);
- Cleaning equipment and vehicles will only be allowed in dedicated facilities, designed to avoid ground and water pollution. Similarly, washing out of concrete mixers and uncontrolled removal of remaining concrete should be a controlled operation; the use of „slush pits“ (lined pits) or tanks should be employed for washing out concrete contaminated equipment following concrete pours. The resultant set concrete can then be disposed of as inert solid waste or reused in bulk fill areas, as appropriate;
- Upon completion of material extraction, all borrow pits and waste disposal sites should be reinstated to reduce the visual effect and re-establish natural vegetation. Limitations to this will occur, especially where material is extracted from currently operating, licensed quarries, in which Project influences are restricted, as will be the case for licensed waste disposal facilities.
- Since the project envisages river control works, it is necessary to avoid this type of works in the period of fish spawning.
- Organizing the construction within the minimum amount of space needed for its functioning, and during selection of the location, ensuring that it is not an area with developed plant and wildlife characteristics in order to avoid unnecessary loss of biotope.
- Collecting humus material and storing it in an organized storage area so that it may be used during finishing works for recultivation and biological protection;
- Carrying out all activities with petroleum and its derivatives during construction or the filling of vehicles in a specially defined place with the maximum mitigation measures to ensure that spilling does not occur. Collecting all packaging for oil and other petroleum derivatives and taking them to a controlled storage area;
- If damage occurs to a vehicle with dangerous liquid materials, traffic must be stopped as in the previous case and transferred to a parallel carriageway. In the meantime the authorized service at the level of the municipality shall be informed and the specialized team for sanitizing damage shall be deployed. The spilled material is removed from the highway using special sorbents. If the liquid reaches outside of the profile and pollutes the soil, sanitization shall be done by removing the soil. All materials which are collected in this way are treated according to the special procedures of regeneration or are stored in the storage area envisaged for such materials.

Operation phase

No specific measures to be implemented, except applying good engineering practice.

General mitigation measures are:

- Provide suitable road markings, signs and signals for the section
- Draw up operational plans for winter maintenance procedures, taking into account environmental protection;
- Slopes of embankments need to be landscaped and planted both to improve the visual effect and reduce potential for surface erosion;
- Provide a road protection zone that will not be used as an arable zone. Considering the expected concentrations of the pollutants, this belt should not spread beyond 5 meters from the edge of the road right of way. The grass obtained by the maintenance of green surfaces in the vicinity of the road shall not be used as cattle feed. It will be important to inform and educate local communities regarding the dangers of using this vegetation. According to the law, PEPS is responsible to perform all sampling, measuring and other monitoring activities during the operation phase, by following all recommendations given within the monitoring plans (component of site specific EIA and this EMP). All the monitoring results are to be provided to the Serbian Environmental

Protection Agency. PEPS will also inform local communities about monitoring results, including on potential pollution of land nearby the motorway. No herbicides shall be used for elimination of weeds;

- Substitute the use of sodium chloride with by other substances with a similar or higher defrosting effect in order to minimize the effects of salinization of soil in the vicinity of motorway resulting from the winter maintenance. Where sodium chloride is used in the maintenance process, precise planning of time distribution and quantities is of critical importance;
- Ensure that other support and other service facilities along the route are designed and erected in after the appropriate EIA and/or studies are made and approved by the relevant national institutions;
- All possible accompanying content along the planned highway must be designed and built in harmony with the fundamental function of this road with a prior Environmental Impact Assessment study;
- The complexes of accompanying content must be supplied with special containers for collection of solid waste so that pollution of soil in the zone of the road is avoided during operation. The containers must be emptied by the authorized company and solid waste must be stored at the proper dump area.

5.1.2. Surface and ground water

The mitigation measures for underground and surface waters encompass all procedures which are necessary for bringing quantified negative effects to within the allowed limits, as well as procedures for minimizing the effects of the phase of construction and phase of operation.

Construction phase

Contractor should carefully plan potentially sensitive operations such as in-river works. Typical procedures will include:

- No construction materials or pollutants, such as cement shall be allowed to fall/flow into water features. All storage of spilling material will be covered to avoid possible emissions with wind blow. Nearby watercourses site will be fenced.
- Extreme caution shall be taken during construction owing to the high erosion potential of the river embankments. The EM shall assess any preventable damage caused by the Contractor and prescribe rehabilitation measures to be completed.
- Construction in the river bed will take place during low water level period;
- No washing of equipment or vehicles will be allowed in the vicinity of watercourses;
- The river banks in the studied area must be protected by barriers during the construction phase for the purpose of preventing negative effects which could be caused by driving and unloading material in the vicinity of the same.
- Driving of machinery within rivers, streams or on their banks should be prevented except in cases when it is impossible to avoid due to construction of a certain structure or building.
- Excavation and construction of foundations for shoreline columns, support walls, and other structures which are located on or in the vicinity of bodies of water, are carried out during periods of low water level (July - September), in order to reduce the negative effects on the rivers and their shorelines to a minimum.
- Maintaining, refueling and cleaning construction machinery shall be carried out at locations which are far from waterways and which will be defined before the works are begun.
- In the direct vicinity of rivers, spillage of any kind of dangerous substances must be avoided. In that sense, the contractor will be required to use biodegradable compounds for lubricating machinery as well as biodegradable transmission fluid in order to reduce pollution down to a minimum during the carrying out of works.
- Providing training to machine operators regarding the sensitivities and working procedures to be followed;
- Checking all machines and equipment for leaks prior to use;
- Preparing site specific emergency plans to respond to any incidents or spillages of hazardous material;
- Storing all fuels at a safe distance from the watercourse;
- Preventing re-fuelling near the watercourse and/or taking precautionary measures to prevent spillage.
- Construction of foundations for bridge piers, retaining walls, and structures located at or in the vicinity of rivers should take place in the period of low water levels (July - September) so as to minimize negative impacts on rivers, their banks and river ecology;
- Storage and handling of fuels, oils and other hydrocarbons through a controlled process, involving measures to prevent soil and water contamination. Those should include fuel and oil storage on sealed surfaces and within secondary containment; refueling of all plant, vehicles and machinery at minimum 50m of any watercourse, drain or channel leading to a water course.
- Similar measures for storage of fuels and re-fuelling of equipment should be put in place in floodplains to prevent groundwater pollution. No storage of fuels and oils will be allowed in floodplains where the potential for washout exists.
- All sites near rivers will be protected by fencing and other means to prevent loss of construction materials, particularly hazardous materials.
- Prevent the movement of machines inside rivers, streams, or on their banks, except when it is unavoidable due to the construction of a structure or construction.
- The Contractor shall construct and operate the necessary collection facilities to prevent pollution.
- The Contractor shall dispose/discharge of collected wastewater in a manner in accordance with Water Protection Conditions.

- Each parking, service, or cleaning and washing plateau will be equipped with Waste water treatment facilities (WWTF) in the manner of sedimentation tank and grease and oil separator. All these WWTF will be temporary objects.
- Contractor will consider in detail all recommended locations of the coalescent filters, described in the EMPC as construction site facilities, and prepare detail plan of their usage in the purpose of works. Moreover, working progress schedule will have influence on facilities installation.
- All washing of plant/equipment/concreting equipment etc. shall take place within the construction camp. Water from washing operations shall be collected in a sedimentation tank, then to be purified through grease and oil separator. Recycled water will be discharged into natural recipient, The Contractor is encouraged to recycle dirty wash water to avoid obligation of removing it off-site.
- Trucks delivering concrete shall not wash the trucks or the chutes on the site or anywhere outside site boundary. All washing operations shall take place at a dedicated location where wastewater can be collected, purified, and discharged of in an acceptable manner.
- All construction camps will be equipped with sanitation. Sanitation facilities contain temporary sewage and disposal tank (sump), which will be discharged in a necessary period by the licensed company.
- Adequate chemical latrines/toilets shall be provided for all staff near the alignment. They shall be emptied & serviced on a regular basis to prevent overflowing by the licensed company;
- All latrines provided by the Contractor shall be efficient, sanitary and non-offensive. A minimum of one toilet shall be provided per 20 persons at each working area and the construction site.
- Storm Water is clean run-off water from the up-slope areas, mostly it will be catch on the perimeter of the site, and discharged into the recipients;
- During construction, the Contractor will ensure that erosion control structures - either permanent or temporary - are installed prior to commencement of construction.
- Any erosion channels developing during the construction period or during the operational and maintenance period shall be backfilled and consolidated immediately and the area restored to the proper condition. All erosion damage shall be repaired as soon as possible. Displaced topsoil will be replaced from approved topsoil.
- Up-slope ditches will be constructed and used during construction phase to divert away from areas of exposed soil to prevent the contamination of clean runoff. .
- Side ditches will be installed down-slope of all erodible stockpiles and upslope protection measures will be used to divert runoff in the event of rain;
- Sandbags will also be placed around storm water inlets/grates, throughout the site to prevent sediment entering piped storm water system.
- All vehicles and plants shall be well maintained to ensure that there are no oil or fuel leakages.
- The Contractor will provide a dished concrete plateau to prevent infiltration of hydrocarbon products.
- Drip trays will be utilized during servicing.
- Drainage from the service area will be channeled into a grease and oil-skimming tank, where it shall be treated to remove old hydrocarbons. Drainage from the washing platform will firstly be channeled into the skimming tank before being released by drain to the sedimentation pond.
- Soil contaminated by oil, fuel or chemicals shall be removed and disposed of at a registered Hazardous Waste Disposal Site or rehabilitated in-situ,
- The Contractor shall educate workers on the appropriate methods for workshop maintenance and fuel points to prevent fuel and oil being washed out of containment areas.
- Toxins and oil must be recovered from the system at least once a week, and if necessary the Engineer should require a higher frequency;
- Toxins and oil recovered must be stored in sealed drums on a covered, bounded area and removed from site either for recycling or disposal at a registered waste disposal Site.
- All spillage of oil onto concrete surfaces shall be controlled by the use of an accepted absorbent material.
- The servicing of equipment and vehicles will only be allowed in the Construction Camp within the dedicated areas.
- The Contractor shall provide grease and oil separation tanks at all areas where oil spillage or collection will occur, i.e. workshops, oil storage, vehicle wash areas and fuel points.
- The Contractor shall provide a method for oil recovery. Recovered oil shall be collected in waterproof drums for recycling or disposed of at a registered Waste Disposal Site. These drums will be stored on site only on a covered, bounded area.
- The Contractor will test effluent discharged from the oil separator tanks for Conformity with relevant effluent conditions if requested to do so by the Engineer when pollution is suspected.
- In the closure to the local water intake area it is forbidden to organize any activities with liquid hazardous material, such a fuel, oil, cleaning and washing waste water, etc.;
- The Contractor must demarcate each location, and all staff will be informed about water intake presence.
- It is forbidden to open any new well in the water intake protected area.
- The Contractor is to ensure that the quality of the water discharged is compliant with the Water Protection Conditions, with respect to the receiving environment.

Operation phase

- The obligation of cleaning water runoff from the highway is based on the application of the Law on Bodies of Water (Official Gazette RS No. 46/91), the Regulation on Classification of Water (Official Gazette RS No. 5/68) and the Plan on Protection of Water (Official Gazette RS No. 6/91). According to legal regulations, atmospheric water which is released into waterways, canals or other water surfaces must be cleaned at least to the quality which corresponds to the class of water in the recipient waterway.
- Removal of water from the highway on the subject section is achieved by free flow over the shoulder and slope of the embankment and on parts of the section with smaller radii, water collected along the median is drained through a closed system to natural recipients outside of the road base.
- Considering that contamination is present in water runoff from the highway in the first 10-15 minutes of rainfall which is of a high enough intensity to move a majority of particles deposited on the highway (tables 6.2.4 - 02 to 6.2.4 - 05), as a measure for preventing infiltration of pollutants into lower layers of soil and underground water or surface water, the already envisaged humus layer can be used on slopes of embankments which has filtering characteristics in the sense of retaining polluting material during vertical permeation into the soil. This can also be used in zones of cuts by laying humus in the collateral drainage ditches. The capacity of a humus layer depends on the intensity of traffic and the relation between drained surfaces of the road and surface infiltration.
- On bridge structures, along the protective barriers and raised curbs, bridge collections areas have been planned by which all atmospheric water from the surface of the bridge and the elastic connections will be collected, guided into the appropriate drainage pipe, hung on the bridge cantilever or proper support, which must be defined in the main design.
- Within the framework of the internal system, surface water removal must be resolved for all accompanying content (rest stops, tollgates, loops, including disconnected sections as well as other operational surfaces) and all structures (viaducts, bridges) on the alignment of the newly planned section of the highway.
- The continuous cleaning of components is necessary for the functioning of the water drainage system. A very important item in a series of other items aimed at ensuring the regular and efficient maintaining of the functions of the system is checking over the condition of the retention basin and cleaning the device during the operation phase. In that way the appropriate protection from pollution of the surrounding soil will be provided considering that over time pollutants become concentrated in the areas of retention basins.

5.1.3. Air quality

No specific measures to be implemented, except applying good engineering practice. Use existing asphalt plant, which is located outside project impact zone.

General mitigation measures during construction phase are:

- The Contractor acts appropriately to minimize the generation of dust caused by construction works. Such measures include frequent watering during dry periods or by comparable means approved by the Engineer.
- Speed limits must be enforced in all areas, including public roads and private property to limit the levels of dust pollution;
- Dust must be suppressed on access roads and overall construction sites during dry periods y the regular application of water. Water used for this purpose must be used in quantities that will not result in the generation of run-off.
- Water trucks dampen haul roads and exposed surfaces to minimize dust generation and utilize dust suppressant products to assist in binding fine surface dust, improve water infiltration and reduce water usage;
- Dust dispersion from construction activities, roads, spoil dumps and other construction locations shall be limited and suppressed to the maximum extent practical.
- Spoil dumps shall be positioned such that they are not vulnerable to wind erosion.
- An appropriate freeboard shall be maintained in trucks hauling dirt, sand, soil and other loose material when leaving the road reserve.

5.1.4. Noise

Construction phase

If measurements taken as a part of planed monitoring activities (see Appendix II) show increased noise levels, contractor is obliged to take appropriate mitigation measures which are predefined within the Appendix I – Mitigation plan.

Contractor should also perform following activities:

- Raising workers awareness that noisy activities should be minimized;
- Adjusting the working hours in line with local conditions;
- Use of modern equipment and machines with noise suppressors when working in the vicinity of populated areas;
- Regular maintenance of construction vehicles and equipment in view of the elimination of unnecessary sources of noise;
- Avoiding the concomitant operation of several noisy machines, when possible;
- Switching-off the machines when out of use;
- Using natural acoustic barriers or screens for protection against the noise round the machines;
- Regular maintenance of access and temporary roads and limiting the speed of vehicles on unpaved roads for transportation of materials.

Operation phase

On the observed section, it is necessary to carry out measures for protection from noise.

The most important measure of protection from noise is construction of noise protection walls. This mitigation measure will be applied in places where the most endangered groups of structures are located. During the selection of the type of wall, attention must be given to the conditions which need to be fulfilled, those are:

- resistance to weather conditions,
- rationality of structure,
- visual effect,
- possibility of pre-cast construction,
- possibility of upgrading,
- spatial conformity,
- ease of maintenance.

With consideration of the level of noise from traffic in the planned period which was obtained through the calculation of authoritative levels defined by law, it is necessary to envisage a structure for protection from noise in places where the alignment is located within the vicinity of settled areas. The analyses on traffic noise which were carried out within the framework of the analyses on possible effects indicate that the limit values of permitted levels for urban areas along major highways are reached at distances of around 80 to around 250 meters from the newly planned highway. The spatial position and maximum heights of noise protection structures are provided in table T 5.1.3.

Table T 5.1.3. Spatial position and lengths of noise protection structures

Chainage (km)	Position	Length (m)
873+879 – 874+110	left	224
877+565 – 878+164	left	604
881+077 – 881+328	left	244
881+451 – 881+614	left	164
885+133 – 885+400	left	264

5.1.5. Impacts on cultural environment

- Contractor is responsible for following national requirements with respect to "chance finds" which may emerge during construction.
- Before beginning any kind of earthworks on the aforementioned locations, it is necessary to inform the Institute for the Protection of Cultural Monuments of Serbia - Belgrade so that they may carry out an archeological study;
- If at any time during construction archeological findings or archeological objects are uncovered, The Contractor is required to immediately, without delay, halt works and inform the authorized Institution for Protection of Cultural Monuments and to undertake measures to ensure the findings are not destroyed or damaged and to protect the area and position in which they are discovered.
- Contractor is not allowed to perform excavation, demolition, alteration or any works that may harm the properties of the cultural monument.
- KS will timely inform the IPCM and authorized expert about the commencement of earth and other works at the archaeological site or in its immediate vicinity, in order to timely perform all the necessary preparations until the archaeological exploration license is obtained. This aspect has been included in the EMP and a costing allowance has been made to cover archaeological watching brief and any subsequent investigations.
- In case of chance finds, Contractor shall mark and secure new identified sites (with a protective railing or other means of protection) to avoid damage in the course of road construction and immediately notify the relevant IPCM.
- KS is obliged to provide for and ensure archaeological intervention in the case they come across new finds. This involves the immediate discontinuation of works and notifying the competent IPCM about the discovery. Carrying out the above activities will require occasional archaeological supervision during construction.

KS will finance producing new documentation and ensure conservation of physical cultural resources. Prior to work, Employer will engage IPCM to do permanent supervision of works at the whole motorway section.

Regarding that there is possibility to find new cultural resources, Contractor will apply following methodology to rescue all excavated material:

- New localities require the presence of archaeological - conservation authority in the execution phase.
- Depending on the character of the findings, possibilities and methods of protection and conservation will be considered and some of the following proposed measures will be applied: conservation of the findings by backfilling; allocation of the findings; and partial allocation of the findings with the conservation of the remainder of locality by backfilling.

According to mentioned facts, the protection of possible localities will be realized in three steps, which will be in accordance to the actual circumstances follow each other. Realization steps are:

- Execute exploratory boreholes for archaeological investigation on the identified sites so as to determine the exact cultural belonging of the sites, stratification of archaeological layers, chronological determination, and preservation of the archaeological layers and the remainders of the architecture if there is any. Investigation in this phase would have to be completed before the commencement of the works on the site.

- On the basis of the archaeological research results in the phase one, new archaeological researches would be planned on special parts of the site that would be endangered by construction. In case that in the course on research in the phase one it happens that the cultural layer on the localities is not preserved or that the line of the communication is avoided, the second-phase research will not be carried out.
- Monitoring by the authorities, i.e. the control while execution of earth works near the alignment with mandatory protection of archaeological excavation if any new archaeological sites are discovered while execution of work.

5.1.6. Flora, Fauna and visual impact

Flora

The following mitigation measures are necessary:

- Clearing up and removal of vegetation should be minimized to the extent necessary for the execution of works.
- Natural vegetation shall be kept in as undisturbed a state as possible. Special attention shall be paid to preserve trees and plant communities such as wetlands or montage forests, strictly according to the preconditions obtained from INP (see appendix IV). Vegetation removals as part of the development requirements - such as along the proposed scarp road - are excluded.
- Based on the detailed design for this project, and locations marked as a ground under high and excessive erosion, The Contractor is obliged to prepare his own plan (Re-forestation Plan) for re-forestation those areas and to perform re-forestation activities according to this plan.

Fauna

The protection of fauna will be ensured by undertaking the following measures:

- Erection of a protective fence along the road, as a measure to prevent domestic and wild animals straying onto the road and being killed. Protective fence should be with the variable density, starting from higher density in a zone of 50cm above the ground and ending with a standard density for regular protective fence.
- Ensure that the protective fence ends at the bridge base, so as to direct wild animals toward the passage under the bridge. Execute the bank revetments with rough, coarse surface to prevent animals from slipping into water.

One of the more significant consequences of construction of the highway is the phenomenon of fragmentation of the habitats which in this case hits amphibians the hardest. The reason can be found in the existence of the waterways which are necessary for their life cycle. For the purpose of protecting biodiversity and undisturbed movement, multi-functional passages can be built along the waterways, viz. in those places where the construction of bridges has been envisaged. Bridges can be their own ecological corridors with a little revamping so that the bank of the waterway takes up a third of the passage under the road. The sides of the bank must be coarse in order to prevent the sliding of animals into the waterway and in order to enable easier exit from the waterway. The area before and after the passage must be covered in an identical type of soil and vegetation.

Along the aforementioned passages, it would also be suitable to use the envisaged slab, tubular and vaulted culverts for movement of wild animals. As there are no larger wild animals in the region in question, these passages represent a suitable place for the crossing of small wild animals. In the following table, a display is provided of the types of culverts, chainages and their sizes.

T 5.1.6. Culverts suitable for the passage of animals on the section Gornje Polje – Caricina Dolina

Type of culvert	Chainage (km)	Length - diameter (m)
Slab culverts	876+527	6
	877+460	6
	884+090	6
	884+567	6
	885+020	6
	885+550	6
	885+649	6
	885+020	6
	885+649	6

Visual Impact

This issue is solved during design phase and there is no additional, site-specific mitigation measures related with the visual impact of the project. Generally, all visual impact during construction works can be divided into two groups:

1. Temporary disturbance of visual characteristics during construction works due to presence of site equipment and mechanization.
2. Space occupation, which can be improved by site organization in accordance with Detailed Design of environmental protection

5.1.7. Construction Camps

The Contractor shall submit a locality and site plan of all construction camps indicating the location of fuel supplies, stockpile sites, offices and the construction area for approval by the Engineer to be approved prior to establishing any camps. The Contractor shall submit a locality and site plan of all construction camps indicating the location of fuel supplies, stockpile sites, offices and the construction area for approval by the Engineer prior to establishing any camps. If there is a need to put any equipment or facilities outside the expropriation boundary it will be done in the agreement of the owner and under Engineer approval.

- No one of the Camps will be in the area of influence on the water bodies (watercourse, water intake, etc.), Storage of hazardous materials will be afar of watercourse, and under specific conditions.
- Site facilities and offices will be selected in the manner to ensure that there is a minimal impact on the environment. All facilities will follow international health and safety standards furnished with power and telecommunication installations, fresh water supply, sanitary and wastewater collecting and treatment installations, solid waste collecting by category and hazardous waste collecting eco-receptacle;
- All Camps will be placed within an existing disturbed area, as far as possible. There will be no Contractor's objects, structures, parking, services, nor material storage in sensitive areas, such as wetlands or erosion potential land;
- All site buildings are containers and other temporary structures. No permanent structures will be built. All objects will be sound-proofing built, and will not pose a danger to personnel and surrounding environment.
- With the decommissioning of the structures all compacted platforms and slab foundations must be ripped and removed.
- Welding, gas cutting or cutting of metal will only be permitted in a specialized protected area inside the Construction site.
- No fires are allowed in or outside the Construction Camp. Adequate and well-maintained firefighting equipment-according to the fire hazard strategies - must be maintained on site during the construction period.
- The Contractor shall be liable for any costs related to extinguishing fires started by the Contractor's employees or subcontractors. Additional penalties for infringements will also be imposed by the EM
- The boundaries of the site shall be demarcated prior to any work commencing on the site. The site boundary demarcation shall be removed when the site is disestablished.
- The Contractor shall demarcate the boundaries of inner limits of the site. Site boundary is defined by expropriation line, and can be changed only in agreement with neighbor landowners. The Contractor shall maintain the demarcation line /
- The method of demarcating the boundaries shall be determined by the Contractor and agreed to by the Engineer prior to any work being undertaken. The method of demarcation consists of steel droppers placed at regular intervals, with nylon rope between the markers where this prove to be safe, but where any unauthorized person move closely pass construction work, netting should be provided preventing building material from falling into these paths.
- The Contractor shall ensure that a/1 his plant, equipment and materials remain within the boundaries of the site, unless otherwise agreed with Engineer.
- Contractor will ensure that materials used for construction on the site do not blow on or move outside the Site and environs, or pose a threat to animals in the area. Failure to do so may result in the Engineer requiring the Contractor to fence the boundaries of the site with wire mesh, prepare covering material etc., at his own expense to the satisfaction of the Engineer.
- Wire mesh fences will be constructed around heritage resources. to prevent access into such areas during construction.
- Fencing shall be kept neat at all times. The Contractor shall be responsible for the maintenance of all fences. Breaches in the fencing must be repaired immediately.
- If fencing is removed temporarily for the execution of work, the Contractor shall reinstate it as soon as practicable. Until re-instatement, the contractor shall demarcate the working area by surrounding it with danger-tape marking.
- Demarcating/Fencing of the construction site shall be suitable to allow access by livestock and local fauna to their natural routes. The purpose of the fenced areas is to control construction and personnel activity within the designated areas, and limit unauthorized access.
- No unauthorized pedestrian or vehicular access shall be allowed into demarcated off-limit areas.
- All vehicles and equipment will be allocated a dedicated parking area in the Camp site;
- No storage of equipment and vehicles will be allowed outside of the designated area:
- All parking, service, cleaning and washing areas will be made of waterproof structure with equipment for collecting spillage. All parking areas will be equipped with WNTF;
- Existing roads (arterial road M-1,12, regional road R-121 and local road network) will be used, as far as possible. No temporary access roads will be permitted, unless, otherwise is accepted by the Engineer, and under agreement with affected landowners.
- In the purpose of the Project, if any existing local road need extension or reinforcement to carry out Contractor's heavy machinery it will be done in accordance with local standards, and approved by the Engineer prior to use;
- If any, temporary roads required Shall be decommissioned by the Contractor and rehabilitated using stockpiled topsoil. Topsoil shall be removed as described under 'Clearing and Grubbing' prior to the construction of the road.
- Access roads shall be regularly brushed or scraped and kept free from dust and mud deposits. In dry weather dust suppression measures may be required.
- The accommodation of traffic is an important aspect on the roads identified for upgrade / maintenance. Where required, temporary works to facilitate the accommodation of traffic during construction, should be completed first as road closures will be avoided as far as possible.
- Adequate and appropriate traffic warning signage will be placed along the route to be used by the construction vehicles from the Camp.

- Adequate and appropriate traffic warning signage will be placed along the route to warn public of construction work and heavy vehicle traffic.
- Transporters of fine materials must ensure that their operation does not pose a nuisance through the spillage of material or the creation of dust.
- All trucks and vehicles removing spoil from the site shall have the load areas covered by a tarpaulin to prevent rocks and spoil from falling onto the road surfaces, or causing a nuisance to persons in the vicinity.
- Deliveries shall be scheduled for off-peak hour traffic time schedules, as far as possible.

5.2. Requirements of site specific implementation plans during construction phase

General environmental protection will be contractually provided for in the organization and planning of the work and operations on work site. Each Contractor should build upon the mitigation measures described in the EIA and EMP and should prepare his own site specific implementation plan (SSIP), to include *inter alia*

- Waste and wastewater management plan
- Traffic Management Plan
- Oil and fuel storage management plan
- In-river works management plan
- Camp management plan
- Emergency response plan
- Re-forestation plan
- Grievance mechanism

Minimum requirements for each of above plans are shown in Appendix I – Mitigation Plan.

Each Contractor should include HSE staff as part of his workforce and they should report to the HSE staff of the Project Management Consultant advising KS. In addition, the Project is to include Independent Environmental Consultants to provide informal advice and undertake monitoring and auditing activities.

All construction sites should be managed in accordance with national legislation on construction and HSE, such as the Law on Occupational Safety and the Law on Occupational Health and Safety and the Regulation on Occupational Safety for Construction Works (Official Gazette of RS, No. 53/97).

5.3. Check List – Mitigation Plan

Phasing, issues and mitigation measures are covered in Appendix I.

6. DESCRIPTION OF MONITORING PROGRAM

Monitoring of the effects of the Project will commence during the construction phase and will continue during the operation of the highway. This EMP sets out the basic parameters to be monitored in order to determine that mitigation measures identified above are being implemented effectively.

Following award of contracts for construction, the individual Contractors will work with KS to develop a detailed monitoring program with specified targets for each indicator, which will be tailored to the requirements of each road sub-section and the elements of The Contractor's Environmental Management System (EMS) and site-specific EMP. Each Contractor will develop a written monitoring program that will be evaluated by the independent environmental consultants and Project stakeholders, including national statutory agencies. The Contractor will cover the cost of implementing the relevant monitoring program in areas of his responsibility.

The monitoring results will be compared to data on current conditions

Compliance with EMP will be monitored by the independent contractor/supervisor, KS and the WB staff.

6.1. Construction Phase

Shortly after mobilization to country The Contractor will develop the monitoring plan in conjunction with the Project Management Consultants (PMC) and relevant statutory authorities. The parameters in the monitoring plan are expected to focus on potential soil and water pollution, especially in areas of higher sensitivity, such as Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), suspended solids, oils and greases to represent potential impact due to construction of the highway, based on the nature of the site activity.

Parameters which require measuring along the highway alignment during operation should be based on the potential for environmental impact and thus focus on water, air, soil and noise pollution, both during construction and operation.

6.1.1. Noise

Noise exposure levels are specified under the Regulation on Allowed Environment Noise Levels (Official Gazette RS, No.54/92). Noise measuring equipment will be used to establish a background or baseline and then during construction to establish increases in level and hence compliance to the standards. It is recognized that the best approach to noise control during construction works is require the use of equipment which conforms to noise standards, and then monitor the issue on an ongoing basis, including reacting to any nuisance complaints by local residences or businesses. If acceptable noise



levels are exceeded, implementing mitigation such as temporary screening or re-arranging work sites this will be the responsibility of the Contractors environmental and construction site staff.

During construction the level of noise increases due to the transport of loads by heavy freight vehicles (removal and delivery of materials) and the use of the construction machinery. These sources of noise are of a temporary character and last until the completion of construction works.

During the phase when works are being carried out, the level of noise must be controlled when necessary, meaning upon the occasion of a complaint being filed for an excess level of noise while works are being carried out. The Rulebook on Allowed Levels of Noise in the Environment defines the methods of measurement, selection of measurement location and the time intervals of measurement.

Within the framework of monitoring noise during the carrying out of works, the following is required:

- measurement of the zero point,
- measurement of the highest levels (peaks) of noise during construction.
- If during the course of works the limits of allowed levels of noise are significantly exceeded, in agreement with the owner of the structure, necessary mitigation measures are undertaken.

The Contractor is responsible for all consequences which arise from excess levels of noise during the phase of construction.

6.1.2. Air Pollution

Constant monitoring has been envisaged for when there are residential buildings located closer than 400 m. In the case of a complaint from a local resident, monitoring of the effects may be organized at that time.

6.1.3. Water

Monitoring of water during the phase of construction of the highway includes determining the effects on the quality of water while construction works are being carried out in the vicinity of waterways or water collectors.

For surface water, the program includes the following parameters: pH, concentration of dissolved oxygen in the water, waste materials, murkiness, concentration of organic compounds and mineral oil.

Limit Values for Serbian water class standard is in according to Serbian Legislation ("Official Gazette of SRS" No. 05/68, 31/82). Documents are presented within the app III of this document.

Monitoring responsibility lies on Serbian road management company (currently "Corridors of Serbia")

The taking of samples is done on a part of a surface waterway downstream from the construction site. The monitoring program is administered in such a way that it can be used to establish which construction works affect the quality of surface waterways. Samples must be taken before the commencement of works, at the time when humus is being removed and when excavation or the building of embankments from earth material is being carried out. Sampling is done in monthly intervals.

In the situation when the measurement results and analysis indicate an increase of negative effects, it is necessary to determine the cause of the deteriorating condition and undertake the necessary mitigation measures. Until the cause of the deteriorating condition is determined, only works which do not have an influence on pollution of surface waters may be carried out.

All measurements begin one month before the beginning of preparatory works. The parameters which are the subject of monitoring are divided into the groups geological-hydrological, physical-chemical and chemical. Measurement of the basic and indicative parameters of underground waters should be done at least four times a year with an interval of at least two months. Measurements of the chemical and physical-chemical parameters are done quarterly. The days when samples are taken will depend on the level of underground water, precipitation and other geological and hydrological relations.

6.1.4. Soil

Relevant parameters for soil impact assessment are: pH, concentration of heavy metals, oils and organic substances. Soils near roads having a high frequency of traffic, as in this case, should be tested for hazardous substances, such as typical heavy metals which may have accumulated from vehicle exhausts.

The program for monitoring soil during the construction phase includes parameters which are authoritative for determining the level of endangerment of the same. There is a wide spectrum of pollutants which have been categorized into the following two groups: heavy metals and greases and oils (remains of uncombusted fuel, lubricants and motor oil, antifreeze, hydraulic fluid, etc.).

Samples must be taken before the commencement of works, at the time when humus is being removed and when excavation or the building of embankments of earth material is being carried out.

In the situation when the measurement results and analysis indicate an increase of negative effects, it is necessary to determine the cause of the deteriorating condition and undertake the necessary mitigation measures. Until the cause of the deteriorating condition is determined, only works which do not have an influence on pollution of soil may be carried out.

6.2. Operational Phase

During operation of the highway the relevant environmental aspects will be monitored and will include noise, air, and water and soil quality. The results obtained will determine if additional environmental protection measures are necessary, such as provision of additional noise attenuation structures, landscaping or modifications to carriageway drainage or treatment.

6.2.1. Noise

During operation, within the defect notification period, noise must be controlled with the goal of controlling the effectiveness of envisaged noise protection measures. Measurement of the level of noise must be carried out in intervals of five years and in cases of complaints from adjacent inhabitants.

Residential object which will be monitored related to noise problems are located on the following chainages

Chainage (km)	Position
873+879 – 874+110	left
877+565 – 878+164	left
881+077 – 881+328	left
881+451 – 881+614	left
885+133 – 885+400	left

6.2.2. Air

For measuring the content of pollutants in the air which are emitted by motor vehicles during the phase of operation of the future E-75 Highway, it is necessary for all measuring stations to be placed in the same manner because only in that way can the proper dispersion model be formed, based on which adequately reliable data on the spatial distribution of air pollution in the affected zone can be obtained.

In the first phase of monitoring which must last 5 years, it is necessary to carry out periodic monitoring of the air quality (1 month in a season), because in order to establish trends of air pollution it is necessary for measurement data to be obtained for at least five consecutive years.

Only in the case where the results of periodic measurement indicate the necessity for further monitoring of air quality would it be necessary to carry out permanent monitoring of air quality, viz. enacting the second phase of monitoring.

6.2.3. Water

The monitoring program for surface waters during the operation includes monitoring of the following parameters: pH, concentration of dissolved oxygen in the water, waste materials, murkiness, concentration of organic compounds and mineral oil, then temperature, color and odor.

Domestic legal regulations which relate to the method of controlling the quantity and quality of waste water (effluent) before it is released into a recipient cannot be applied to the control of the quality of cleaned atmospheric waste water. Depending on the climatic factors, scope and structure of traffic, the composition of effluent varies during one hydrological year. Besides that, as opposed to a majority of European countries, in Serbia there are no prescribed emissions standards. That is why in this specific case it is only possible to monitor the effect of operation of the future highway on the quality of water of the recipient through emissions standards.

Measuring the quality of water of the recipients (Southern Morava River with its tributaries) is aimed at understanding the effects of runoff waste water on the quality of water in the recipient.

The TOR envisages the water removal system to be an open type system. With that in mind, monitoring of surface water during operation of the project should be carried out at a place downstream from where the water removal canals empty into the recipient Southern Morava.

Purpose of the monitoring is to comply with Serbian legislation. Within the Article 73 of Law on Environmental Protection ("Official Gazette of RS" No. 135/2004, 36/2009, 72/2009) is stated that polluters are obliged to submit the data on monitoring to the Environmental Protection Agency in a way prescribed by regulations.

"Koridori Srbije" needs to ensure that quality of the water which enters the recipient river does comply with the Serbian water class standard for specific river recipient.

It is necessary for the measurement and processing of data to be carried out continuously every four months. This means taking samples in January, April, July and October, which covers all periods of low and high water levels within the function of rain and drought. In that manner, possible concentrations of pollutants in runoff water will be controlled and with that also the condition of the class of the waterways in the studied area.

The monitoring plan for underground waters was done in accordance with the requirements of the TOR as well as in accordance with the basic characteristics of construction of the subject section of the highway.

Within the framework of the geological-hydrological studies on the characteristics of underground waters, a map of the levels of underground waters was drafted which covers the area of the analyzed section. The hydraulic parameters of underground water are determined in each testing which implies the determination of the coefficient of water permeability and its comparison with previously obtained data. Based on these results the hydraulic conditions of each bore hole are determined.

The testing program encompasses the parameters which can be used to evaluate the current condition of the quality of underground water and the degree to which it is polluted with polluting substances from the subject section. The testing program includes the following measurements:

- Terrain measurements: temperature of air and water, pH, electrical conductivity, oxidation/reduction potential,
- Basic parameters: color, dissolved materials, total organic carbon, nitrogen, nitrates, sulfates, chlorides, chemical and biological consumption of oxygen,
- Indicative parameters: microelements, phenols, mineral oil, polycyclic aromatic hydrocarbons, aromatic hydrocarbons, pesticides.

6.2.4. Soil

Monitoring of soil during the operation of the highway, viz. monitoring the effects of operation of the future E-75 Highway, section Gornje Polje - Caricina Dolina, on the quality of soil, must be carried out at the edge of the "buffer zone" of highway.

The Contractor will ensure a preliminary testing ("zero monitoring") of soil pollutants according to the Monitoring Plan of this EMP document. In the preliminary testing, the locations where sampling is done must be selected randomly and be small in number. The first and most important step in the analysis of the quality of soil is the taking of samples. It is not only quality of the measurement results that depends on the manner in which the samples are taken, but also the conclusions which relate to the quality of the analyzed soil. Any particular sample of soil can rarely be reproduced in the sense of its physical and chemical characteristics. For example, the second sample, taken from the same sampling point, won't necessarily be identical to the first sample. The depth of sampling depends on the use of the land, as well as on the effects which are present on that land. From cultivated land, samples are taken from a depth of 0-30 cm and from land which is used for growing fruits, samples are taken from two depths- from 0-30 cm and from 30-60 cm. Individual samples are then placed into a PCV container, mixed up and stones and plant remains are removed. The prepared sample is then put into a PVC bag, marked and transported to the laboratory for analysis.

Following the preliminary testing a plan for further testing is created. For this purpose the place of sampling is defined first. The number of samples depends on the preliminary testing and is related to the structure being tested.

Parallel to the control of the quality of soil, the quality of underground water must also be monitored. The quality of underground water requires the monitoring of pollutants which are present in the soil and for the purpose of determining the effects of soil pollution on the pollution of underground water. Sampling of underground water is done using the piezometer.

6.3. Check List – Monitoring Plan

Details related to the monitoring program are tabulated in Appendix II.

7. PUBLIC CONSULTATION

7.1. Public Consultations on EIS

In respect to environmental safeguard issues, the Client (PEPS) has already prepared subsection EIS on preliminary/feasibility design of E-75 Highway section between Gornje Polje and Caricina Dolina, in accordance with Serbian legislation. The national disclosure process encompassed four rounds of public consultations for each sub-section (on TOR for environmental consultant, on scope of environmental assessment, on draft EIS and on draft final EIS) and were carried out in period from 2006 to 2009.

The national EIA procedure in respect to E-75 highway section from Gornje Polje to Caricina Dolina started at Jan 26, 2006, when PEPS (former Serbian Road Directorate) submitted the Request to the Ministry for environmental protection (MOE) in order to receive document determining scope and content of EIS. According to the Serbian Law on EIA ("Official Gazette of RS" No. 135/2004, 36/2009), this step was announced in daily newspaper "Politika" (Feb 15, 2006), and interested parties were invited to participate in process of defining the scope and content of EIS. At Mar 10, 2006, the Ministry provided the Terms of Reference and that information was made public in daily newspaper "Politika" (Mar 23, 2006). The CIP Institute, Belgrade prepared draft EIS, which was submitted to MOE for its approval (Aug 05, 2008). At the same time PEPS announced this step in daily newspaper "Politika" (Sep 12, 2008), when public and other interested parties and organizations were invited to participate in process of public consultation on draft EIS for E-75 Highway Project, section Gornje Polje - Caricina Dolina.

Public Consultation was held in Leskovac, on Oct 09, 2008, and there were no major complains on prepared draft EIS. The sub-section EIS has been approved by the Serbian Ministry of Environment and Spatial Planning (former MOE) on Jun 18, 2009 (No 353-02-236/2008-02).

7.2. Public Consultations on Corridor Level EIA report

In accordance with OP/BP 4.01 the Borrower has engaged an independent consultant to prepare Corridor Level EIA for E-75 Highway from Grabovnica to Levosoje, which include highway sub-section from Gornje Polje to Caricina Dolina. Besides consolidating the sub-section EIA, the Corridor Level EIA also addressed the cumulative, induced, indirect and transboundary impacts. The draft EIS has been received by the Bank and commented upon. The Client subsequently updated the Corridor Level EIS and prepared a final version of the document.

The in-country disclosure of draft Corridor Level EIS was carried out in the period from February 25 (when the documents were made publicly available on site and at the Client's web site) to March 12th (when the public meetings were held in Vranje). Public announcements in Serbian and English were published in the daily newspaper Politika, inviting the public, authorities and relevant institutions to have an insight into the EIS for the Project. Prior to announcement in the newspapers, the EIS was delivered to the Municipality of Vranje and published on the KS and PE "Roads of Serbia" web site.

Public Consultations were concluded on March 12, 2009, from 12 to 02 PM (local time), by presentation of the subject EIA on the premises of the Municipality of Vranje.

Presentation of the EIA for the E-75 Highway Project, Nis – FYRM Border, Section Grabovnica – FYRM Border, was attended by representatives of the Municipality of Vranje, EIA Author, WB representative, representatives of the PE "Roads of Serbia" and the interested public. List of participants is included in this Report.

During the public consultations, there were no significant remarks in regards to environmental protection issues related to Gornje Polje - Caricina Dolina Highway section.

8. INSTITUTIONAL ARRANGEMENTS

KS is responsible for the overall implementation of the Project, including management of environmental and social issues under the Project.

The EIS for E-75 Gornje Polje – Caricina Dolina highway section, Corridor Level EIA and Detailed Design of Environmental Protection for E-75 Gornje Polje – Caricina Dolina highway section provides the base for the preparation of this site specific EMP. As part of the detailed design stage for this section, KS has prepared this site-specific EMP and Checklists. The site-specific EMP and Checklist are included as part of the bidding documents to ensure the contractors are aware and meet their formal obligations in the area of the environmental protection. After contract signing, The Contractor will prepare his implementation plan, to be approved by the KS ("Corridors of Serbia")'s Supervision Consultant, containing the detailed information on meeting the requirements detailed in this EMP.

During project implementation, a firm of independent consultants, who will report directly to KS, will monitor whether and how well contractor complies with the measures as outlined in the EMP. Any non-compliance with the EMP or any other safeguards will require immediate remediation. Contractors *vis-a-vi* the borrower, and the borrower *vis-a-vis* the Bank will need to present reasons for noncompliance, propose a detailed and time-bound action plan to achieve compliance, and obtain the no objection of the Bank for the action plan. The cost of proposed corrective measures will be borne by the responsible contractor.

9. IMPLEMENTATION SCHEDULE AND REPORTING PROCEDURES

Prior to the commencement of works KS will submit to the Bank for its approval: this section specific Environmental Management Plan and Checklist.

The Contractor will prepare his compliance reports in respect to this EMP and his SSIP at regular intervals as instructed by KS.

The Contractor will submit reports in both Serbian and English language in hard copy and electronic versions.

Separate independent environmental and social supervision will directly reporting to KS for the implementation of the project,

Project progress reports, including monitoring indicators and reporting on the implementation of the requirements set forth in the Environmental Impact Assessments and the Resettlement Policy Framework, will be prepared by KS on a quarterly basis and submitted for Bank review. The Bank will review the reports and verify their contents through periodic site visits.

The Contractor will provide "Zero monitoring" results prior to commencement of earth works, during its own mobilization phase.

Semi-annual reviews will be carried out each year, jointly by the Borrower and the Bank together with other participating IFIs and bilateral donors, to measure progress made in implementing the Project. The semi-annual reviews shall cover, *inter alia*: (a) progress made in meeting the Project objectives; and (b) overall Project performance against Project monitoring indicators.

10. REFERENCE

- 1 Detailed site-specific EIA for E-75 Highway Nis – Border of FYRM, section Gornje Polje - Caricina Dolina, CIP Institute Belgrade, 2008
- 2 Corridor X level EIA Report for E-75 Nis – Border of FYRM Highway, PEPS, 2009
- 3 Environmental Assessment Sourcebook No 25, Environmental Management Plans, The World Bank Environment Department, January 1999
- 4 Roads and the environment: A Handbook, The World Bank Environment Department
- 5 Project Appraisal Document (PAD) to the Republic of Serbia Corridor X Highway Project, Report No: 47069-YF, June 12th, 2009

Appendix I
CHECK LIST
MITIGATION PLAN



Phase, location	Issue	Mitigation	Institutional responsibility		Notes
			Install	Operate	
Highway Construction	Relocation of services	Effective co-ordination with utility companies during relocation.	Contractor, KS	Contractor, KS	
	Noise impact on affected residents, km 873+879 to km 874+110, left side	Noise protection construction, L=230m	Contractor	Contractor	
	Noise impact on affected residents, km 877+565 to km 878+164, left side	Noise protection construction, L=600m	Contractor	Contractor	
	Noise impact on affected residents, km 881+077 to km 881+328, left side	Noise protection construction, L=250m	Contractor	Contractor	
	Noise impact on affected residents, km 881+451 to km 881+614, left side	Noise protection construction, L=163m	Contractor	Contractor	
	Noise impact on affected residents, km 885+133 to km 885+400, left side	Noise protection construction, L=267m	Contractor	Contractor	
	Inadequate prevention of construction-related noise from vehicles, asphalt plants, crushing and batch plants and equipment	The plants and equipment used for construction will strictly conform to noise standards.	Contractor	Contractor	
	Noise Impact - Disturbance to residents	Working hours/activities will be adjusted to reduce noise disturbance and working time restricted to 0630 to 1930hrs, or as otherwise agreed locally. Maintain dialogue or use grievance mechanism to allow residents to contact Project staff to make representations.	Contractor	Contractor	
	Noise impact - Protection of workers H&S	Noise standards will be strictly enforced to protect construction workers from noise impacts, in accordance with international HSE procedures. All Project works will adhere to international H&S standards, including minimum PPE standards, e.g. hard hat, safety boots, ear defenders and noise exposure limited to 85 dB(A).	Contractor	Contractor	
	Construction waste.	Heavy metals are separated and should be removed and disposed of at approved dump sites, in accordance with The Contractors waste management plans (WMP).	Contractor	Contractor	
	Potential contamination of soil and water resources.	Each parking, service, or cleaning and washing plateau will be equipped with waste water treatment facilities which will be temporary objects	Contractor	Contractor	
	Maintaining animal mobility through culverts and bridges	Use of designed culverts and bridges as animal crossing points.	Contractor	Contractor	
	Emission from construction vehicles and machinery	All vehicles, equipment and machinery used for construction will be regularly maintained and inspected/certificated to ensure that the pollution emission levels conform to the standards prescribed.	Contractor	Contractor	

Phase, location	Issue	Mitigation	Institutional responsibility		Notes
			Install	Operate	
	New borrow pits damaging agricultural, archaeological or ecological resources	Contractor have to use the Borrow pits on a specific locations which are predefined within the Detailed design	Contractor	Contractor	
	Asphalt-plant-dust, fumes, workers health and safety, ecosystem disturbance	Contractual requirement-use existing asphalt plants; requirement for official approval or valid operating license or new plants require certification and approval.	Contractor	Contractor	
	Stone quarry	Contractual requirement-use existing quarries; requirement for official approval or valid operating license.	Contractor	Contractor	
	Sand and gravel borrow pit-disturbance of river bed, water quality, ecosystem disturbance	Contractor has to use the Borrow pits on specific locations which are predefined within the Detailed design . It is allowed to use existing borrow pits or buy material at licensed facilities; no borrowing from rivers. Or use new pits which require approval and licensing.	Contractor	Contractor	
	Construction related dust, from movement of vehicles at site and to sites from borrow pits and quarry sites, etc.	Dust suppression will be used on unsealed road surfaces, asphalt mixing sites and temporary service areas. Water truck bowser with spray bar will be used.	Contractor	Contractor	
	Vehicles hauling materials will generate dust nuisance	Vehicles delivering material will be covered.	Contractor	Contractor	
	Failure to properly manage/store topsoil, leading to degraded and substandard site reclamation and re-vegetation	Clearly defined topsoil storage and handling in contract specification and management plan and follow up with regular inspection & monitoring and reporting.	Contractor	Contractor	
	Flora - vegetation protection	Clearing up and removal of vegetation should be minimized to the extent necessary for the execution of works	Contractor	Contractor	
	Preventing domestic and wild animals straying onto the road and being killed	Erection of a protective fence along the road, as a measure to prevent domestic and wild animals straying onto the road and being killed. Protective fence should be built with the variable density	Contractor	Contractor	
	Landscape impact, soil erosion	Develop and implement landscape planting: Re-forest ground of classes 6 and 7 under high and excessive erosion	Contractor, KS	Contractor, KS	
	Damage to agricultural lands, including drainage and irrigation infrastructure	Liaise effectively with PAPs before start of construction, maintain dialogue, develop a grievance procedure, strictly control machinery and vehicle access and reinstate all affected areas.	Contractor	Contractor	
	Livestock resources damaged by machinery and vehicles	Liaise effectively with PAPs before start of construction, maintain dialogue, develop a grievance procedure, strictly control machinery and vehicle access, and consider fencing for protection.	Contractor	Contractor	

Phase, location	Issue	Mitigation	Institutional responsibility		Notes
			Install	Operate	
	Contamination of soil or water resources	Storage and handling of fuels, oils and other hydrocarbons will be a controlled process, involving measures to prevent soil and water contamination. Designs will include storage on sealed surfaces and within secondary containment and refueling of all plant, vehicles and machinery will not be allowed within 50 m of any watercourse, drain or channel leading to a water course.	Contractor	Contractor	
	Damage to aquatic ecosystems	Prevent the movement of machines inside rivers, streams, or on their banks, except when it is unavoidable due to the construction of a structure or construction.	Contractor	Contractor	
	Contamination of soil or water resources	All sites near rivers shall be protected by fencing and other means to prevent loss of construction materials, particularly hazardous materials.	Contractor	Contractor	
	Traffic disruption to residents and longer distance travelers	Develop Traffic Management Plan in conjunction with road authorities to manage all temporary accesses, delivery of material and machinery.	Contractor	Contractor	
	Residents injured by construction traffic and machinery	Conduct safety awareness campaigns, focusing on schools and children.	Contractor	Contractor	
	Workers injured during construction	Implement international HSE standards in all contracts.	Contractor	Contractor	
	Illegal or excessive borrowing may damage archaeological or land resources	No earth borrowed from unauthorized locations.	Contractor	Contractor	
	Reduced land or property values	Establish and maintain dialogue with PAPs to reduce adverse effects as part of ongoing design and construction.	Contractor, KS	Contractor	
	Contamination of soil or water resources	Contaminated or hazardous waste such as bitumen waste to be disposed of in selected areas approved by the Ministry of Environment. All waste disposal to comply with a Waste Management Plan, to be developed at the start of construction.	Contractor	Contractor	
	Pollution of groundwater and soils during demolition of properties	Develop working method statement to include effective management of materials.	Contractor	Contractor	
	Damage to water resources	All abstractions and any formalized discharges must be licensed/ approved by relevant authorities.	Contractor	Contractor	
	Damage to aquatic habitats and fish	All in-river works will be conducted outside of the fish spawning season and Contractors will prepare management plans for such works as a part of their Construction Method Statements.	Contractor	Contractor	
	Damage to river morphology	Digging and making the foundations for bridge piers, retaining walls, and structures located at, or in the vicinity of, surface water bodies, will take place in the period of low water levels (July-September) so as to minimize negative impacts on rivers and their banks.	Contractor	Contractor	



Phase, location	Issue	Mitigation	Institutional responsibility		Notes
			Install	Operate	
	Soil and water pollution	Construction vehicles and equipment will be maintained and refueled at protected refueling stations. Fuel storage and handling sites located away from drainage channels and important water bodies in accordance with Management Plan.	Contractor	Contractor	
	Soil and water pollution	Develop plans for cement and wash-water management.	Contractor	Contractor	
	Water pollution	Develop monitoring program for sensitive water courses, such as major river crossings and reporting, feedback and remedial action procedures. This should be linked to the Management Plans to be developed by The Contractors.	Contractor	Contractor	
	Temporary access-vegetation removed, soil compacted, landscape and vegetation impacted	Remove topsoil layer initially and afterwards de-compact alignments and reinstatement topsoil and perform re-vegetation	Contractor	Contractor	
	Impact on fish and other animals that depend on water as eco-system	Avoid river control works in the period of fish spawning. All in-river works will be conducted outside of the fish spawning season and Contractors will prepare management plans for such works as a part of their Construction Method Statements.	Contractor	Contractor	
	Land resources damaged	Identify work areas with contractor(s) and describe system approvals for extensions and fines for violations.	Contractor	Contractor, KS	
Construction camps	Community tension and disruption	Locations for camps are predefined within the Detailed Design of the Project. Contractor should prepare Camp Management Plan	Contractor	Contractor	
	HSE Standards	Work camps are required to conform to international Health, Safety and Environment (HSE) standards	Contractor	Contractor	
	Wastewater collection and disposal/treatment	Camps should be furnished with sanitary and wastewater collection and disposal/treatment facilities and should operate fully compliant waste systems, involving storage of waste by waste category.	Contractor	Contractor	
	Contamination of soil or water resources	Storage of fuels and re-fueling of equipment will be controlled in floodplains to prevent groundwater pollution. No storage of fuels and oils will be allowed in floodplains where the potential for washout exists.	Contractor	Contractor	
	Spread of disease, including STIs	Conduct awareness campaigns for camp workers and if relevant nearby communities.	Contractor	Contractor	
	Water and soil pollution	The sewage system for such camps will be properly designed and built so that no water pollution takes place. Such facilities will be decommissioned at end of the construction period.	Contractor	Contractor	

Prior to initiating works, the Contractors will be required to prepare and submit for approval Site-Specific Implementation Plans (SSIP) consisting of:

Waste and wastewater management plan

The Contractor's SSIP should cover all aspects of waste management, including implementation of practice standards such as reduce, re-use and recycle. It should specify final disposal alignments for all waste and demonstrate compliance to national legislation and best practice procedures on waste management.

The WMP will, as a minimum, include details of temporary waste storage, waste transfer and pre-treatment prior to final disposal or recycling. Licensed/approved facilities for solid and liquid waste disposal must be used and a duty of care and chain of custody for all waste leaving the site will be followed. As part of the plan Contractors will be expected to produce waste handling forms for chain of custody, which will be used to control waste leaving site. Thus the waste controller will keep a copy of the form and the driver will always carry a copy and will ensure that the load is signed for at the final disposal site. All records will be kept by The Contractor for audit purposes and to demonstrate that the project is complying with best practice and applicable legislation.

Oil and fuel storage management plan

The Contractor's SSIP should cover all procedures for storage, transportation and usage of oils and fuels, refueling of plant and machinery and procedures for minimizing the risk of ground and water contamination. All oils and fuels will be required to be stored within secondary containment of 110 % capacity and all spillages shall be cleaned up immediately. Re-fuelling vehicles will carry Spill Kits to enable spillages to be cleaned up as soon as possible. All categories of spillage will be reported in accordance with the Plan to be developed by The Contractor. Toolbox Talks would be expected to be delivered on an ongoing basis as „continued training” and following any significant incident.

In-river works management plan

The Contractor's SSIP should cover procedures and plans for safeguarding aquatic habitats and fish during in-river construction work and will complement the Construction Method Statements.

Camp management plan

The Contractor's SSIP should contain procedures for establishing and operating construction camps in order to safeguard nearby communities and environmental resources.

Re-forestation plan

In accordance with the preconditions obtained from INP, The Contractor will prepare plan for reforestation areas which were destroyed during construction phase.

Emergency response plan

The Contractor's SSIP should contain procedures for emergency response in the event of accidents or major incidents, in order to safeguard people, property and environmental resources.



Appendix II
CHECK LIST
MONITORING PLAN

Phase, item	What parameter is to be monitored?	Where is the parameter to be monitored?	How is the parameter to be monitored?/ type of monitoring equipment	When is the parameter to be monitored? (frequency of measurement or continuous)	Why is the parameter to be monitored? (optional)	Install and operate
Construction						
Contamination of surface water during construction	suspended solids, organic compounds, lubricants, fuel, solvents, heavy metals, pH value, mineral oils	On a part of a surface waterway downstream from the construction site.	Water quality analysis	before the commencement of works, at the time when humus is being removed and when excavation or the building of embankments from earth material is being carried out. During construction sampling will be done on monthly basis	EIA compliance	Contractor
Contamination of underground water during construction	suspended solids, organic compounds, lubricants, fuel, solvents, heavy metals, pH value, mineral oils	On the basis of the program prescribed within the main design of environmental protection	Water quality analysis	One month before the commencement of works. During construction sampling will be done quarterly.	EIA compliance	Contractor
Contamination of soil during construction	Heavy metals and greases and oils	On the basis of the program prescribed within the main design of environmental protection	Soil quality analysis	One month before the commencement of works. During construction sampling will be done quarterly.	EIA compliance	Contractor
Noise	Noise Levels	km 873+879 to km 874+110	Noise meter	Every month	Settlement potentially affected with the noise	Contractor
Noise	Noise Levels	km 877+565 to km 878+164	Noise meter	Every month	Settlement potentially affected with the noise	Contractor
Noise	Noise Levels	km 881+077, to km 881+328	Noise meter	Every month	Settlement potentially affected with the noise	Contractor
Noise	Noise Levels	km 881+451, to km 881+614	Noise meter	Every month	Settlement potentially affected with the noise	Contractor
Noise	Noise Levels	km 885+133, to km 885+400	Noise meter	Every month	Settlement potentially affected with the noise	Contractor
	Damage to irrigation and Drainage infrastructure	Agricultural lands	Visual observations, discussions with PA's	weekly	Compliance to EIA and social commitments	Contractor e.g. Environmental staff

Phase, item	What parameter is to be monitored?	Where is the parameter monitored?	How is the parameter to be monitored?/ type of monitoring equipment	When is the parameter to be monitored? (frequency of measurement or continuous)	Why is the parameter to be monitored? (optional)	Install and operate
	Dust	At construction sites	Visual monitoring	Regularly site visits	Check environment and H&S requirements	Contractor
	Waste water from construction camps and portable sites	At construction camps and portable facilities at work sites	Monitoring of appropriate installation and operation of wastewater units, latrines and septic tanks	Regularly site visits	Check environment requirements are being maintained	Contractor
	Community tension and disruption.	Construction sites	Observation	Regularly site visits	EIA compliance	Contractor
Air Quality	Measuring carbon monoxide (CO) and nitrogen dioxide (NO2) is recommendable in stage one. If the measurement results show exceeded allowable concentration values, the list of pollutants should be extended by measuring the concentrations of nitrogen monoxide (NO), sulphur dioxide (SO2), hydrocarbon (CXYH), and solids/particulates (PM10).	Characteristic profiles according to the monitoring program produced by Contractor and approved by KS	Laboratory equipment	Two times during Construction works	Settlement potentially affected with the air pollution	Contractor
	Asphalt plant - possession of official approval or valid operating license	asphalt plants	Supervision inspection	before work begins	Ensure plant compliance with environment, health and safety standards	Plant Operator, contractor
	Stone quarry - possession of official approval or valid operating license	stone quarry	Supervision inspection	before work begins	Ensure compliance with EIA	Quarry Operator, contractor
	Sand and gravel borrow pit - possession of official approval or valid operating license	sand and gravel borrow pit	Supervision inspection	before work begins	Ensure compliance with EIA	Quarry Operator, contractor
	Asphalt, dusty, bulk materials - truck load covered and/or wetted	job site	Supervision inspection	Regular inspections during work	Ensure compliance of performance with environment, health and	Contractor
	Traffic management - hours and alignments selected	job site	Supervision inspection	Regular inspections during work	Ensure compliance with EIA	Contractor
Construction site						

Phase, item	What parameter is to be monitored?	Where is the parameter to be monitored?	How is the parameter to be monitored?/ type of monitoring equipment	When is the parameter to be monitored? (frequency of measurement or continuous)	Why is the parameter to be monitored? (optional)	Install and operate
Vibration	Vibration levels	job site	Supervision, observations	Regular inspections during work and on complain	Ensure compliance to EMP	Contractor
Noise disturbance to human and animal population	noise levels; equipment	job site; nearest homes	Mobile noise meter	once per week and on any complaint	assure compliance to EMP	Contractor
Traffic disruption	existence of traffic management plan; traffic congestion	at and near job site, local roads	inspection; observation	before works start; once per week at peak periods	assure compliance to EMP	
Workers safety	Protective equipment; organization of bypassing traffic	job site	inspection	Regular inspections during work	Ensure compliance to EMP and H&S standards.	Contractor
Operation						
Contamination of soil during highway operation	Heavy metals and greases and oils	On the basis of the program prescribed within the main design of environmental protection	Soil quality analysis	Quarterly, at least 5 years during operational phase of highway section	EIA compliance	Contractor
Contamination of soil or water resources.	Concentration of dissolved oxygen, waste materials, oil, suspended solids, organic compounds, lubricants, fuel, solvents, heavy metals, pH value, color and odor	On river Southern Morava, Characteristic profiles according to the monitoring program produced by Contractor and approved by KS	it is necessary for the measurement and processing of data to be carried out continuously every four months. (January, April, July and October)	Monthly, at least 5 years during operational phase of highway section	EIA compliance	PEPS
Maintenance						
Noise disturbance residents, workers	noise levels	job site; nearest homes	Noise meter	Regularly	Ensure compliance to HSE Standards.	Maintenance Contractor

Phase, item	What parameter is to be monitored?	Where is the parameter to be monitored?	How is the parameter to be monitored?/ type of monitoring equipment	When is the parameter to be monitored? (frequency of measurement or continuous)	Why is the parameter to be monitored? (optional)	Install and operate
Possible air, water and soil pollution	air, water and soil quality (suspended solids, organic compounds, lubricants, fuel, solvents, heavy metals, pH value, water conductivity)	job site; material storage areas; wash down areas for equipment; equipment maint. facilities	laboratory with necessary equipment	Regular inspections during maintenance activities and on complain	Ensure compliance to HSE Standards.	Maintenance Contractor
Vibrations	limited time of activities	job site	supervision	Regular inspections during maintenance activities and on any complaint		Maintenance Contractor
Workers safety	Protective equipment; organization of bypassing traffic	job site	inspection	Regular inspections during maintenance activities and on any complaint		Maintenance Contractor
Road safety						
Increased vehicle speed	condition of traffic signs; vehicle speed	road section included in project	visual observation; speed detectors	during maintenance activities; unannounced	a)-b) enable safe and economical traffic flow	Traffic Police
Erosion, rockfall, hazardous conditions	condition of hazard signs	road section included in project	visual observation	during maintenance activities	Maintenance Contractor	Traffic Police, Supervision Contractor



Appendix III

LEGISLATION

MAIN SERBIAN LEGISLATION:

The main laws and regulations currently in force in Republic of Serbia which are relevant to the environmental protection during planning, design, construction and operating of this Project are listed below:

- Law on planning and construction ("Official Gazette of RS" No. 72/2009, 81/2009)
- Law on nature protection ("Official Gazette of RS", 36/09)
- Law on environmental protection ("Official Gazette of RS" No. 135/04, 36/09, 72/09)
- Law on EIA ("Official Gazette of RS" No. 135/2004, 36/2009)
- Law on Strategic EIA ("Official Gazette of RS" No. 135/2004)
- Law on waste management ("Official Gazette of RS", 36/09)
- Law on noise protection ("Official Gazette of RS", 36/09)
- Law on water ("Official Gazette of RS", 46/91, 53/93, 67/93, 48/94, 54/96, 101/05)
- Law on forest ("Official Gazette of RS", 46/91, 83/92, 54/93, 60/93, 53/93, 67/93, 48/94, 54/96, 101/05)
- Law on air protection ("Official Gazette of RS", 36/09)

Regulations established on the basis of the Law on EIA include the following:

- Decree on establishing the List of Projects for which the Impact Assessment is mandatory and the List of projects for which the EIA can be requested ("Official Gazette of RS" No. 114/08)
- Rulebook on the contents of requests for the necessity of Impact Assessment and on the contents of requests for specification of scope and contents of the EIS ("Official Gazette of RS" No. 69/05)
- Rulebook on the contents of the EIS ("Official Gazette of RS" No. 69/05)
- Rulebook on the procedure of public inspection, presentation and public consultation about the EIS ("Official Gazette of RS" No. 69/05)
- Rulebook on the work of the Technical Committee for the EIS ("Official Gazette of RS" No. 69/05)
- Regulations on permitted noise level in the environment ("Official Gazette of RS" No. 54/92)
- Decree on establishing class of water bodies ("Official Gazette of SRS" No. 5/68)
- Regulations on dangers pollutants in waters ("Official Gazette of SRS" No. 31/82)

Other relevant Serbian legislation

- Law on confirmation of convention on information disclosure, public involvement in process of decision making and legal protection in the environmental area ("Official Gazette of RS", 38/09)
- Law on public roads ("Official Gazette of RS" No. 101/2005, 123/07)

Appendix IV

PRECONDITIONS FROM THE RELEVANT INSTITUTIONS



1. PRECONDITIONS OBTAINED FROM INP



ЗАВОД ЗА ЗАШТИТУ ПРИРОДЕ СРБИЈЕ

Београд • ул. Београд - Царичина Долина • бр. 91 • тел. 011/2603-886, 2603-887 • факс. 011/2603-887 • e-mail: info@natprotection.org.rs

1-2 JUL 2006
566-329/07

19. 05. 2006

Бр. 03 - 853 / 02

САОБРАЋАЈНИ ИНСТИТУТ ЦИП Д.О.О.
Немањина 8
11000 БЕОГРАД

УСЛОВИ ЗАШТИТЕ ПРИРОДЕ И ЖИВОТНЕ СРЕДИНЕ
ЗА ПОТРЕБЕ ИЗРАДЕ ИДЕЈНОГ ПРОЈЕКТА АУТОПУТА Е-75, БЕОГРАД
- НИШ - ГРАНИЦА БЈР МАКЕДОНИЈА, ДЕОНИЦА ГОРЊЕ ПОЉЕ -
ЦАРИЧИНА ДОЛИНА ОД km 873+714.86 ДО km 886+050.91

Саобраћајни институт ЦИП д.о.о. поднео је захтев за издавање услова који су од значаја за израду Идејног пројекта аутопута Е-75, Београд - Ниш - Граница БЈР Македонија, деоница Горње Поље - Царичина долина од km 873+714.86 до km 886+050.91 (бр. 566-329/07 од 19. 05. 2006.).

На основу достављене документације и увида у Регистар заштићених природних добара у Републици Србији, Завод за заштиту природе Србије констатује, да се на траси Идејног пројекта аутопута Е-75, Београд - Ниш - Граница БЈР Македонија, деоница Горње Поље - Царичина долина, не налазе посебно заштићена природна добра те Обрађивач Идејног пројекта нема посебних обавеза према чл. 61. и 61. Закона о заштити животне средине („Службени гласник РС”, бр. 66/94).

Међутим, Обрађивач Идејног пројекта је обавезан да према релевантној законској регулативи изврши валоризацију и утврди начин, мере и услове заштите природе и животне средине, односно адекватно коришћење и уређење простора у складу са наменом, највише у вези са чињеницом да је због своје угрожености флора и Фауна на читавој територији Србије под одређеним видом заштите (Уредба о заштити природних реткости «Службени гласник Републике Србије» бр. 50/93; Уредба о стављању под контролу коришћења и промета дијалге флоре и фауне «Службени гласник Републике Србије» бр. 31/2005). Са тим у вези:

РАДНА ЈЕДИНИЦА У БЕОГРАДУ
21000 Нови Сад, Раденска 20
тел. 011/403-144, 401-145, телефакс. 011/401-052
nat@natprotection.org.rs

РАДНА ЈЕДИНИЦА У НИШУ
18000 Ниш, Вождарска 11
тел/факс. 018/523-448, 523-449
nis@natprotection.org.rs

РАДНА ЈЕДИНИЦА У ГРИНГЛАСУ
81000 Гр. Београд, Др Милана Ракића 91
тел. 011/2603-886, 2603-881; факс. 011/2603-887
beograd@natprotection.org.rs

www.natprotection.org.rs

TRACE
ТРЕИС ГРУП ХОЛДАА

259/733

необходно је у што већој мери очувати ова станишта на току Јужне Мораве и у њеној правној зони.

Надаље, већи део предметне деонице аутопута Е-75 пролази кроз Грделичку клисуру која представља рефугијум терцијерне флоре, ретких угрожених биљних врста и мешовите реликвне вегетације, те су њено очување и заштита од изузетног значаја. Овде се могу наћи врсте које су у Србији постале ретке или су сасвим ишчезле. Такве су ендемичне балканске врсте: *Colobarda veschitziana* (Pančić ex Hutch), *Soo* (Ихтормишов жаворњак) чије се станиште налази у непосредној близини деонице (Царичина долина) у клисури Деравен. Наиме, овај такође је урлићен у Црвену књигу флоре Србије I. Обзиром да сва врста расте на сраницама поред путева, претпоставка је да и у самој Грделичкој клисури (на деоници аутопута Царичина долина - Владичин Хан), има станишта на којима би се могла пронаћи. У случају да се негативни утицаји наставе ова станишта би постала еколошки лабилна и рањива.

Такође, клисура представља и један од коридора којим се поједини представници херпетофауне шире од југа према северу. Овај коридор је уједно и најкраћи пут између Врањске и Лесковачке котлине. Врсте који користе овај коридор су Стелски гуштер *Podiceps fusicus*, као и Балкански зидни гуштер *Podiceps alpestris*. Очување овог дела коридора је изузетно значајно ако се има у виду да се рубови ареала ових врста налазе на управо поменутих просторима.

Фауну птица Грделичке клисура карактерише већи број заштићених и угрожених врста. То су пре свега грабљивице, као што су сури арао *Aquila chrysaetos* и сиви соко *Falco peregrinus*. Популације ове две врсте су у неповољном положају, зависе од заштите, па је неопходно смањење или елиминисање негативног антропогеног утицаја. Поред њих, не треба занемарити остале, карактеристичне врсте термофилних, камених станишта овог подручја, као што су велика ушара *Bubo bubo*, јаребица камењарка *Alectoris graeca*, планински мис *Molticola satralis*, медитеранска белка *Sciurus hibernicus*, даурска ласта *Nucifraga caucasica*.

ЕКОЛОШКИ КОРИДОРИ

Изградњом аутопута врши се фрагментација станишта биљних и животињских врста и ствара се непропустљива баријера за највећи (или велики) број животињских врста. Ради очувања биодиверзитета региона неопходно је обезбедити слободно кретање јединки између очуваних субпопулација природних станишта. Због тога је неопходна изградња еколошких коридора, који повезују просторне јединице изолованих природних станишта. Очување проходности ових еколошких коридора је од приоритетног значаја за очување биодиверзитета региона, како врста. Законом заштићених као природне реткости, тако и значајних ловних врста. У ту сврху потребно је током пројектовања и изградње аутопута планирати и изградњу пролаза са ситне и крупне животиње, изнад или испод аутопута, зависно од потребе и карактеристике терена како би се негативни ефекти саобраћајнице што више ублажили.

Користећи нека досадашња позитивна инострана искуства, сматрамо да су се мултифункционални пролази за ситне и крупне животиње, првенствено сисаре, показали као једина решења овог проблема:

- Предвиђени прелази (мостови) преко водотока такође се могу искористити као својеврсни еколошки коридори, уз мале преправке. Корито водотока треба да заузима највише једну трећину пролаза испод пута;
- Димензије пролаза пројектовати тако да испуне овај услов;
- Профил корита унутар пролаза треба да има нагиб мањи од 45° (оптимално 30°);
- Странице обалоутарда водотока унутар пролаза треба да буду грубо хрпаве (нпр. прављењем хоризонталних ребара), чиме би се спречило клизање животиња у воду, и омогућило њихов лакши излазак из воде;
- Простор испред и иза пролаза треба да буде прекривен истоветним типом земљишта на датом локалитету, и природном вегетацијом околине;
- Као пролазе за водоземце и неке друге врсте животиња које преферирају влажна станишта и живе у близини воде, могуће је искористити већ пројектоване цеви за дренажу тла.

ПОЗАЈМИШТА

Позајмишта песка и земљишта имају вишеструки негативни утицај на биодиверзитет. У случају стварања отвореног воденог окна фреатске издани на позајмишту, долази до загађивања фреатске издани. Отворено фреатско окно својим испаревањем негативно утиче на природни режим околних влажних станишта. После напуштања позајмишта, обновљена природна вегетација и водена површина привлачи животињске врсте, које могу да страдају на аутопуту. Дугорочно посматрано овакво станиште функционише као клопка за многе врсте. Највише су угрожене популације птица, водоземаца и гмизаваца.

Услови:

- Позајмишта не могу да се копају дубље од максималног нивоа подземне воде, да би се спречила појава отвореног фреатског окна;
- Позајмишта код прелаза за дизелач треба да садрже очуване делове плодног земљишта оригиналне структуре (обезбедити потребну количину плодног земљишта) ради формирања ремиза;
- Приликом ревитализације обновити вегетацију која је карактеристична за дату област. Избежавати озелењавање дрвенастим врстама и врстама са привлачним плодовима да би се спречавало привлачење птичјих врста и њихово страдање уз аутопут.

УТИЦАЈ АУТОПУТА НА ЗЕМЉИШТЕ

Изградња и експлоатација аутопута утичу на земљиште на коме сам флоре и фауне обитава и људска популација, па је неопходно дефинисати ужу и ширу зону утицаја изградње и функционисања објекта аутопута на животну средину (посебно са аспекта очувања пољопривредног земљишта и производње хране одговарајућег квалитета). С тим у вези треба предвидети зоне утицаја и количине загађивача који спирањем са коловоза аутопута доспевају у земљиште и воду, те на основу тога утврдити мере и препоруке за коришћење земљишта.

На површинама и зонама где су концентрације тешких метала и других загађивача веће од дозвољених мора се утврдити таква намена површина којом ће се избећи културе које служе за исхрану људи и стоке (земљиште поред аутопута може се користити у пољопривредне сврхе на удаљености 30 м од ивице коловоза). На површинама за које се утврди да су у таквој зони утицаја аутопута најсавршеније је предвидети пошумљавање, односно културе засада дрвета или других индустријских биљака.

Осим наведених мера које се односе на заштиту флоре, фауне, и земљишта, Идејним пројектом аутопута Е-75, Београд – Ниш – Граница БЈР Македонија, десница Горње Поље – Царичина долина обезбедиће се услови за изградњу саобраћајних површина, инфраструктурних мрежа и објеката, као и уређење простора, те са тим у вези морају бити испуњени и следећи услови:

1. Обрађиваћ Идејног пројекта аутопута Е-75 је дужан да, у складу са Законом о процени утицаја на животну средину („Службени гласник РС”, бр. 135/04), код надлежног органа покрене поступак процене утицаја планираних радова на животну средину.
2. Приликом израде идејног пројекта аутопута Е-75 на предметној локацији посебну пажњу обратити на подручја значајна са аспекта заштите природе. Ово се посебно односи на шумске комплексе, водотокове и њихова приобаља, барске и мочварне површине, ливаде и сл. Иако се ради о мањим површинама, окруженим навољима и пољопривредним земљиштем, оне представљају посебне остатке природних станишта флоре и фауне. Стога треба настојати да траса аутопута буде тако дефинисана да се планираним радовима не униште потпуно, односно уништење постојеће флоре и фауне свести на најмању могућу меру, а по завршетку радова обавезно је успоставити биљни покривач (култивисати терен) на свим угроженим местима, применом одговарајуће флоре и таквих врста које су биолошки постојане у датим климатским условима, отпорније на штетне утицаје (издуване гасове и сл.) као и да је избор врста усклађен са околним простором и његовом наменом.

3. Предвидети формирање zelenih poјасова у аутопут, као и заштитних конструкција различитих апсорпционих својстава у функцији заштите од буке и умањења негативних ефеката загађења ваздуха. Ове заштитне појасове треба лоцирати нарочито на оним деоницама где траса аутопута тангира рурална и урбана насеља.
4. Идејним пројектом утврдити начин организације градилишта аутопута са јасно прецизираним локацијама за објекте, паркинге и путеве проласка тешке механизације, као и позајмишта, односно депоније материјала, те начин и мере санације и уређења путног појаса, односно стављања простора у намену утврђену пројектном документацијом.
5. Посебну пажњу посветити заштити и уређењу простора, односно локалитета где су смештене базе за одржавање пута. Мере заштите треба да спрече негативне ефекте на животну средину које сви објекти, са машинама и пратећим садржајима, могу изазвати.
6. Начин транспортовања, утовар, истовар и депоновање грађевинског материјала одредити посебно за сваку деоницу аутопута, тј. градилиште.
7. Забрањено је сервисирање и одржавање возила, грађевинских машина и сл. дуж трасе пута. Уколико дође до хаваријског изливања уља или горива неопходно је извршити санацију локације.
8. Текуће одражавање возила, грађевинских машина и сл. вршити на прописно изграђеном каналу. Инвеститор је у обавези да обезбеди сакупљање отпадних материја при сервисирању, и њихово одлагање у складу са законом.
9. Забрањено је депоновање шута, земље и осталог отпада у зони трасе пута и непосредно уз њу, током и по завршетку радова, осим на локацијама које ће се пројектом организације градилишта утврдити као привремене или трајне депоније.
10. Хумус који ће бити коришћен за радове на санацији терена засебно депоновати и заштити од спирања.
11. Строго је забрањено бацање комуналног и другог отпада у водотоке и земљиште.
12. Комунални отпад се може привремено депоновати дуж трасе аутопута на одговарајући начин постављањем одговарајућих специјалних судова за његово прикупљање. Током извођења радова, инвеститор је обавезан да у оквиру простора одржава максимални ниво комуналне хигијене.
13. Посебно предвидети заштиту водотока и земљишта, од пробоја загађења у случају авцидентних ситуација, нарочито код превоза

опасних материја. У случају инцидента и изливања загађујућих материја (горива, моторног уља и др.) како у водотоке, тако и у земљиште, неопходна је загађено место евакуисати под условима надлежне комуналне службе, а локацију санирати.

14. При пројектовању система одвођења атмосферских вода применити таква решења која ће спречити директно изливање штетних материја на коловоза, у водотоке и земљиште.
15. Такође, евентуалне усене и насипе пројектовати тако да прате и да се уклапају у природни облик терена, односно применити биоинжењерске мере заштите терена од ерозије. Приликом покривања шкарпи вегетацијом, треба имати у виду да постоји природни, максимални степен нагиба до кога се вегетација може одржати без помоћи техничких мера. Земљиште доста стрмих шкарпи треба учврстити жичаном мрежом испод које се сади трава и аутохтоно шибље.
16. Сва посајмишта по завршетку рада треба довести у одговарајуће функционално стање усаглашено са непосредном околином. Посајмишта рекултивисати тако што се земљиште прво насипа хумусом, а затим се пошумљава – озелењава одговарајућим аутохтоним врстама флоре.
17. На свим ризичним пунктовима трасе аутопута обезбедити одговарајуће противпожарне мере заштите, посебно шума, људства, технике на градилишту и др.
18. Уколико се приликом извођења грађевинских радова на траси аутопута јави потреба за уређењем водотокова, обавезна је примена тзв. „натуралног уређења“, приликом природних материјала, вегетације и сл. из самог окружења истих. Забрањује се бетонирање обала и корита водотокова, те је обавезно њихово максимално очување, посебно обала и корита реке Јужно Мораве, а све у циљу заштите и очувања станишта аутохтоне водене, и терестричне флоре и фауне тога подручја.
У случају да је неопходно измештање корита водотокова, потребно је то чинити у што мањем обиму, и то само колико је неопходно за изградњу аутопута. При формирању новог корита и обала, водити рачуна да се њихов изворни и аутентичан изглед и намена очува.
Такође, уколико се јави потреба пресецања корита водотокова, неопходно је обезбедити одређена пропусне за несметан ток воде, а самим тим и несметан живот и развој водене флоре и фауне.
19. Идејним пројектом обавезно предвидети да, уколико се у припреми локација планираних за изградњу аутопута, односно свих објеката везаних за исти, открије природно добро које је геолошко – палеонтолошког или минеролошко – петрографског порекла, а могло би да има својства природног споменика, извођач радова има обавезу

да о томе обавести Завод за заштиту природе Србије и да предузме све мере како се природно добро не би оштетило до доласка овлашћеног лица.

20. По усвајању пројекта, молимо вас да нас повратно информисете о реализованом концепту, посебно за сегмент који се односи на заштиту природе и животне средине, како би смо слично, прихватљиве варијанте и даље примењивали у пракси (нпр. ефикасност постојења одређених прелаза и пролаза за животиње, њихово одржавање, економичност за сам пројекат итд.).
21. Обрађивач је дужан да поштује и све друге одредбе заштите утврђене Законом о заштити животне средине, другим прописима као и важећим планским актима вишег реда.

Образложење

Одредбом члана 33. и 34. Закона о заштити животне средине („Службени гласник РС”, бр. 135/04) и члана 51. и 51. Закона о заштити животне средине („Службени гласник РС”, бр. 66/91), одређено је да организација за заштиту природе, тј. Завод за заштиту природе Србије утврђује услове заштите и даје податке о заштићеним природним добрима у поступку израде просторних и других планова, односно основа (шумских, водoprивредних, ловних, риболовних и др.) и друге инвестиционо – техничке документације.

У складу са наведеном законском одредбом, САОБРАЋАЈНИ ИНСТИТУТ ЦИП д.о.о., поднео је захтев бр. 566-329/97 од 19. 05. 2006. године за издавање услова заштите природе и животне средине за потребе израде Идејног пројекта Е-75, Београд – Ниш - Граница БЈР Македонија, деоница Горње Поље – Царичина долина од km 873+714.86 до km 886+050.91.

Достављено:

- Наслову
- Министарству науке и заштите животне средине
Управа за заштиту животне средине
- Архиви

Директор Завода
Проф. др. Лидија Амиџић
Лидија Амиџић



ЗАВОД ЗА ЗАШТИТУ ПРИРОДЕ СРБИЈЕ

СЕДНИШТЕ • 11000 Београд, Др Војна Рајска 51 • тел: 011 2663-800, 2043-401 • факс: 011 2663-897 • beograd@natureprotection.org.rs

број: 27. 02. 2006
број: 03 - 237 / 2

САОБРАЋАЈНИ ИНСТИТУТ - ЦИП д.о.о.
Б Е О Г Р А Д

пријем: 29 FEB 2006
Број: 03-237/2
6 566-360/07

САОБРАЋАЈНИ ИНСТИТУТ ЦИП д.о.о.
Немањина 6/IV
11000 БЕОГРАД

Предмет: Допуна и измена Улова заштите природе и животне средине за потребе израде Идејног пројекта аутопута Е-75, Београд – Ниш - Граница БЈР Македонија, деоница Горње Поље – Царичина долина од км 873+714.86 до км 885+726.739

Саобраћајни институт ЦИП д.о.о., поднео је захтев за допуну и измену Улова заштите природе и животне средине бр. 03 – 853/2, издатих 29. 06. 2006. године, за изградњу и експлоатацију планираних објеката, са предлогом евентуалних мера заштите за подручје које обухвата зону утицаја аутопута Е-75, Београд – Ниш - Граница БЈР Македонија, деоница Горње Поље – Царичина долина.

Допуна и измена наведених услова је потребна због измене дела Идејног пројекта (промена траса аутопута од км 878+960.41 до км 881+819.43). Траса аутопута се поред насеља Предејине „помера“ у брдо и пролази тунелом дужине 1000 m.

Увидом у достављену документацију и Регистар заштићених природних добара у Републици Србији, Завод за заштиту природе Србије констатује, да се на траси аутопута Е-75, Београд – Ниш – Граница БЈР Македонија, деоница Горње Поље – Царичина долина, од км 878+960.41 до км 881+819.43, која обухвата предметни тунел, не налазе посебно заштићена природна добра те Обрађивач Идејног пројекта нема посебних обавеза према чл. 51. и 61. Закона о заштити животне средине („Службени гласник РС“, бр. 66/91).

На основу наведеног, Завод за заштиту природе Србије потврђује Улове заштите природе и животне средине за потребе израде Идејног пројекта Е-75, Београд – Ниш - Граница БЈР Македонија, деоница Горње Поље – Царичина, издате под бројем 03 - 853/2, дана 29. 06. 2006. године.

Београд, 27. фебруара 2006. године
Др Војна Рајска 51
11000 Београд
тел: 011 2663-800, 2043-401
факс: 011 2663-897
www.natureprotection.org.rs

Београд, 27. фебруара 2006. године
114 Београд, Рајска 51
www.ici.org
тел: +381 11 2663 800, 2043 401
факс: +381 11 2663 897
www.ici.org.rs

ПРИРОДНО-ЗАШТИЋЕНА СРБИЈА
11000 Београд, Др Војна Рајска 51
тел: 011 2663 800, 2043 401, факс: 011 2663 897
www.ici.org.rs

www.natureprotection.org.rs



Такође, осим већ утврђених Услови, у вези израде Идејног пројекта аутопута Е-75, Београд – Ниш – Граница БЈР Македонија, доолице Горње Поље – Царичина, на делу трасе аутопута на којој се налази планирани тунел, Завод исте допуњује следећим мерама и условима:

1.Планску и техничку документацију новопројектованог тунела, на траси аутопута Е-75, потребно је ускладити са најновијим знањима технике пројектовања и изградње тунела, са захтевима безбедности саобраћаја, са економским начелима и мерилима за оцену оправданости његове изградње и са прописима о заштити животне средине, тако да штетни утицаји на природу, због онеживаног утицаја на исту, буду што мањи.

2.Потребно је настојати да се радовима на изградњи тунела уништење постојеће флоре и фауне, око планираних излазних, односно улазних портала, лево и десно тунелске цеви, као и на падинама које засађују тунелске цеви, сведе на најмању могућу меру, јер ће исте послужити као ефикасни прелази за различите животињске врсте, односно за њихово одржање на овом простору.

3.Идејним пројектом је предвиђено да планирани тунел у дужини од 1000 m прође кроз стенски комплекс шкриљаца. С тим у вези потребно је водити рачуна да је при неповољним морфолошким, хидролошким, хидрогеолошким и вегетационим условима, овај материјал подложен клизању, дубоком јаружењу и површинском спирању. Ове појаве су управо најинтензивније на појединим теренима у сливу Јужне Мораве, пре свега у пределу Грделичке клисуре, те је обзиром на наведено, потребно кроз Пројекат предвидети мере и решења која ће омогућити успостављање стабилности терена, односно који ће онемогућити евентуална обрушавања истог.

4.Утврдити и начин организације градилишта тунела са јасно прецизираним локацијама за објекте, паркинге и путеве проласка тежне механизације, као и позајмишта, односно депоније материјала, те начин и мере санације и уређења путног лојаса, односно стављања простора у намену утврђену пројектном документацијом.

5.Радови на минирању, при изградњи предметног тунела, морају се планирати и изводити по шеми строго контролисаног минирања и са квалификованим лицима за ту врсту посла. Допрему експлозива и иницијалних средстава планирати из одговарајућег овлашћеног магацина, а њихово допремање вршити возилима за ту намену.

6.Забрањено је депновање ископаног стенског материјала, земље и сл. у зони око тунелских улазних портала и непосредно уз њих, те у околној зони Јужне Мораве, током и по завршетку радова. Исти депновати на локацијама које ће се пројектом организације градилишта утврдити као привремене или трајне депоније.

7.На одговарајућим пунтовима у склопу тунела планирати потребне системе сигнализације, вентилације, евентуални видео надзор одговарајуће противпожарне мере заштите и сл.

8.Након изградње тунела неопходно је уволити сву механизацију, грађевински материјал, контејнере, резервне делове и др., са трасе пута.

9.По завршетку радова обавезно је успоставити билни покривач (мултивисати терен) на свим угроженим местима применом одговарајуће вегетације.

10.Идејним пројектом обавезно предвидети да уколико се у припреми локација планираних за изградњу тунела, односно свих објеката везаних за исти, открије природно добро које је геолошко – палеонтолошког

или минеролошко – петрографског порекла, а могло би да има својства природног споменика, извођач радова има обавезу да о томе обавести Завод за заштиту природе Србије и да предузме све мере како се природно добро не би оштетило до доласка овлашћеног лица.

О б р а з л о ж е њ е

Одредбом члана 33 и 34 Закона о заштити животне средине („Службени гласник РС”, бр.136/04) и члана 51 и 61 Закона о заштити животне средине („Службени гласник РС”, бр. 86/91), одређено је да организација за заштиту природе, тј. Завод за заштиту природе Србије утврђује услове заштите животне средине и даје податке о заштићеним природним добрима у поступку израде просторних и других планова, односно основа (шумских, водопривредних ливних, риболовних и др.) и друге инвестиционо – техничке документације.

У складу са наведеном законском одредбом, САОБРАЋАЈНИ ИНСТИТУТ ЦИП д.о.о., поднео је захтев бр. 566-369/97 од 29. 01. 2008. године за допуну и измену Улова заштите природе и животне средине бр. 03 – 853/2, издатих 29. 06. 2006. године, за потребе израде Идејног пројекта Е-75, Београд – Ниш - Граница БЈР Македонија, деоница Горње Поље – Царичина долина од km 873+714.86 до km 885+726.739.

Достављено:

- Наслову
- Министарству заштите животне средине
- Министарству за инфраструктуру
- Архиви



Директор Завода

Проф. др. Лидија Амиџић

L. Amicic



ЗАВОД ЗА ЗАШТИТУ ПРИРОДЕ СРБИЈЕ

Београд, Београдска краљева Царина 19а • Контакт центар: 11100 Београд • Контакт центар: 11100 Београд • Контакт центар: 11100 Београд
Телефон: 011 4290 1111 • Факс: 011 4290 1112 • Е-пошта: z.z.n.s@z.z.n.s.rs • Веб: www.z.z.n.s.rs

КОРИДОР 10 доо
БЕОГРАД

Београд, Београдска краљева Царина 19а

Број: 03-2356/3
Датум: 08.10.2010

КОРИДОР 10 доо
11000 БЕОГРАД
Београдска краљева Царина 19а

Предмет: Мишљење о Студији о процени утицаја пројекта ауто-пута Е-75 Ниш - граница БЈРМ, деоница Горња поље - Царинска долина на животну средину

Дописом бр. 1294/10 доставили сте Заводу за заштиту природе Србије захтев за издавање мишљења о Студији о процени утицаја пројекта ауто-пута Е-75 Ниш - граница БЈРМ, деоница Горња поље - Царинска долина на животну средину.

Студију је обрадио Савремена истраживачка институција - СИИ доо из Београда. Инвеститор је Јавно предузеће „Путеви Србије“ из Београда.

Студија је обрађена на 115 страна и садржи већи број рефералних карата, прилога, табела и других прилога.

У прелиминарном поступку обрађивања Студија је обезбедила одговарајуће услове заштите природе од Завода за потребе израде пројектне и друге документације.

Након разматрања Студије, констатовано је да су мере заштите природе и животне средине које је прописао Завод, доследно уграђене у Студију.

У том смислу, предметна Студија о процени утицаја се може позитивно оценити.

С поштовањем,

Директор Завода

Проф. др Милош Ставретовић



Достављено
- Архива

Институт за заштиту природе Србије
11000 Београд, Београдска краљева Царина 19а
Телефон: 011 4290 1111 • Факс: 011 4290 1112
www.z.z.n.s.rs

Институт за заштиту природе Србије
11000 Београд, Београдска краљева Царина 19а
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11000 Београд, Београдска краљева Царина 19а
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www.z.z.n.s.rs

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TRACE
ТРЕЙС ГРУП ХОЛДАНГ

269/733

ОМ ЗАГОВОРНИ
СРБИЈЕ

PRECONDITIONS OBTAINED FROM IPCM

ПУБЛИЧНИ
ИНСТИТУТ
1441
No 40/2233
24.09.2008 год.

РЕПУБЛИКА СРБИЈА БЕОГРАД	
ПРОЈЕКАТ	26.09.2008
ОД: КМ	11
186-426/08	

МБ/ЈБ

Републички завод за заштиту споменика културе - Београд, на основу чл. 99, став 2. тачка 1, 100, став 1., 109., 110. и 104. Закона о културним добрима («Службени гласник РС», број 71/94) и члана 131. Закона о општем управном поступку («Службени лист СРЈ», бр. 33/97 и 31/01), на захтев Саобраћајног института СРП из Београда, улица Немањина бр. 6, доноси

РЕШЕЊЕ

I Мере техничке заштите за израду Идејног пројекта Е-75 Београд - Ниш - Граница БРМ деоница Горње поље - Царичина долина, могу се предузети према следећим условима:

- на траси Ауто пута Е-75 Ниш - Граница БРМ, деоница Горње поље - Царичина долина од км 873+714,86 до км 886+050,91 регистровани су бројни археолошки локалитети;
- не може се са сигурношћу тврдити да су градњом пута на овој деоници угрожени археолошки локалитети;
- како је у непосредној близини трасе ауто пута током 2002. године регистровано пет археолошких налазишта, за која не можемо са сигурношћу тврдити да ли ће бити девастирана градњом трасе ауто пута, неопходно је стално присуство археолога Републичког завода за заштиту споменика културе - Београд током земљаних радова;
- у случају да, у току радова, открије до сада нерегистровани локалитет или његов део, инвеститор је у обавези да о томе, без слагања, обавести Републички завод за заштиту споменика културе - Београд;
- инвеститор је дужан да обезбеди средства за истраживање, археолошки надзор, заштиту, чување, публикавање и излагање добара која уживају претходну заштиту, а која се открију приликом извођења радова.

II Подносилац захтева дужан је да изради пројекат у снему у складу са издатим условима из тачке I. овог решења.

III По изради пројекта у складу са овим условима, подносилац захтева је дужан да на исти прибави сагласност Републичког завода за заштиту споменика културе.

IV Ово решење не ослобађа подносиоца захтева обавезе прибављања и других услова, дозвола и сагласности предвиђених прописима о планирању и изградњи.

V Ово решење важи годину дана од дана издавања.

VI Жалба не одлаже извршење овог решења.

Образложење

Овом Заводу се Саобраћајни институт СРП из Београда, улица Немањина бр. 6, захтевом за утврђивање услова за предузимање мера техничке заштите за израду Идејног пројекта Е-75 Београд - Ниш - Граница БРМ деоница Горње поље - Царичина долина.

Археолошки локалитети регистровани на предметној деоници ауто пута јесу непокретна добра која уживају претходну заштиту, у складу са одредбама Закона о културним добрима.

По захтеву је, применом одредаба чл. 99, став 2. тачка 1, 100, став 1., 109. и 110. Закона о културним добрима, решено као у диспозитиву.

Прилог бр. 7

На основу члана 104. став 3. Закона о културним добрима, жалба не одлаже извршење решења.

ПОУКА О ПРАВНОМ ЛЕКУ: Против овог решења дозвољена је жалба Министарству културе у року од 15 дана од дана достављања решења. Жалба се подноси преко доносиоца овог решења, а на основу члана 16. Закона о културним добрима, ослобођени је плаћања републичке административне таксе.

Директор

Вера Павловић Љинчарски



Доставити:
- Подносиоцу
- Архиви



Special Specification



SPECIAL SPECIFICATION – LOT 2

Content:

PAVEMENT STRUCTURE DESIGN

DRAINAGE DESIGN

DESIGN OF ENGINEERING STRUCTURES

BRIDGES

ENVIRONMENTAL PROTECTION DESIGN

DESIGN OF NOISE SUPPRESSION STRUCTURES

DESIGN OF TECHNICAL INFRASTRUCTURE

DESIGN OF LIGHTING SYSTEM AT „PREDEJANE“ GRADE-SEPARATED JUNCTION AND POWER SUPPLY TO TOLL STATIONS

DESIGN OF 10/04kV TRANSFORMER STATION, „PREDEJANE“ INTERCHANGE AND 10kV FEEDER CABLE

DESIGN FOR DISPLACEMENT AND PROTECTION OF 10kV I 1kV POWER CABLES

DESIGN FOR DISPLACEMENT AND PROTECTION OF 35kV TRANSMISSION LINE

DESIGN FOR DISPLACEMENT AND PROTECTION OF THE EXISTING TELECOMMUNICATION NETWORK

DESIGN OF OCS RECONSTRUCTION AND OVERPASS EARTHING

DESIGN FOR DISPLACEMENT AND PROTECTION OF THE EXISTING WATER PIPES

CIVIL ENGINEERING DESIGN OF TELECOMMUNICATION CABLE CONDUIT

DESIGN FOR DISPLACEMENT AND PROTECTION OF LINESIDE CABLES

LANDSCAPING DESIGN



PAVEMENT STRUCTURE DESIGN

AS-3.4. CONSTRUCTION OF PAVEMENT SUBGRADE

AS-3.4.1 Subgrade

AS-3.4.1.1 Description

Subgrade planned to be constructed on the MAIN ALIGNMENT of the studied highway section shall be made of stone aggregate from the borrow pit along the alignment. Research for the purpose of the studied design has shown that the material is acceptable for pavement subgrade and therefore applicable for use on the primary traffic ridden areas.

The design thickness of the subgrade course shall be $d = 70$ cm. The course shall be composed of two sub-layers.

AS-3.4.1.2. Material for Subgrade Construction

Pure rock material free of adverse admixtures such as: clay particles, altered aggregate grains and rock massif parts prone to fragmentation, shall be used. It is also necessary to meet the requirement asking to avoid use of other material for subgrade construction without the prior approval of the Design Engineer. Criteria applied in material feasibility analysis shall be also applied in feasibility evaluation on the site.

AS-3.4.1.3. Construction

Stone aggregate shall be placed mechanically into the subject course. Manual placing shall be accepted only locally, on spots approved by the Engineer.

Stone aggregate shall be supplied to the site by appropriate means.

Any correction of aggregate grading on the site, i.e. on the placing location shall be approved by the Engineer fully in accordance with relevant results obtained in preliminary tests.

The water quantity required for attaining of optimal aggregate moisture for better compaction shall be introduced uniformly into the aggregate volume at the supply location.

If water shall be added on placing location, then water shall be dosed in a way to escape washout of small fractions. The allowable deviation of optimum moisture shall be maximum ± 2 m.-% during the course of compacting.

Spreading of stone aggregate shall be performed mechanically in layers not exceeding 35 cm in thickness. Spreading shall be performed on the same day as wetting.

Compacting shall be performed from the lower edge towards the higher edge of the course. Number of passes of appropriate compacting devices, previously determined on the trial section, shall be checked by testing within the regular control of density, i.e. compactness of the placed stone aggregate.

Any irregularity identified in the course of compacting shall be corrected, as directed by the Engineer.

Prior to completion of compaction, bearing capacity of the placed course shall be measured.

If values specified in the design documentation are not obtained, the Contractor shall assure the placed course quality by performing the additional actions.

The compacted course shall be provided with levels, width and gradient, as stated in the Design.

If the Contractor would temporary store stone aggregate fractions prior to placing into the subject course, then the stockpiling area shall be previously prepared in adequate manner (leveled, strengthened and drained).

AS-3.4.1.4. Testing Standards

Testing of physical and mechanical properties of subgrade material shall be performed fully in accordance with standards listed below:

SRPS EN 1097 2	Testing of Stone and Aggregate Resistance Against Abrasion by Los Angeles Method
SRPS B.B8.037	Determination of Frail Grains in Coarse Aggregate
SRPS U.B1.018	Determination of Grain Size Distribution and Determination of 0.08 mm Particles by Aerometry (or applying SRPS B.B8.036)
SRPS B.B8.036	Determination of Particles Passing the Sieve 0.02 mm (procedure stated in this SRPS Standard shall apply)
SRPS B.B8.038	Clay and Mud Contents
SRPS U.B1.042	Determination of California Bearing Ratio
EN 933 8	Sand Equivalent
NF P 94 066	Coefficient de fragmentabilite des materiaux rocheux
SRPS EN 1744-1	Organic Admixtures Participation

AS-3.4.1.5. Criteria For Subgrade Material Quality Evaluation

The stone material to be used for subgrade construction shall meet the following requirements:

- Maximum grain size shall not exceed 75 mm,
 - Coefficient of fraction resistance to crushing determined by Los Angeles Method(EN 1097-2) shall not exceed 45 % (category LA45)
 - Fragmentability coefficient of stone material specified according to NF P 94-066 standard (Coefficient de fragmentabilite des materiaux rocheux) shall be $FR \leq 7$ on sample tested at natural moisture.
 - Organic admixtures content in stone aggregate shall not color the 3% solvent of sodium deposit darker than reference color (test as per EN 1744-1).
- In addition, material to be incorporated into subgrade course shall also meet the following criteria:
- Plasticity index of possible present fine grains (smaller than 0.425 mm) shall be less than $I_p < 6\%$
 - Sand equivalent shall be minimum 60, $ES \geq 60$ (according to EN 933-8).

AS-3.4.1.6. Control of Constructed Subgrade

Control of Material

Material shall be in strict compliance with the above specifications and required quality.

Bearing capacity

Control of bearing capacity shall be performed as follows:

- Measuring modulus of deformability by circular plate method - SRPS U.B1.047 :1997
- Measuring deflection of the subgrade surface by Benckleman beam or deflectometer with falling weight.

Required bearing capacities

Criteria for bearing capacity control by measuring the modulus of deformability by circular plate method depend on type of material identified in the road body. According to this, the following criteria have been stated in the original design:

Embankment and subgrade composed of „uncontaminated“ detritus

If embankment and subgrade are to be constructed of material that satisfies criteria stated in Item 3.4.1.5. of these Technical Specifications, then the said material so-called „uncontaminated“ detritus shall be incorporated into two layers provided with overall thickness as shown on Figure 1 of these Technical Specifications.

Subgrade of stone material that satisfies criteria stated in Item 3.4.1.5. $d = 2 \times 35 \text{ cm}$

Road bed composed of „uncontaminated“ detritus
Figure 1. Layout of subgrade composed of „uncontaminated“ detritus

In the course of construction, the required bearing capacity shall be as follows:

Modulus of deformability $E_{v2} = 140 \text{ MPa}$
Maximum deflection measured by Benckleman beam (standard axis) $U_{40kN} = 55 \text{ mm}$
Modules relationship $E_{v2} / E_{v1} < 2.5$

Subgrade on Roadbed Composed of Mixed Soil in Cutting and Side Cuts

Subgrade composed of previously described material on the roadbed of mixed soil shall be constructed in two layers in overall thickness, as presented on Figure 2 of these Technical Specifications.

Subgrade of stone material that satisfies criteria stated in Item 3.4.1.5. $d = 2 \times 35 \text{ cm}$

Roadbed composed of mixed soil
Figure 2. Layout of the subgrade on the earthen roadbed of mixed soil

In the course of construction, the required bearing capacity shall be as follows:

Modulus of deformability $E_{v2} = 120 \text{ MPa}$
Maximum deflection measured by Benckleman beam (standard axis) $U_{40kN} = 0.65 \text{ mm}$
Modules relationship $E_{v2} / E_{v1} < 2.5$

Costs for retesting due to unsatisfactory results, shall be borne by the Contractor.

The assessment of test results among which there are also results not fulfilling the required compactness, shall be performed through computation of normal standard deviation, „quality number – Z“, where Z shall be ≥ 0.90 . The allowable deviation – quantil shall be less than 10%.

Evenness Control

Evenness of formation of the studied course shall be defined by measuring deviations under the 4 meter long straight edge placed in any direction against road axis. The deviation against design thickness for the entire set of testing data shall be as follows:

- For 90 % of overall control measurements, deviation shall not exceed 20 mm
- Maximum allowable deviation against the designed thickness shall be 30 mm
- Mean thickness of all control measurements shall not deviate for more than 10 mm.

Isolated spots characterized with actual thickness lower than maximum shall be locally repaired and brought to 90% tolerance. Number of samples (tests on control section) shall not be less than 10 except otherwise agreed with the Engineer. If such is the case, structural analysis of „quality number- „Z“, where Z is $Z \geq 0.88$ shall apply. Then the required criterion is that the error – quantil shall be less than 10%.

The width of the constructed course shall be at least equal to the width stated in the design so as no single profile of the outer course edge shall be pulled toward the road axis for more than 50 mm related to the designed width.

AS-3.4.1.7. Check of Construction Quality

The compliance with requirements stated in the design documentation and these Technical Specifications shall be determined for each separated type of stone aggregate planned to be incorporated into the subject course.

- Prior to placement compliance with preliminary tests shall be provided and
- In the course of placement, compliance shall be obtained with both regular and external control tests.

Preliminary Tests

Preliminary tests shall be performed to check the compliance of stone aggregate properties with the required ones, i.e.

- Crushing resistance – Los Angeles Coefficient
- Coefficient of stone material fragmentability defined according to NF P 94-066 Standard
- Grain size distribution of stone aggregate prior and after the fragmentability test
- Plasticity of small particles (smaller than 0.425 mm) prior and after the fragmentability test
- Sand equivalent
- Organic admixtures participation

Results of preliminary tests shall be in compliance with evidences on properties of supplied stone aggregates submitted by the Contractor.

Regular Control

In the course of placing, regular control by the Contractor (to be performed by certified testing facility) must be able to define compliance of aggregates with requirements stated in the design documentation and these Technical Specifications.

In the course of placing of stone aggregate into the subject course, the relevant laboratory shall take samples, and test compliance of their properties against the minimum frequency required.

As a rule, samples of stone aggregates shall be taken from the temporary stockpiling area (2/3) and from constructed non-bound base course (1/3).

Minimum testing frequency of stone aggregate during regular control in the course of placing into the subject course shall be as follows:

Properties	Minimum Testing Frequency	
• Coefficient of fractions resistance against crushing, determined by Los Angeles method (EN 1097-2)		4000 m ² /1000 m ³
• Fragmentability coefficient FR according to NF P 94-066	4000 m ² /1000 m ³	
• Participation of grains up to 0.063 mm in size	4000 m ² /1000 m ³	

•	Grain size distribution of stone aggregate mixture	4000 m ² /1000 m ³
•	Testing of plasticity of small particles	4000 m ² /1000 m ³
•	Sand equivalent	4000 m ² /1000 m ³
•	Organic admixtures participation	8000 m ² /2000 m ³

Minimum testing frequency during regular control in subgrade layer shall be:

Properties	Minimum Testing Frequency
• Bearing capacity:	
- Static deformation modulus Ev2	2000 m ²
- Deflections	50 m ¹
• Formation course:	
- Evenness	20 m ¹
- Height and gradient	20 m ¹

External Control

Volume of works for external control during the construction of the subject course shall be 1:4 in relation to regular control volume. Control tests shall be performed by relevant testing facility appointed by the Client.

Spots for taking of stone aggregate samples on the temporary stockpiling area and on the subject course shall be defined by the Engineer according to static method of random sample.

AS-3.4.1.8. Measurement and Payment

The performed work previously controlled and accepted by the Engineer shall be measured in m². Previously accepted and measured work shall be paid in unit price stated in the Contract per one square meter (m²) of the completed course.

AS-6.2.2. BASE COURSE CONSTRUCTION OF NON-BOUND STONE AGGREGATE 0/31 mm

AS-6.2.2.1 Description

This work shall consist of supply, transportation, placing, rough and fine spreading, possible wetting and compacting of non-bound stone aggregate base course, dimensions as designed.

AS-6.2.2.2 Basic Materials

Basic material shall be a mixture of crushed grains, originated by stone crushing, rough natural grains or artificial stone

Material Quality

Quality requirements are explained in detail with standard SRPS EN 13242:2007-Aggregates For Non-Bound Or Hydraulically Bound Materials For Use In Civil Engineering Works And Road Construction.

Stone Aggregate

The mixture of non-bound stone aggregate is composition of crushed stone fractions, stone grit, sand and filler, as to assure the required grading. Grading determination is defined with standard SRPS EN 933-1:2009

Grading

Grading of non-bound stone aggregate shall be within the following limits:

Square mesh sieve openings (mm)	Passing through sieves in mass %
Crushed aggregate	
0/31 mm	
0,09	2-9
0,25	5-15
0,50	8-21
1,0	11-30
2,0	15-40
4,0	20-50
8,0	28-62
16,0	46-75
31,5	95-100
45,0	100

And to meet following requirements:

Uniformity coefficient $C_u > 6$
 Curvature coefficient $CC = 1 \div 3$.
 Fine particles presence

Stone aggregate may contain components smaller than 0.063mm (as per SRPS EN 13242:2007) within the following quantity:

- At stockpile: up to 5% (by weight)
- After placing: up to 8% (by weight).

Participation of stone grains up to 0.02 mm shall not exceed 3% (by weight).

Plasticity index of fine particles (smaller than 0.425mm) shall be below 6.

Sand equivalent shall be at least 60 – ESmin=60 (in conformity with SRPS EN 933-8:2008).

AS-6.2.2.3 Mechanical Properties of Stone Aggregate

Coefficient of resistance against crushing, determined by Los Angeles method (SRPS EN 1097-2:2008), shall not exceed 30%.

Frost resistance of stone grains, when determined as per SRPS EN 1367-2:2009, by magnesium sulphate test and expressed in percentage of skinned parts of original sample mixture shall be up to 25m.-%, but when tested by sodium sulphate, up to 5m.-%.

With stone aggregate is allowed maximum 20 m.-% of grains where the shape does not meet the requirement 1 : d \square 3 : 1 (test as per EN 933-4).

Organic admixtures contents in stone aggregate shall not color the 3% solvent of sodium deposit darker than reference color (test as per SRPS EN 1744-1:2009).

Stone aggregate shall not contain harmful non-quality grains or admixtures (test as per SRPS EN 1744-1 :2009).

Bearing coefficient of stone aggregate, when determined by CBR laboratory test, shall be at least 80%.

AS-6.2.2.4 Works

It shall be necessary before work commencement to check whether or not machinery and tools that will be used in construction, meet the work execution requirements as present by the present Work Specifications.

Stone aggregate placing for the subject course shall be performed mechanically. Manual placing shall be allowed only locally, on spots where agreed by Engineer.

Any improvement of aggregate grading on site, i.e. on placing location, shall be allowed by Engineer based on results of preliminary tests.

Water quantity as necessary for optimal aggregate moisture for better compaction shall be introduced uniformly into aggregate just with supply location.

When the water should be added on placing location, than water dosage shall take place in the manner as to avoid washout of small fractions. Deviation of optimal moisture shall be maximum \square 2% by weight, during the course compacting.

Stone aggregate spreading for this course shall be carried out by pavers. Spreading shall take place on the same day when moisturizing took place.

Compacting shall take place from the lower edge towards the higher edge of the course. Number of passes of appropriate compacting devices, previously determined with trial section shall be checked by testing within the regular control of density, i.e. compactness of the placed stone aggregate.

All irregularities that might be detected during compacting shall be corrected as directed by Engineer.

Bearing capacity of the course placed shall be measured before the compaction finishing.

When the properties as required by Design would not be attained, the Contractor shall assure the placed course quality by additional actions.

The course compacted shall have levels, width and gradient as presented by Design.

AS-6.2.2.5 Temporary Stockpile

If the Contractor would temporary store fractions of stone material before placing into the subject course, then the stockpile area shall previously be prepared in an appropriate way (planned, strengthened, drained)

A temporary approach road shall be constructed to the temporary Stockpile

AS-6.2.2.6 Construction Quality

Compaction

Average value of the stone aggregate placed compactness into the subject course as determined relating the density following Proctor procedure, shall exceed 98%. The estimation of results not fulfilling the compactness as required, shall be carried out by calculation of normalized standard deviation, quality number – Z" where the Z value should be ≥ 0.85 . The error allowed – quantal – should be bellow 15%.

The Designer proposed to determine placed aggregate layer compactness by using measurements with isotropic measuring device (nuclear density meter).

Bearing Capacity

Bearing Capacity of the completed course shall be determined by static deformational modulus E_{v2} , which shall comply with following requirements:

Bearing Capacity control shall take place by one of two methods:

1. Deformability modulus measuring by circular plate method – SRPS U B1.047: 1997
2. Deflection of the course completed measuring by Benckelman beam or by deflectometer with falling weight.

1. Required values for deformability modulus

Required value of the deformability modulus at first sublayer (d= 15cm) shall be $E_{v2} \geq 160$ MPa.

Required value of the deformability modulus at second sublayer (d=15cm) shall be $E_{v2} \geq 200$ MPa.

The required value of deformability modules relationship shall be $E_{v2} / E_{v1} < 2.2$.

The assessment on acceptability of results where are present such ones that do not fulfill the required density, shall take place by calculation of normalized standard deviation with quality number– Z", the value of which (Z) shall be ≥ 0.90 . The error allowed shall be the quantil bellow 10%.

2. Required values for deflection

Eighty-five percent of deflection, when measured by Benckelman beam under standard axle loading shall be $U_{40kN} = 0.47$ mm at first sublayer (d= 15cm).

Eighty-five percent of deflection, when measured by Benckelman beam under standard axle loading shall be $U_{40kN} = 0.40$ mm (d= 15cm) at second sublayer (d= 15cm).

Measuring shall take place:

- ON NEW PAVEMENT OF THE MOTORWAY ROUTE in three points within the cross section, in the middle and in zones of the left and right edge of the course completed, distanced longitudinally 50 cm. Measurement may be carried out by deflectometer with falling weight.

- ON PAVEMENT OF EXISTING CARRIAGEWAY WIDENING in one point within the cross section, in contact zone to the existing pavement.

Evenness, levels, gradient

Course formation evenness shall be determined by deviations measurement under the straight edge of 4 m that shall be placed in any direction at the road axis. Deviations allowed are as follows:

- Course formation shall deviate of the straight edge up to 20 mm (top limit). When such deviations would appear continuously, then evenness shall be corrected as ordered by Engineer;
- Levels of measuring spots on the course formation shall be determined by leveling apparatus. Course formation at random spot shall deviate of the level as designed for maximum \square 10 mm (top limit).

- Course formation gradient, in conformity with Design proposal, shall be the same as lateral and longitudinal gradient of the pavement surface designed.

AS-6.2.2.7 Construction Quality Control

The conformity with requirements of Design and the present Work Specifications shall be determined for each separated type of aggregate that would be foreseen for use with the subject course, as follows:

- Before placing, with preliminary testing;
- During the construction, within the regular and external controls.

AS-6.2.2.8 Preliminary Tests

Preliminary tests shall serve to perform the conformity check of stone aggregate against requirements as presented with these Work Specifications, meaning:

- Stone aggregate grading;
- Participation of grains up to 0,063 mm;
- Grain shape;
- Uniformity degree and curvature coefficient;
- Plasticity of fine particles (finer than 0.425)
- Sand equivalent;
- Resistance against crushing – Los Angeles coefficient;
- Organic admixtures participation;
- Bearing capacity – CBR procedure;
- Testing as per modified Proctor test;
- Optimal moisture;
- Highest density

Results of preliminary tests shall conform to the proposed Contractor's proofs on the properties of supplied stone aggregates.

AS-6.2.2.9 Regular Control

The regular control by Contractor (done by a certified laboratory) shall determine the conformity of the aggregate with requirements of Design and the present Work Specifications, during the stone aggregate placing into the subject course.

The laboratory shall take samples and check the conformity of properties with the minimal frequency required during the stone aggregate placing into the subject course.

Statistical principles for materials sampling shall be respected.

Minimal frequency of the stone aggregate testing during regular control of placing into the subject course shall be as follows:

Properties	Minimal testing frequency
Grading of stone aggregate mixture	1000 m ³

Grain shape	
Uniformity degree and curvature coefficient	
Participation of grains up to 0,063 mm	
Fine particles plasticity	
Sand equivalent	
Moisture and density as per Proctor	
Organic admixtures participation	2000 m ³

Minimal testing frequency during the regular control of placing into the non-bound base course shall be as follows:

Properties	Minimal testing frequency
Moisture participation and density	200 m ²
Bearing capacity	
- Static deformation modulus Ev2	2000 m ²
- Deflections on new pavement of motorway route	50 m ¹ x 3
- Deflections on existing pavement widening of motorway	50 m ¹
Course formation:	
- Evenness	20 m ¹
- Levels and gradients	20 m ¹

Control Tests

External control volume with subject course construction is regularly 1/4 compared to regular control. Control tests shall be done by the institution that is certified by Employer.

Stone aggregate sampling spots at the temporary stockpile and on subject course placing spots shall be determined by Engineer, as per statistical method of random sample.

Protection and Maintenance of the Course

The Contractor shall protect and maintain the course constructed at his own expense all the time before the next course construction. Maintenance shall include corrections of any damages and shall take place within such volume and frequency as to assure the intact course and in good condition. Repairs shall maintain good surface evenness of the course constructed.

AS- 6.2.2.10 Measurement and Payment

The quantity to be paid for to Contractor at the Contract Unit Price shall be the number of cubic meters (m³) of the course completed in the designed thickness and accepted by Engineer.

DRAINAGE DESIGN**8.5.1/2.01., 8.5.1/12.01. GEODETIC SURVEY.**

Description of works: Geodetic survey of rainwater sewage system shall be performed when sewage system is accepted and prior to trench backfilling as follows: position of inspection manholes and gullies, spacing between them (section lengths), pipe diameters per sections, inspection manhole bottom levels and bottom levels and diameters of all pipes in the inspection manhole. After completion of geodetic survey the As-built report shall be prepared and delivered to the Investor. Measurement and payment: Payment will be done per m² of completely surveyed system.

8.5.1/3.03 - 8.5.1/11.04. PROCUREMENT, TRANSPORT AND FIXING OF PIPES ON BRIDGES

Description of works: Procurement, transport and fixing of polyester GRP pipes and joining fittings on bridges. Pipes and fittings shall be fabricated pursuant to standard EN 1610. All elements will be provided with BD marking meaning that they can be laid not only inside buildings but also in outer parts of structures. Pipes shall be fixed in accordance with Manufacturer's instructions and joined with flanges containing rubber inserts embedded in polyester resin body to guarantee a water impermeable joint. Measurement and payment: Payment will be done per m² of fully assembled pipes dependent upon diameter.

8.5.1/4.04 - 8.5.1/11.04. PROCUREMENT, TRANSPORT AND FITTING COMPENSATION SOCKETS

Description of works: Procurement, transport and fitting of compensation plates at bridge expansion joint. Thermal elongation shall be compensated for with compensating socket fitted at default spacing. Measurement and payment: Payment will be done per one fully fitted compensation socket dependent upon diameter.

8.5.1/4.05 - 8.5.1/11.05. PROCUREMENT, TRANSPORT AND FITTING OF PIPE SUPPORTS (HANGERS)

Description of works: Pipes shall be secured against movement by means of specially designed clips resistant to dynamic movements and ambient conditions, spaced as designed. Clips, support, bolts and base plates shall be made of stainless steel. Measurement and payment: Payment will be done per one fully fitted support dependent upon pipe diameter.

8.5.1/4.06 - 8.5.1/11.06. PROCUREMENT, TRANSPORT AND MOUNTING POLYESTER FITTINGS

Description of works: Polyester fittings shall be made of pipe lengths to withstand various pressure and rigidity classes same as pipes. The system shall be resistant to chemical agents, blows (even at temperature of -40°C) and UV radiation. The polyester fittings shall be used to connect gullies to stormwater sewers. Measurement and payment: Payment will be done per one fully fixed fitting dependent on diameter.

8.5.1/2.14. STREET GULLIES.

Description of works: Procurement, transport and installation of street gully made of reinforced concrete pipe, Ø400 mm. The price includes: gully, coupling and rain grating, SRPS M.J6.254. Measurement and payment: Payment will be done per one installed gully.

Devices for water protection against pollution – separators:

8.5.1/12.09. OIL SEPARATORS WITH INTEGRATED BY-PASS.

Description of works: Procurement and delivery of separators with bypass line in the reinforced concrete tank, D400 load bearing capacity class. Material: BYPASS separators are mineral oil separators designed for treatment of oily rainwater from large areas. Separator is accommodated in the cylindrical or rectangular concrete tank which size is adjusted to a nominal capacity. Maximum flow capacity of this device is five or ten times higher than nominal flow. A separator treats waste water only to a value of nominal flows and in case of higher flows water passes only through bypass line on the assumption that the first wave had washed oil and dirt and that remaining water quantity is relatively clean. Coalescent filter is installed in the tank and its size corresponds to the required nominal flow. Separator mark is provided with the following information: Manufacturer's name, Name of equipment; SEP Qn/Qmax - 1 -Vo - r; Nominal capacity Qn; Max. capacity Qmax; Tank number 1; Catch basin volume Vo; Tank material. Prefabricated separators are those which are fully assembled in the factory. Separator can be assembled in situ only if its nominal flow is 150 or higher. During separator construction, width-length ratio of 1:1.5 to 1:5 shall be respected. Distance between separator bottom and outflow pipe shall be 20 % of water depth. Minimum water depth shall be 2.5 m including depth of 0.15 m for light fluid and 0.35 m for deposition of sediments. Water area measured in m² shall amount to 0.2 x NS, total volume measured in m³ shall amount to 0.5 x NS and volume of chamber for light fluid storing shall be 0.03 x NS. Separator lid shall have an indication "Separator" and mark for load bearing capacity class according to EN124. Moreover there shall be a plate with an inscription made of durable material (e.g. stainless steel) and placed on the visible place at inner side, if possible. The following data shall be indicated on the plate: EN858, class (I or II), nominal size (NS), separator volume in l or m³, catch basin volume in l or m³, capacity of oil chamber in l or m³, depth of oil storing maximum volume, year of production, manufacturer's name or mark and certification authority's mark. Other marks can be added. Measurement and payment: Payment will be done per one fully installed device.

8.5.2/2.15., 8.5.1/12.13. WING MANHOLES.

Description of works: Construction of outflow structure provided with wing walls made of reinforced water impermeable concrete, class MB 40, fully in accordance with design details. Measurement and payment: Payment will be done per one fully completed structure.

8.5.1/2.12., 8.5.1/12.10. CAST IRON LIDS.

Description of works: Procurement, transport and fitting of cast iron framed lids (400 kN load bearing capacity) for inspection manholes according to SRPS.M.J6.226. Framed lid shall be fitted to reinforced concrete ring on the manhole top. Measurement and payment: Payment will be done per one fully fitted lid.

8.5.1/2.13., 8.5.1/12.11. CAST IRON RUNGS.

Description of works: Procurement, transport and installation of cast iron rungs at each 30 cm of height according to SRPS.M.J6.285. Measurement and payment: Payment will be done per one installed rung.

8.5.1/2.17., 8.5.1/12.14. OUTFLOW STRUCTURE.

Description of works: Construction of MB30 concrete outflow structures at rainwater sewage outlets into the channel according to designed detail. Measurement and payment: Payment will be done per one fully completed structure.

8.5.1/12.15. FLAT CHECK VALVES.

Description of works: Procurement, transport and fitting of flat check valves at rainwater sewage outlets into the watercourse according to designed detail. FCV Ø300 mm; FCV Ø400 mm; FCV Ø500 mm; FCV Ø600 mm. Measurement and payment: Payment will be done per one fully fitted flat check valve.

8.5.1/2.23., 8.5.1/3.07. - 8.5.1/11.07., 8.5.1/12.19. GEODETIC SURVEY

Description of works: Geodetic survey of rainwater sewage system shall be performed when sewage system is accepted and prior to trench backfilling as follows: position of inspection manholes and gullies, spacing between them (section lengths), pipe diameters per sections, inspection manhole bottom levels and bottom levels and diameters of all pipes in the inspection manhole. After completion of geodetic survey the As-built report shall be prepared and delivered to the Investor. Measurement and payment: Payment will be done per m² of completely surveyed system.

DESIGN OF ENGINEERING STRUCTURES

MAIN WORKS FOR THE SUPPORTING STRUCTURE MADE OF REINFORCED EARTH

07.07.00 EARTH WORKS FOR THE SUPPORTING STRUCTURE MADE OF REINFORCED EARTH

07.(wall No.)07.03 EMBANKMENT CONSTRUCTION

Description

This item includes filling, spreading, rough and fine levelling, wetting and compaction of earth material containing minimum 30 % of rock aggregates with grains varying from 0 to 125 mm in size. Fragments coarser than those specified in the design will be removed mechanically or by hand or by rough sieving on improvised screens.

When performing embankment construction, standard method will apply except in a 2 m wide belt along the already embedded concrete blocks where spreading will be done by means of lightweight bulldozer and compaction will be performed through the use of vibration smooth roller having maximum 8 tons in weight, to obtain 0.20 m thick layers.

In 2.0 m wide area from concrete blocks, spreading will be done by hand in 15 cm thick layers. The main compaction will be done by 40/50 cm wide vibration plate along the concrete blocks. After stabilizing the material, 60/70 cm wide vibration roller having maximum weight of 1 tone will be used.

The relevant geogrid will be placed after reaching the layer thickness of 30 cm fully in accordance with these Technical Specifications.

Spreading shall be performed according to profiles, heights and relevant slope inclinations stated in the design.

Compacting shall be done until minimum of Ms=40 MPa or equivalent dynamical modulus E_{vd} is obtained. Compactness shall be tested by applying standard round plate test (D=30 cm) or by means of device for dynamic modulus testing. Dynamic modulus test will be performed in accordance with SRPS UB1 047/97, SRPS UE8.010/1981 and SRPS UB1 046/68/92 Standards and NGT 39 Instructions for compactness control of both subgrade and embankment used for substructure in German railways.

Measurement

Measurement will be done per m³ of spread material and payment will be done according to contract unit prices that will include all work on filling, spreading, rough and fine levelling, wetting and compaction of material taken from the local excavation pit.

Payment

Payment will be made according to real quantities and contract unit price per measurement unit.

07.(wall No.)10.00 GEOSYNTHETIC MATERIALS

07.(wall No.)10.01

07.(wall No.)10.02

Description of geosynthetic materials

Uniaxial geogrids and relevant HDPE connectors resistant to chemical and mechanical impacts shall be used, as specified in the design.

Geogrid must be fabricated of HDPE plate oriented in single direction so as the obtained strips will be characterized with high degree of molecules orientated toward the strip direction that will also maintain their continuity through the transverse joining rib.

The required tensile strength for 120 year design life that will cause maximum deformation of 1% for grid M1 must be 8.21 kN/m, and for grid M2, 18.14 kN/m, at mean temperature of 200C. The said values represent relation of maximum tensile strength of geogrids for maximum deformation of 1% at the end of 120 year period and calculated safety factor. Due to lack of national legislation, the safety factor was calculated in accordance with British standards applied to geosynthetic materials.

Tensile strength in control tests at short loading must be 52.5 kN/m for M1 geogrid and 88.0 kN/m for M2 grid, with peak deformation of about 11.5% for the said force value.

The Manufacturer of geosynthetic materials that will be used for construction of this type of structures must be provided with adequate certificate issued by relevant independent institution stating that characteristics of fabricated geosynthetic material are in compliance with the solution applied in the design herein.

For the purpose of elongation, each geogrid junction must be capable to withstand 100% of tensile strength at control tests.

Geogrid must be inert to all chemicals naturally found in soils and must be stable at ambient temperatures. Geogrid must not be susceptible to hydrolysis and must be resistant to aqueous solutions of salts, acids and alkalis (pH = 2.0 to 12.5) and non-biodegradable. It must also contain minimum 2% of dispersed carbon black which gives a high degree of protection by preventing UV light from penetrating beyond a thin layer at the surface.

STRUCTURE MADE OF REINFORCED EARTH – CONSTRUCTION TECHNOLOGY

Description of works

The structure made of reinforced earth will be constructed according to instructions stated in these Technical Specifications. The following must be taken into account.

The first row of concrete blocks must be precisely aligned to escape mistakes that can occur in joints in the course of wall construction.

Cutting of blocks, if necessary, will be precisely performed by means of adequate cutting tools.

The adjoining geogrid rolls must not be overlapped but positioned edge-to-edge so as problems referring to block levelling could be escaped. The end ribs must be precisely cut off by hand to enable proper connection and required fire resistance (geogrid must not be visible on the outer wall side).

In the course of work execution, the following must be borne in mind:

- Filling must be properly compacted especially along subgrade.
- In each construction phase, compacted layer must be in compliance with subgrade-geogrid connection to escape voids formation.
- Geogrid must be placed at right angle to the subgrade surface with tolerance of ±50 mm, and spaced at 5 m.
- Sufficient tension shall be applied to ensure geogrid together with connector is firmly attached to the block wall.
- Tension shall be performed by special tool by applying one-man force.
- Continuity of geogrids should be avoided. If this is necessary due to better use of material, then continuity should be enabled through the use of appropriate joints (HDPE bars) supplied by the same Manufacturer engaged for geogrids and connectors.

Measurement

Unit price for geogrids includes as follows: procurement, cutting and placement of geogrids as well as all relevant accessories for tensioning and continuity, if necessary.

Unit price for connectors includes procurement and installation of polyethylene connectors.

Measurement will be done according to theoretical sizes stated in the design. Measurement unit for geogrids is m², and for connector m¹.

Payment

Quantities defined in the above mentioned way will be paid per contract unit price for measurement unit.

BRIDGES

13.1.4.1 Concrete layer for slope. Concrete class I MB 20.

13.1.4.2 Waterproofing protection

This item includes all work, material, equipment and transport together with galvanized wire mesh needed to construct a concrete cover on top of waterproofing layer of fine grained concrete class II, MB20, 5cm thick.

Prior to placing of waterproofing layer, 1:3 cement mortar shall apply followed by fine grained concrete layer, 2,5 cm thick.

Lathing made of 2 mm thick iron galvanized wire and 25x25 mm openings shall be placed over the said layer in wet state. Another 2.5 cm thick layer of fine grained concrete of similar quality shall be placed over the said layer. The class of concrete shall be MB20.

Payment will be done per m2 of completed work, including all work, material, equipment and transport.

13.1.4.4 Plain concrete for open caissons.

This item includes all work and amount of plain concrete, class MB20, that is placed in caissons, according to 13.2.2 of Technical Specification

13.2.6 Erection of shuttering for foundation works. These works include shuttering of foundation pits with wooden planks and steel frames and combination thereof and shuttering with steel material.

13.2.6.1 Timber shuttering includes driving and/or placing of wooden planks and beams and struts for supporting the wall made of wooden planks.

The Design Engineer and/or the Contractor shall be responsible for preparation of shuttering design fully in accordance with design documentation, geotechnical report, surveyed ground and ground water levels and forecast oscillation of the said level. The design prepared by the Contractor shall be submitted to Design Engineer and Engineer for their approval. The shuttering design shall secure the pit from surrounding structures and traffic. Tilting and lateral movement of shuttering in the course of placing shall be straighten at the Contractor's cost.

If the Contractor plans to remove the timber, the technological process shall be harmonized in a way that shall prevent damage of the particular structure in the course of removing. The Contractor shall cut the excessive length of shuttering upon the Engineer's approval in the course of foundation backfilling.

Sealing planks may be tongued and grooved. For the purpose of driving, at the point of impact, planks shall be provided with shoe and notched and trimmed top. Sizes of planks shall be defined by structural analyses and quality and class according to JUS U D0.001.

For round and sawn timber, buckling shall be defined according to JUS U.C9.200. Quality shall be defined according to JUS U D0.001 and allowable stresses according to JUS U.C9.400. In a case of water impermeable shuttering, joints shall be controlled and sequence in planks driving previously defined. Sheet-pile wall shall be driven deeper than foundation bottom for the height specified in the relevant hydraulic calculations.

13.2.6.2 Shuttering with wooden planks, steel piles and struts

Similar specifications as in 6.2.3.2.2 shall apply. Steel segments shall be sized according to JUS U.E7.081 and JUS U.E7.086. Wedges shall be made only of oak timber, category I. Steel-sheet piles for the purpose of strutting shall be made of rolled and cold formed steel sections.

Works covered by these technical specifications include providing of all material, facilities, equipment and workmen required for execution of works on placing of sheet-pile walls and shuttering of steel-sheet piles in dry and/or water environment as well as works referring to removal and/or cutting the piles, as stated in the design fully in accordance with contractual conditions and these technical specifications, relevant drawings and Engineer's instructions. For the purpose of protection of foundation pits in the course of excavation, placing of subbase and all works referring to construction of foundation for bridge piers, construction of sheet-pile walls and/or shuttering made of steel-sheet piles shall be required. Type of steel-sheet piles shall be selected by the Contractor provided that thickness of the sheet-pile walls which one segment shall be built into the foundation as a protection against undercutting shall not be less than 9 mm. To improve adhesion, along the whole circumference of sheet-pile walls and/or shuttering which one segment shall be built into the foundation to the height of subbase and foundation footing crown shall be fitted with anchors welded as specified on drawings and cutting of steel-sheet piles after completion of foundation and piers shall be performed up to levels specified in the drawings (top foundation level), or as directed by the Engineer. In a case of sheet-pile walls and/or shuttering consisting of steel-sheet piles planned to be removed after completion of works, in the course of construction of subbase and foundation, the Contractor shall apply all relevant measures to prevent damage of the concrete cover. If he/she fails to apply the said measures and fails to remove the supports he/she shall cut them to the level specified by the Engineer, and costs for supports shall not be accepted. Prior to commencement of works on assembly of sheet-pile walls and/or support, the Contractor shall prepare relevant design fully in accordance with data stated in structural design, geotechnical report, surveyed ground and ground water levels as well as forecast of water level to be expected in the course of foundation construction. The Contractor shall submit the sheet-pile wall design to the Engineer for his/her approval. Prior to commencement of works, the Contractor shall mark and secure edges of sheet-pile walls and control the accuracy of driving. Steel-sheet piles not matching with the surrounding piles shall be removed and replaced. This is also referring to deformed and too short piles. Costs for replacing of damaged sheet-pile walls shall be borne by the Contractor. Movement and lateral displacement of sheet-pile walls and steel-sheet piles in the course of placing shall be straightened at the Contractor's cost so as adequate clearance can be provided, as stated in the design. If not otherwise specified by the Engineer, steel sheet piles shall be driven to the levels specified in drawings provided that top level of piles shall be for 50 cm higher than the adopted level of water expected during the works.

Measurement and Payment

Works shall be measured in square meters of outer vertical surfaces of shuttering and/or sheet-pile walls according to mean measure obtained by measuring the mean height obtained from the mean value of heights of four edge points, or according to the drawing. The measurement herein includes full compensation for all work, material and transport. Segments of shuttering exceeding measures herein and shuttering removed after concreting shall be the property of the Contractor. If works have not been separately measured, price of these works may be included into the price referring to excavation items, as stated in the contract.

13.2.7 Placing the sub-base made of gravel and sand in 30 cm thick layers under foundation including compaction of layers to modulus of compressibility $M_s=30$ MPa.

13.2.8 Construction of side/back walls

13.2.8.1 Scope and Contents of Works

Construction of side/back walls includes filling, spreading rough/fine leveling and compaction in 30 cm thick layers, fully as designed. All work shall be completed in line with the design, these Technical Specifications and SRPS U.E.010 – Earth Works in Road Construction



13.2.8.2 Material

For construction of side/back walls, inorganic materials of specified quality shall be used.

Organic waste, roots, turf, i.e. material that would, in time, change its mechanical and physical properties due to biochemical actions, cannot be incorporated into side/back walls.

Material for construction of side/back walls can be obtained from cuts along the road route, borrow pits, and by dredging sand from the Sava/Danube rivers "on site" or from the stockpile of dredged sand.

13.2.8.2.1. Regulations for Control of Materials Quality

- SRPS U.B1.010 – Sampling
- SRPS U.B1.012 – Determination of Soil Moisture
- SRPS U.B1.014 – Determination of Bulk Density of Solid Particles
- SRPS U.B1.016 – Determination of Bulk Density
- SRPS U.B1.018 – Determination of Granulometric Composition
- SRPS U.B1.020 – Determination of Consistency Limits
- SRPS U.B1.024 – Determination of Combustible and Organic Matters
- SRPS U.B1.038 – Determination of Optimum Water Content
- SRPS U.B1.042 – Determination of California Bearing Ratio (CBR %)

Classification of materials, preliminary testing of materials and criteria for assessing quality of materials prior to incorporation will be performed fully in accordance with Items 3.4.1 – Earth Embankments.

13.2.8.3. Haulage, Filling and Compaction

The haulage and filling of materials over a prepared foundation soil may start only after the Engineer has approved the lower layers.

Filling shall be performed in 30 cm thick layers. The height (thickness) of every spread layer shall be in compliance with the tamping effect by depth of the used tamping device, type of fill material, and segregation occurrences.

Relevant testing, control and machinery adopting shall be performed for every type of material to be incorporated into an embankment.

Every layer of embankment shall be compacted with an appropriate mechanical device. All places inaccessible for machines, or places where the use of heavy tamping devices would be unsuitable for other reasons (filling behind structures, retaining walls, etc.) shall be tamped with other suitable devices or methods, the use of which shall be subject to the approval by the Engineer.

Moisture of material, filling conditions, and compaction shall be performed fully in accordance with the Item 3.4.1 – Earth Embankments.

13.2.8.4 Measurement

The quantity of incorporated material shall be measured in m³ of actually incorporated quantities within the project, excluding the topsoil layer on embankment slopes, but including the shoulder core, and as approved by the Engineer.

13.2.8.5 Payment

Quantities determined as per 13.2.8.4. shall be paid at agreed prices for 1 m³ of incorporated fill material.

The contract prices shall include all works on topsoil stripping, spreading, wetting or drying, compaction, construction of stepped cuts and fills, levelling of embankment slopes and shoulders with the accuracy of ± 5 cm with respect to the designed embankment slopes, humification and grassing of slopes, and other works from this description, including all materials and labour, transport and haulage, and the Contractor shall have no right to claim any extra monies for the construction of embankments.

13.2.9 Placing 80 cm thick cover protecting a gravel wedge made of gravel sand where top 30 cm shall be stabilized with cement and bottom 50 cm compacted in two layers to modulus of compressibility $M_s=40$ MPa.

13.4.1.3 Placing of 10 cm thick sub-base blinding layer made of MB 15 concrete under foundations, head beams and crossing slabs.

13.11.6 Lining construction of composite crushed stone

The Item includes all work, material, equipment, and transport for lining made of crushed stone in a culvert.

Protective lining of culvert's bottom shall be made of composite crushed stone embedded in lean concrete, class MB20.

Protective lining shall be extended for 5 m on both upstream and downstream sides. This lining shall end by transverse sill.

If the water stream gradient does not exceed 5 %, joints shall be filled with concrete or cement mortar. If the gradient exceeds 5%, joints shall be 5-15 cm deep.

Quantity of material shall be measured in m³ of actually executed works according to dimensions stated in the design and as approved by the Engineer.

The unit prices shall include all work on lining construction and other related works together with all material, equipment and transport, and the Contractor shall have no right to claim any extra payment for embankment construction.

13.11.8 Underlays shall be made of mixed mortars provided that minimum strength shall be in compliance with the concrete, class MB45. Concerning the quality of used materials, provisions stated in these Specifications shall apply. Underlays shall be installed in a way that shall always enable presence of overpressure. Jointed principle or grouting may apply. Mortars shall be characterized with permanently increased volume of minimum 1%. Underlays exceeding 50 mm in thickness shall be additionally reinforced.

Within the works on installation of bearings, gutters and similar elements that require placing of underlay, the Contractor shall submit within the methodology of installation design all relevant evidences testifying that the mortar mix to be used as underly is in strict compliance with the required specifications. The said design together with detailed description of construction methodology shall be submitted to the Engineer for his/her approval.

13.11.9 Steel plates embedded into a girder at points where girders rest onto bearings.

13.11.15 "Fugeband" bands for ensuring the watertightness joint between two concrete members

The Item includes all work, material, equipment and transport to ensure the watertightness joint between two culvert members. "Fugeband" rubber bands for sealing of transverse joints in longer culverts cast in situ, shall be placed on outer sides of culvert walls toward the embankment. At the contact point between the two adjoining walls, 2 cm thick styrofoam board shall be placed. Joint in inner side toward the culvert opening shall be filled with plastic putty. Payment will be done per m' of completely performed work.

ENVIRONMENTAL PROTECTION DESIGN**DESIGN OF NOISE SUPPRESSION STRUCTURES****NOISE SUPPRESSION WALLS****10.(wall No.)03.01 i 10.(wall No.)06.01 PROCUREMENT AND ERECTION OF HEA 140 STEEL COLUMNS****Description of works**

Columns for standard noise barriers shall be made of HEA, HEB or HEM steel (Euronorm 53-62).

Procurement and erection of HEA steel columns shall be fully in accordance with DIN1025, SRPS EN10025 and EN10327.

Nominal spacing between steel columns for standard noise barriers is:

- * on embankments and already built structures – 4.00 or 5.00 m
- * on new structures – 2.00 or 2.50 m

HEA steel columns for noise barriers on embankment shall be planted into prefabricated reinforced concrete foundation and positioned at 4.00 m centre-to-centre spacing.

HEA steel columns for noise barriers on bridges shall be positioned at 2.00 m centre-to-centre spacing and anchor plate will be used to connect steel column and bridge structure and/or concrete footway.

Steel columns shall be positioned vertically and in line. Column distortion, which can make difficult placing of members, is not allowed.

In order to achieve that steel columns are positioned vertically and in line, reinforced concrete members shall be placed prior to fixing the next steel column and afterwards absorption or transparent panels will be inserted between adjacent steel columns.

Measurement

Payment per kilogram (kg) of planted HEA steel columns.

10.(wall No.)04.01 PROCUREMENT AND INSTALLATION OF ABSORPTION PANELS**Description of works**

Absorption panels used in construction of sound barriers shall satisfy the general criteria:

- * to meet acoustic requirements
- * to take into account traffic safety requirements
- * to be structurally stable and to hold its shape
- * to be resistant and protected against corrosion and degradation
- * to be of adequate size
- * to have constant colour shade
- * to be fire resistant
- * to be resistant to rockfall
- * to be easy for maintenance

Size and composition of absorption panels shall fully meet the current standards and quality requirements (DIN 52210, DIN 52212, DIN 1725/1, ZTV-LSW 88, EN 1793/1794 etc.).

Absorption panels shall be stable in size and appropriate for safe placing. Limit values and tolerances of structural members and works shall meet standards for sound barriers. Hollow members shall be designed so that penetrated water can be quickly and completely drained. Water drainage shall not be aimed at members placed one below the other and in case of a panel with tongue-and-groove joint water shall not be retained on upper members. In case of hollow members or absorbing subwalls, sound absorbing or isolating members shall be placed at spacing of minimum 2 cm from wooden or metal parts. Hollow space shall be airy although it does not apply to aluminium members resistant to salt water. Absorbing and isolating members shall be resistant to light, weather conditions, salting and rotting, hydrophobic and free of any material provoking corrosion.

Absorption panels shall meet requirements at least for B1 class of building materials according to DIN4102.

They shall be placed so that hold required position even after long time period. Absorption panels shall be inserted between adjacent steel columns.

Standard length of absorption panels for sound barriers on embankment is 3.96 m while standard height is 50 cm.

During demolition of absorbing panels standard procedures and technical specifications for each material shall be applied.

Measurement

Payment per one (pc.) absorption panel placed.

10.(wall No.)06.02. PROCUREMENT AND PLACING OF ANCHOR PLATES**Description of works**

Connection between steel column and the bridge structure shall be enabled via steel anchor plate, sized as designed, quality S235JO (Č0362 according to SRPS C.B0.500).

Steel plates are fitted with anchor bolts made of RA 400/500-2, O12, fully in accordance with detail shown on graphical documentation.

Measurement and Payment

Payment will be done per piece of installed steel anchor slab.

10.(wall No.)07.01 PROCUREMENT AND INSTALLATION OF TRANSPARENT PANELS**Description of works**

Transparent panels planned to be used as sound barriers shall fulfil the following criteria:

- * Acoustic requirements
- * Safe traffic
- * Maintain structural stability and shape
- * Resistant and/or protected against corrosion
- * Provided with relevant sizes
- * Maintain the selected color tone
- * Resistant to fire load
- * Resistant to stone blows
- * Resistant to vehicle impact
- * Easy for maintenance

Sizes and composition of transparent panels shall be in strict compliance with applicable standards and quality requirements (DIN 52210, DIN 1725/1, ZTV-LSW 88, EN 1793/1794 and other).

Standard sizes of transparent panels to be used as sound barriers on bridge structures are L=1.96 m.

Standard height may exceed 2.0 m.

When transparent panels are planned to be used as sound barriers (acrylic glass, polycarbonates, standard or safety glass), transparency of plastic materials shall not get worse during their service life. They shall be specially protected against UV radiation and shall be resistant to scratches.

In the course of demolition of transparent panels, standard procedure and technical specifications for each material shall apply.

Measurement and Payment

Payment will be done per piece of installed transparent panel.

DESIGN OF TECHNICAL INFRASTRUCTURE

DESIGN OF LIGHTING SYSTEM AT „PREDEJANE“ GRADE-SEPARATED JUNCTION AND POWER SUPPLY TO TOLL STATIONS

2. GENERAL AND TECHNICAL SPECIFICATIONS FOR SUPPLY OF EQUIPMENT AND EXECUTION OF WORKS

2.1. GENERAL SPECIFICATIONS FOR SUPPLY OF EQUIPMENT AND EXECUTION OF WORKS

The items in the Bill of Quantities and Cost Estimate include description, labour, material, machinery, tools, costs and company's profit for quality completion of each item.

All equipment shall be fabricated and all works executed according to applicable regulations and standards.

Execution of works

- Works shall be performed in strict accordance with the Design Documentation, the Contract and the "General and Technical Specifications for the Supply of Equipment and Execution of Works".
- In the case of any discordance the Contractor shall duly request the Engineer's decision. Any design modification shall be supported by a written approval of the Designer and the Engineer. The Contractor shall organize the work to avoid interference with other contractors' performance on the site. The Contractor shall also pay all delays and damage inflicted to other contractors.
- The Contractor shall not assign the contract in full or in parts to any third party without the Employer's consent. The works shall be performed fully as specified in these conditions and other rules governing this kind of work. If during the performance some of these rules are modified, amended or new ones are passed the Contractor shall observe them without any compensation.
- The Contractor shall keep the structures and installations safe from mechanical damage, illegal use and the like, until final commissioning and issue of the final certificate.
- The Contractor shall perform the works (supply of materials included) not envisaged in the design documentation if they are necessary for proper functioning of a structure or for compliance with current regulations. The Contractor shall hand over the structure in proper order for operation.
- These Technical conditions give only important general principles for quality performance. Everything else shall be subject to the relevant codes of practice listed in the design documentation.

Measurement and payment

The work shall be done in strict accordance with the approved design documentation and priced bill of quantities. Lists of materials, bills of quantities and detailed and other drawings shall constitute integral parts of the priced bill of quantities. The work shall be performed as directed by the Engineer and no alterations or important work phases (trial energizing and the like) may be done otherwise. The priced bill of quantities and conditions of contract award shall be integral parts of the contract document. The unit prices shall be the Contractor's selling prices and shall cover:

- Preliminary and final works for quality performance.
- Expenditures for the execution such as: labour, materials and waste, tools, formwork, scaffolds, costs of erection and dismantling, transport, overheads and other expenses allowed in the relevant regulation.

The work shall be performed in accordance with the tender documents, technical regulations and standards with the use of quality materials and skilled workforce, and shall be tested as specified.

Improper materials, which are not in compliance with the relevant technical regulations shall be removed from site by the Contractor and replaced with materials of good quality without entitlement to any compensation whatever.

If any work is performed with materials which do not comply with the technical conditions in the design documentation or with the Engineer's instructions the Contractor shall perform them at his own cost without any compensation whatsoever.

If the design documentation is incomplete or inaccurate the Contractor shall duly request its amendment and interpretation. Any costs of redesign or demolition due to the Contractor's failure to comply shall be borne by him and the Contractor will not be entitled to any compensation or time extension.

Upon completion of all the works or if directed by the Engineer in the course of phases, the Contractor shall make the prepare the structure for use and backfill and level off trenches and holes, clean buildings, installations, appliances and components of the equipment installed.

All these works shall be covered by the main items and will not be paid for separately.

The Contractor shall keep the completed plant, installations, appliances and components in order, clean and fully safe until commissioning. This shall be covered by unit price.

Supply of materials

The materials for the contracted works shall comply with SRPS standards but if these are not available then with other approved standards governing various kinds of materials. Each consignment shall be accompanied with test certificates on compliance.

The mechanical and electrical parameters of the equipment shall be confirmed by type and series tests. Each component shall bear indelible marks identifying the Manufacturer and the technology. The Contractor shall have responsibility for the materials used and unused and for the performance until take-over and issue of the final certificate.

2.2. TECHNICAL REQUIREMENTS FOR SUPPLY OF EQUIPMENT AND EXECUTION OF WORKS

1.1.01.07, 1.1.01.08, 1.1.02.02, Delivery and placing of cable line marks

Description of works

The Contractor shall deliver and place markers for cable line marking on both developed and undeveloped areas, mark cable ends and points of crossing with ground installations.

Measurement and Payment

Payment will be done per one marker.

1.1.01.09, 1.1.01.10, 1.1.01.11; Delivery and laying of PVC pipes

Description of works

The Contractor shall deliver and lay PVC pipes in routings under arterials in the course of civil engineering works.

Measurement and Payment

Payment will be done per m of laid pipe.

1.1.03.14; Delivery and fitting of arms for public lightning

Description of works

The Contractor shall deliver and fix 1.5 m long single arms onto public lighting columns.

Measurement and Payment

Payment will be done per piece of delivered and fixed arm.

1.1.03.15; Delivery and fitting of double arms onto public lighting columns

Description of works

The Contractor shall deliver and fix 1.5 m long double arms onto public lighting columns.

Measurement and Payment

Payment will be done per piece of delivered and fixed arm.

1.1.03.16; 1.1.03.17; Delivery and fitting of holders for two lamps onto the public lighting column

Description of works

The Contractor shall deliver and fix the holder for two lamps onto the public lighting column.

Measurement and Payment

Payment will be done per piece of delivered and fixed holder.

1.1.03.18; 1.1.03.19; 1.1.03.20; 1.1.03.21; 1.1.03.22

Delivery and mounting of public lighting luminaires

Description of works

The Contractor shall deliver and mount luminaires specified in the BoQ onto the steel galvanized public lighting column.

Measurement and Payment

Payment will be done per piece of delivered and mounted luminary.

1.1.03.27. Procurement, delivery and placing of galvanized strip

Description of works

The Contractor shall deliver and lay a FeZn 25x4 mm galvanized strip for protective earthing of the lighting installation in the same trench with 1 kV cable. The metallic columns in the lighting installation and the switchboard ROJO shall be bonded to the strip.

Measurement and Payment

Payment will be done per m of delivered and placed strip.

1.1.03.28. Procurement, delivery and fitting of cross piece

Description of works

The Contractor shall deliver and fit a cross piece in K-U-K housing and seal it with bitumen according to JUS N.B4.936. The case shall be fitted next to each column where earthing strip spurs towards the column and continues along the trench.

Measurement and Payment

Payment will be done per delivered and fitted cross piece.

DESIGN OF 10/04kV TRANSFORMER STATION, „PREDEJANE“ INTERCHANGE AND 10kV FEEDER CABLE**2. GENERAL AND TECHNICAL SPECIFICATIONS FOR SUPPLY OF EQUIPMENT AND EXECUTION OF WORKS****2.1. GENERAL SPECIFICATIONS FOR SUPPLY OF EQUIPMENT AND EXECUTION OF WORKS**

The items in the Bill of Quantities and Cost Estimate include description, labour, material, machinery, tools, costs and company's profit for quality completion of each item.

All equipment shall be fabricated and all works executed according to applicable regulations and standards.

Execution of works

• Works shall be performed in strict accordance with the Design Documentation, the Contract and the "General and Technical Specifications for the Supply of Equipment and Execution of Works".

• In the case of any discordance the Contractor shall duly request the Engineer's decision. Any design modification shall be supported by a written approval of the Designer and the Engineer. The Contractor shall organize the work to avoid interference with other contractors' performance on the site. The Contractor shall also pay all delays and damage inflicted to other contractors.

• The Contractor shall not assign the contract in full or in parts to any third party without the Employer's consent. The works shall be performed fully as specified in these conditions and other rules governing this kind of work. If during the performance some of these rules are modified, amended or new ones are passed the Contractor shall observe them without any compensation.

• The Contractor shall keep the structures and installations safe from mechanical damage, illegal use and the like, until final commissioning and issue of the final certificate.

• The Contractor shall perform the works (supply of materials included) not envisaged in the design documentation if they are necessary for proper functioning of a structure or for compliance with current regulations. The Contractor shall hand over the structure in proper order for operation.

• These Technical conditions give only important general principles for quality performance. Everything else shall be subject to the relevant codes of practice listed in the design documentation.

Measurement and payment

The work shall be done in strict accordance with the approved design documentation and priced bill of quantities. Lists of materials, bills of quantities and detailed and other drawings shall constitute integral parts of the priced bill of quantities. The work shall be performed as directed by the Engineer and no alterations or important work phases (trial energizing and the like) may be done otherwise. The priced bill of quantities and conditions of contract award shall be integral parts of the contract document. The unit prices shall be the Contractor's selling prices and shall cover

- Preliminary and final works for quality performance.
 - Expenditures for the execution such as: labour, materials and waste, tools, formwork, scaffolds, costs of erection and dismantling, transport, overheads and other expenses allowed in the relevant regulation.
- The work shall be performed in accordance with the tender documents, technical regulations and standards with the use of quality materials and skilled workforce, and shall be tested as specified.
- Improper materials, which are not in compliance with the relevant technical regulations shall be removed from site by the Contractor and replaced with materials of good quality without entitlement to any compensation whatever.
- If any work is performed with materials which do not comply with the technical conditions in the design documentation or with the Engineer's instructions the Contractor shall perform them at his own cost without any compensation whatsoever.
- If the design documentation is incomplete or inaccurate the Contractor shall duly request its amendment and interpretation. Any costs of redesign or demolition due to the Contractor's failure to comply shall be borne by him and the Contractor will not be entitled to any compensation or time extension.
- Upon completion of all the works or if directed by the Engineer in the course of phases, the Contractor shall make the structure for use and backfill and level off trenches and holes, clean buildings, installations, appliances and components of the equipment installed.
- All these works shall be covered by the main items and will not be paid for separately.
- The Contractor shall keep the completed plant, installations, appliances and components in order, clean and fully safe until commissioning. This shall be covered by unit price.

Supply of materials

The materials for the contracted works shall comply with SRPS standards but if these are not available then with other approved standards governing various kinds of materials. Each consignment shall be accompanied with test certificates on compliance.

The mechanical and electrical parameters of the equipment shall be confirmed by type and series tests. Each component shall bear indelible marks identifying the Manufacturer and the technology. The Contractor shall have responsibility for the materials used and unused and for the performance until take-over and issue of the final certificate.

2.2 TECHNICAL SPECIFICATIONS FOR SUPPLY OF EQUIPMENT AND EXECUTION OF WORKS

01.01.08;

Procurement and delivery of Al/C wire 3x50/8 mm²

Description of works

The Contractor shall deliver the said wire and perform installation and tensioning to the newly-designed poles.

Measurement and Payment

Payment will be done per m of delivered and installed wire.

01.01.09; Control of executed works

Description of works

Control of executed works, all required tests provided with relevant certificates and putting into operation.

Payment

Payment will be done in lump sum.

01.01.10; Voltage switch off and safeguarding the construction site

Description of works

When displacing the existing power cables it is necessary to switch off voltage and safeguard the construction site. Voltage switch off shall be done by the relevant power distribution company at Contractor's request and the construction site shall be safeguarded by the Contractor to avoid putting in risk human health and goods.

Measurement and Payment

Payment will be done upon the invoice issued by the relevant power distribution company.

01.02.04; 01.02.06; 01.02.07; 01.02.08; 01.02.09; 01.02.10; 01.02.11;

Delivery and installation of HV/LV switchgear

Electrical equipment for high and low voltage switchgear shall satisfy the relevant regulations and recommendations.

Supports for devices and apparatus shall be of metal or other non-flammable materials and shall not demand any specific maintenance.

Switchboard door will be provided with danger warning plate: "High voltage – Danger".

Headroom from the ground to live equipment shall not be less than 5 m.

Metallic structures (doors, frames, supporting skeleton etc.) shall be coated with red lead i.e. primed and grey oil paint. High voltage isolator and switchboard metallic parts shall be painted in the same way. Galvanized steel and aluminium parts need not be painted.

0.4kV switchboards shall bear plates with names of each terminal and metering instrument.

The high voltage incoming and outgoing cables shall be marked with collar plates showing their use, type and nominal voltage.

Secondary circuits of current instrument transformers shall be earthed directly at the clamps.

The metallic parts of plants, supporting structure, control levers, casings, devices and other, not normally under voltage but with which servicing staff may come into contact shall have visible connections to transformer station earthing.

The metallic handles, levers etc. need not be separately earthed if they have conductive bond to earthed apparatuses. However, if such bonds are in the form of toothed gearing – jaw couplings they shall be connected to STS earth electrode.

To enable periodic check of earthing propagation resistance an earth circuit connector shall be designed between the earth electrode and protective earthing.

Buried couplings in the earthing system shall be protected against corrosion in a reliable way.

Upon completion of the works the propagation resistance value shall be measured.

Operating staff shall use rubber gloves, boots, insulated base and rod, tested for 10 kV voltage to protect themselves from electric shock.

Measurement and Payment

Payment will be done per delivered and mounted items of equipment given in the Bill of Quantities.

01.02.05; Power transformer for outdoor application

Transformer shall comply with building codes. They shall bear plates with clearly inscribed main data. The plates shall be so positioned that data can be easily and safely read during operation.

Transformers shall be designed to withstand stresses in operation without damage or reduction of their operating capacity.

A pole-mounted transformer shall be in such a position that its operation, characteristics and lifetime will not suffer in adverse ambient conditions, nor will it cause any negative environmental impact.

Transformers shall not cause harmful vibrations in adjacent pole sections or interference and damage to its structural parts.

Sufficient cooling shall be possible which will not cause any damage in the network.

Automatic safety from electrical overload and inside or outside faults shall be designed to match the size and equipment of the transformer.

Automatic shut off control shall be supplemented with manual start control of all devices that have to be electrically separated from operating parts in a transformer station.

01.02.12: Earth electrode for STS

Description of works

Excavation needed to lay protective earth wire, bury it and tamp earth in 15 cm thick layers. The STS earth electrode shall be in the form of two concentric conductors around the foundation of copper strand min. 35 mm² buried as shown on the drawings. Galvanized iron pipes 2.5" dia 3 m long shall be placed at apex points in the outer concentric conductor.

Measurement and Payment

Payment will be done per m³ of excavated earth and for complete assembly of earth electrode.

01.02.13: Miscellaneous works

Description of works

The Contractor shall also supply small material required for mounting and bonding and perform all required measurements and tests together with issuing of relevant certificates. Inspection and putting into operations shall be performed upon completion of all works.

Payment

Payment will be done in lump sum.

DESIGN FOR DISPLACEMENT AND PROTECTION OF 10kV I 1kV POWER CABLES

2. GENERAL AND TECHNICAL SPECIFICATIONS FOR SUPPLY OF EQUIPMENT AND EXECUTION OF WORKS

2.1. GENERAL SPECIFICATIONS FOR SUPPLY OF EQUIPMENT AND EXECUTION OF WORKS

The items in the Bill of Quantities and Cost Estimate include description, labour, material, machinery, tools, costs and company's profit for quality completion of each item.

All equipment shall be fabricated and all works executed according to applicable regulations and standards.

Execution of works

• Works shall be performed in strict accordance with the Design Documentation, the Contract and the "General and Technical Specifications for the Supply of Equipment and Execution of Works".

• In the case of any discordance the Contractor shall duly request the Engineer's decision. Any design modification shall be supported by a written approval of the Designer and the Engineer. The Contractor shall organize the work to avoid interference with other contractors' performance on the site. The Contractor shall also pay all delays and damage inflicted to other contractors.

• The Contractor shall not assign the contract in full or in parts to any third party without the Employer's consent. The works shall be performed fully as specified in these conditions and other rules governing this kind of work. If during the performance some of these rules are modified, amended or new ones are passed the Contractor shall observe them without any compensation.

• The Contractor shall keep the structures and installations safe from mechanical damage, illegal use and the like, until final commissioning and issue of the final certificate.

• The Contractor shall perform the works (supply of materials included) not envisaged in the design documentation if they are necessary for proper functioning of a structure or for compliance with current regulations. The Contractor shall hand over the structure in proper order for operation.

• These Technical conditions give only important general principles for quality performance. Everything else shall be subject to the relevant codes of practice listed in the design documentation.

Measurement and payment

The work shall be done in strict accordance with the approved design documentation and priced bill of quantities. Lists of materials, bills of quantities and detailed and other drawings shall constitute integral parts of the priced bill of quantities. The work shall be performed as directed by the Engineer and no alterations or important work phases (trial energizing and the like) may be done otherwise. The priced bill of quantities and conditions of contract award shall be integral parts of the contract document. The unit prices shall be the Contractor's selling prices and shall cover:

• Preliminary and final works for quality performance.

• Expenditures for the execution such as: labour, materials and waste, tools, formwork, scaffolds, costs of erection and dismantling, transport, overheads and other expenses allowed in the relevant regulation.

The work shall be performed in accordance with the tender documents, technical regulations and standards with the use of quality materials and skilled workforce, and shall be tested as specified.

Improper materials, which are not in compliance with the relevant technical regulations shall be removed from site by the Contractor and replaced with materials of good quality without entitlement to any compensation whatever.

If any work is performed with materials which do not comply with the technical conditions in the design documentation or with the Engineer's instructions the Contractor shall perform them at his own cost without any compensation whatsoever.

If the design documentation is incomplete or inaccurate the Contractor shall duly request its amendment and interpretation. Any costs of redesign or demolition due to the Contractor's failure to comply shall be borne by him and the Contractor will not be entitled to any compensation or time extension.

Upon completion of all the works or if directed by the Engineer in the course of phases, the Contractor shall make the prepare the structure for use and backfill and level off trenches and holes, clean buildings, installations, appliances and components of the equipment installed.

All these works shall be covered by the main items and will not be paid for separately.

The Contractor shall keep the completed plant, installations, appliances and components in order, clean and fully safe until commissioning. This shall be covered by unit price.

Supply of materials

The materials for the contracted works shall comply with SRPS standards but if these are not available then with other approved standards governing various kinds of materials. Each consignment shall be accompanied with test certificates on compliance.

The mechanical and electrical parameters of the equipment shall be confirmed by type and series tests. Each component shall bear indelible marks identifying the Manufacturer and the technology. The Contractor shall have responsibility for the materials used and unused and for the performance until take-over and issue of the final certificate.

2.2. TECHNICAL REQUIREMENTS FOR SUPPLY OF EQUIPMENT AND EXECUTION OF WORKS

01.01.01;02.01.01;

Dismantling of the existing 1 kV masts

Description of works

The Contractor shall dismantle the existing masts indicated in the graphic documentation. The dismantled masts shall be handed over to the User or Employer in his warehouse. The masts shall be carefully dismantled, transported to distance of 5 km and stored to enable their reuse, if any. The Contractor, Engineer, Employer and User shall jointly determine the state of equipment to be dismantled, storing method and location, its further treatment and status. During dismantling care shall be taken neither to endanger human safety and property nor to affect stability of surrounding structures. The masts can be dismantled only when voltage is permanently switched off.

Measurement and Payment

Payment will be done per one dismantled mast.

01.02.01; 02.02.01 Dismantling the equipment from 1 kV mast

Description

The Contractor shall disassemble 1 kV equipment from 1 KV masts planned for pulling down (marked with arrows on drawings) and hand it over to user or the Employer in his store. Dismantling, transport within 5 km distance and storage shall be careful so that dismantled equipment can be reused eventually. The Contractor, the Engineer, the Employer and the User shall jointly assess the condition of the equipment being dismantled, the place and method of storage, further treatment and status. The equipment which is not planned for dismantling shall be kept in order and shall neither threaten safety of people or goods nor impair the stability of installations. The equipment may be dismantled only after turning off the power for good.

Measurement and Payment

Per each dismantled set of 1 kV equipment (a set means the equipment from one 1 kV mast).

02.02.05; Delivery and laying of cable duct

Description of works

Delivery and laying of PPOO-A, 4x150 mm², 1kV cable into the already prepared trench under and its routing through the Juvidur pipes under the highway. The item includes spreading of sub-base composed of fine grained earth or sand, 20 cm thick, supply and laying of 2 PVC warning tapes - first to be placed at the depth of 0,3 m from the cable and the other at 0.5 m from the cable. Procurement and laying of lead clamps bearing the impressed cable characteristics: type, voltage, section and year of laying.

Marks shall be placed at both entry and exit from the Juvidur pipes an inside the cable trench at every 5 m of the cable length. Backfilling with compaction in layers, bonding of cable ends. Procurement and placing of cable marks for unregulated ground.

Measurement

Measurement will be done per m. Complete material and work included.

01.02.06; Control of executed works

Description of works

Control of executed works, all required tests together with issue of relevant certificates and putting into operation.

Measurement and Payment

Payment will be done in lump sum.

01.02.07;02.02.08; Switching off the voltage and securing the site

Description of works

When displacing the existing cable lines, voltage shall be switched off and the site properly secured. The Contractor shall agree with the competent Power Distribution Company to switch off the voltage and secure the site.

Measurement and Payment

Payment will be done per account issued by the competent Power Distribution Company.

DESIGN FOR DISPLACEMENT AND PROTECTION OF 35kV TRANSMISSION LINE

2.1. GENERAL REQUIREMENTS FOR SUPPLY OF EQUIPMENT AND EXECUTION OF WORKS

The items in the Bill of Quantities and Cost Estimate include description, labour, material, machinery, tools, costs and company's profit for quality completion of each item.

All equipment shall be fabricated and all works executed according to applicable regulations and standards.

Execution of works

- Works shall be performed in strict accordance with the Design Documentation, the Contract and the "General and Technical Specifications for the Supply of Equipment and Execution of Works".

- In the case of any discordance the Contractor shall duly request the Engineer's decision. Any design modification shall be supported by a written approval of the Designer and the Engineer. The Contractor shall organize the work to avoid interference with other contractors' performance on the site. The Contractor shall also pay all delays and damage inflicted to other contractors.

- The Contractor shall not assign the contract in full or in parts to any third party without the Employer's consent. The works shall be performed fully as specified in these conditions and other rules governing this kind of work. If during the performance some of these rules are modified, amended or new ones are passed the Contractor shall observe them without any compensation.

- The Contractor shall keep the structures and installations safe from mechanical damage, illegal use and the like, until final commissioning and issue of the final certificate.

- The Contractor shall perform the works (supply of materials included) not envisaged in the design documentation if they are necessary for proper functioning of a structure or for compliance with current regulations. The Contractor shall hand over the structure in proper order for operation



- These Technical conditions give only important general principles for quality performance. Everything else shall be subject to the relevant codes of practice listed in the design documentation.

Measurement and payment

The work shall be done in strict accordance with the approved design documentation and priced bill of quantities. Lists of materials, bills of quantities and detailed and other drawings shall constitute integral parts of the priced bill of quantities. The work shall be performed as directed by the Engineer and no alterations or important work phases (trial energizing and the like) may be done otherwise. The priced bill of quantities and conditions of contract award shall be integral parts of the contract document. The unit prices shall be the Contractor's selling prices and shall cover:

- Preliminary and final works for quality performance.
- Expenditures for the execution such as: labour, materials and waste, tools, formwork, scaffolds, costs of erection and dismantling, transport, overheads and other expenses allowed in the relevant regulation.

The work shall be performed in accordance with the tender documents, technical regulations and standards with the use of quality materials and skilled workforce, and shall be tested as specified.

Improper materials, which are not in compliance with the relevant technical regulations shall be removed from site by the Contractor and replaced with materials of good quality without entitlement to any compensation whatever.

If any work is performed with materials which do not comply with the technical conditions in the design documentation or with the Engineer's instructions the Contractor shall perform them at his own cost without any compensation whatsoever.

If the design documentation is incomplete or inaccurate the Contractor shall duly request its amendment and interpretation. Any costs of redesign or demolition due to the Contractor's failure to comply shall be borne by him and the Contractor will not be entitled to any compensation or time extension.

Upon completion of all the works or if directed by the Engineer in the course of phases, the Contractor shall make the prepare the structure for use and backfill and level off trenches and holes, clean buildings, installations, appliances and components of the equipment installed.

All these works shall be covered by the main items and will not be paid for separately.

The Contractor shall keep the completed plant, installations, appliances and components in order, clean and fully safe until commissioning. This shall be covered by unit price.

Supply of materials

The materials for the contracted works shall comply with SRPS standards but if these are not available then with other approved standards governing various kinds of materials. Each consignment shall be accompanied with test certificates on compliance.

The mechanical and electrical parameters of the equipment shall be confirmed by type and series tests. Each component shall bear indelible marks identifying the Manufacturer and the technology. The Contractor shall have responsibility for the materials used and unused and for the performance until take-over and issue of the final certificate.

2.2. TECHNICAL SPECIFICATIONS FOR DELIVERY OF EQUIPMENT AND EXECUTION OF WORKS

2.7. Dismantling of the existing 35 kV masts and equipment installed on 35 kV masts

Description of works

The Contractor shall dismantle the existing 35 kV equipment installed on 35 kV masts to be dismantled (the masts are indicated on drawings). The dismantled equipment shall be handed over to the User or Employer in his warehouse. The equipment shall be carefully dismantled, transported to distance of 5 km and stored to enable its reuse, if any. The Contractor, Engineer, Employer and User shall jointly determine the state of equipment to be dismantled, storing method and location, its further treatment and status. During dismantling care shall be taken to keep equipment in a good state and neither to endanger human safety and property nor to affect stability of surrounding structures. The equipment can be dismantled only when voltage is permanently switched off.

Measurement and Payment

Payment will be done per complete work. (complete work means dismantling of one 35 kV mast and equipment installed on one 35 kV mast).

2.6. Earthing of 35 kV mast

Description of works

Earthing of 35 kV mast. The item includes earth excavation, procurement and installation of earth electrode. The excavated channel shall be protected during backfilling. The earth electrode shall be made of galvanized iron, Ø10 mm. Zinc coat for earth electrode shall be minimum 70 µm thick. Underground joints shall be protected against moisture penetration by grouting with bitumen.

Measurement and Payment

Payment will be done per one earth electrode fully installed on 35 kV mast

DESIGN FOR DISPLACEMENT AND PROTECTION OF THE EXISTING TELECOMMUNICATION NETWORK

Missing technical specifications for some items in the Bill of Quantities

12.5.01.13, 12.5.02.11, 12.5.03.11, 12.5.04.10, 12.5.05.10, 12.5.06.08, 12.5.07.10
DETECTION OF THE EXISTING CABLE ROUTE BY CABLE DETECTOR

Description

Certified device shall be used for detection of the existing cable route and prescribed safety at work measures respected.
Measurement per meter of length.

12.5.05.15 SEALING OF PIPES WITH CONCRETE

Description

Sealing of transverse telecommunication cable conduit under the road with 3-5 cm thick layer of lean concrete MV-20 in width of 30 cm.
Measurement per meter of length.

12.5.01.19, 12.5.02.18 PLUGGING OF Ø40 mm PIPE

Description

The pipes shall be closed with specified plugs according to the relevant ZJPTT regulations. Take account of preventing penetration of water, earth and rodents prior to plugging.
Measurement per piece.

12.5.03.17, 12.5.04.16 PLUGGING OF Ø110 MM PIPE

Description

The pipes shall be closed with specified plugs according to the relevant ZJPTT regulations. Take account of preventing penetration of water, earth and rodents prior to plugging.

Measurement per piece

12.5.01.23, 12.5.02.22 STRAIGHT CABLE JOINT ON OPTIC CABLE IN THE TRENCH

Description

Straight cable joint (in trench) shall be made according to the relevant ZJPTT regulations. Cable joint location shall be georeferenced and entered into the As-built design.

Measurement per piece.

12.5.01.27, 12.5.02.28, 12.5.03.21, 12.5.04.20, 12.5.05.21, 12.5.06.17, 12.5.07.20
GEODETTIC SURVEY AND MAPPING

Description

Geodetic survey shall be performed according to ZJPTT regulations and professional rules. Survey shall be verified and approved by TELEKOM SRBIJA a.d. Company.

Measurement per meter of length.

12.05.01.26, 12.5.02.27, 12.5.03.20, 12.5.04.19, 12.5.05.20, 12.5.06.16, 12.5.07.19
PREPARATION OF AS-BUILT TECHNICAL DOCUMENTATION

Description

Preparation of as-built technical documentation.

Preparation per set.

12.5.02.24 CONNECTING OF NEW RE PIPES Ø40 AND THE EXISTING ONES

Description

Connecting of the planned RE pipes ø40 and the existing ones. All required works and small instalation material included.

Measurement per meter.

12.5.02.23 DISMANTLING OF UNDERGROUND CABLE

Description

Dismantling of the existing telecommunication cable and disposal of dismantled material to the safe place and commisioning to the Employer.

Measurement per meter.

12.5.02.14, 12.5.03.14, 12.5.04.13, 12.5.05.13, 12.5.07.13,
PLACING COMBS INSIDE THE TRENCH

Description

Combs shall be placed according to ZJPTT regulations. Special attention shall be paid to levelling and stability.

Measurement per piece.

12.5.05.17 Positions does not contain any additional description

DESIGN OF OCS RECONSTRUCTION AND OVERPASS EARTHING

1. This Technical specification governs the execution, inspection and take over of the works needed to install 25 kV, 50 Hz single phase overhead contact line equipment together with internal inspection, testing and trial operation.

2. The works include civil and installation works to erect and mount equipment and materials and supply of necessary equipment and materials apart from those to be provided by the Employer, transport, insurance and other works listed in the General conditions and in the itemized descriptions. This Specification governs both civil works and installation unless stated that it refers to one class of works only.

3. As this specification mainly refers to OCS reconstruction the Contractor shall get familiar with the existing structures and the equipment purchased and prepare a detailed time schedule in conjunction with the user. These actions shall be approved by the Engineer.

4. OCS erection shall start as soon as the construction permit based on the technical documentation is obtained and shall be carried out in accordance with the Provisional technical instructions for design and construction of single phase 25 kV, 50 Hz overhead contact line on YR (TPE-KM1) General construction rules and this Technical Specification.

Whenever the Railways of Serbia are exempt from enforcing a general regulation, then only those provisions of the regulation which are not in conflict with the railway regulations shall apply.

5. Inspection described herein means the awareness of the Engineer that the works have been done in accordance with the contract documents which will not release the Contractor from his responsibility for the technical accuracy of the executed works.

6. Acceptance in this Specification means take-over of the works and the incorporated equipment and materials by quality and quantity for the sake of the settlement of accounts and payment.

7. Internal inspection of civil works shall be done after their completion and prior to erection.

Final internal inspection shall follow completion of OCS erection and precede an invitation to a relevant authority to perform inspection in accordance with the general regulations.

8. Testing of completed OCS envisaged in this specification shall be partly done at the time of the final internal inspection Section 0.7 hereof and partly when the OCS is put under voltage and during the trial operation.

9. The trial operation according to this Specification may start after a technical inspection, elimination of defects detected during technical inspection and live tests, i.e. upon receipt of the use permit.



12.6.01 DISMANTLING WORKS

Description of works

OCS fittings to be dismantled either permanently or temporarily as provided by the design shall be disassembled into parts by the Contractor (if their condition allows this), sorted out and handed over to the User or Employer in their store. Dismantling, transport within the distance of 5 km and storage shall be careful so that some fittings can, after repair be reused for maintenance. The Contractor, the Engineer, the Employer and the User shall jointly identify the condition of the fittings for dismantling as well as the way and place of storage, its further treatment and status.

It will be important to keep dismantled equipment in order and never threaten safety of people and goods or impair the structural stability.

OCS fittings may be dismantled only after suspension of traffic and power turning off on the OCS section concerned.

12.6.01.01 Payment per kg of dismantled mast. The Item includes breaking the foundation if an abandoned foundation may interfere.

12.6.01.02 The existing catenary system consisting of a catenary, a contact wire, and droppers shall be transferred to new cantilevers on OCS masts. Care shall be taken to keep the OCS fittings undamaged during the transfer. Tolerances of adjusted stagger and pull-off in curves shall not exceed ± 50 mm and ± 10 mm in overlaps.

12.6.01.03 Wherever tension length is changed, droppers shall have to be replaced. Permissible contact wire heights above high rail level at support points and dropper points shall be for:

- contact wire heights except minimum ones not less than 5020 mm- ± 15 mm
- minimum contact wire height /5020 mm/ - + 10 mm, - 0 mm.

12.6.01.04 Payment per each dismantled single cantilever and bracket assembly.

12.6.01.05 Payment per each dismantled mast earthing bonded to rail.

12.6.02 EARTHWORKS

12.6.02.01 Marking foundations for masts, portals and anchor ties, removal and replacement of crushed stone for ballast prism

Description of works

Mast centre lines shall be marked by the Contractor in the following way: by drawing one vertical and two horizontal lines on rail head and mast serial number on rail web in special paint (one rail only) and by pegging the track centre line and portal mast centre line.

Pits for foundations shall be marked by the Contractor based on pegged mast locations and high rail level (Local abbr. GİŞ) fully as designed. The setting out accuracy shall be certified by the Works manager and the Engineer and an entry shall be made in the construction log book

Prior to foundation setting-out the Contractor shall check the spacing of support points, distances between mast centre line to track centre line and the track side at which a mast shall be erected. In case of any discrepancy he shall inform the Engineer immediately.

Tolerances in foundation setting out compared to the designed ones are:

- mast centre to centre line distance ± 100 mm
- tension length ± 500 mm
- distance from track centre line to mast centre line +50mm - 0 mm

Measurement and Payment

Payment will be done per each marked foundation pit at each mast location.

12.6.02.02 Excavation of foundation pits for masts, portals and anchor ties, 0-2 m deep without strutting in cat. II-III ground

Description of works

Excavation of foundation pits shall be careful, true to designed dimensions, without damage inflicted to underground installations and threat to personal safety. Excavation shall be done by hand. Pit sides shall be perpendicular down to the depth required, and the bottom shall be well levelled and horizontal.

Pits shall be safe from the beginning of excavation until concreting. Pit sides for cantilever masts shall be parallel i.e. at the right angle to the nearer rail while pit sides for portal masts shall be perpendicular, i.e. parallel to the portal centre line unless otherwise specified by the design.

If major trouble is encountered during excavation of pits because of underground installations excavation shall be stopped, the pit shall be made safe and either the Designer or the Engineer shall be invited. Data shall be daily recorded in the construction log book and every such entry shall be signed by the Employer's Engineer who shall thus confirm acceptance of foundation pits.

Dimensions and depth of pits, their positions in relation to track centre line, bottom evenness, safety against ground collapse shall be checked and the soil bearing capacity determined to check its compliance with the designed value. In case the designed bearing capacity differs from the actual one, foundations shall be modified by the Engineer in conjunction with the Designer.

In special cases foundation pits in hard ground need not be timbered if the Engineer approves it.

Measurement and Payment

Payment will be done per m³ of excavated foundation pit at support point.

12.6.02.03 Backfilling and compaction of earth around foundations together with spreading

Description of works

If foundation is planned to be backfilled from above, excavated earth will be used. Backfilling shall be in 20 cm thick layers together with compacting.

Measurement and Payment

Payment will be done per m³ of earth to be used for foundation backfilling.

12.6.02.04 Haulage of spoil of all categories with loading and unloading within 5-20m distance

Description of works

Spoil apart from the quantity needed for backfilling around a finished foundation shall be hauled away. Embankment slopes, ballast and drains shall be cleaned. Spoil shall not be deposited at track side and shall by no means be thrown over and mixed with crushed stone ballast. Drains must not be clogged with spoil either.

Measurement and Payment

Payment will be done per m³ removed spoil

12.06.03 CONCRETE WORKS

12.6.03.01 Concreting of mast foundations, portals and anchors through the use of concrete, class MB15. Mechanical mixing and compaction by pre-vibrator.

Description of works

Foundation pit dimensions shall be checked prior to concreting, pit shall be cleaned well and made safe against ground collapse. Concrete shall be, as a rule mixed mechanically and vibrated.

Concrete mass for foundations can be mixed at a central point and transported to the point of placing in mixers, dumpers, rail cars or working train provided mix homogeneity is ensured by constant agitation and the mass is placed before cement starts to set. Concrete may be mixed in special trains which will serve for both mixing and transport of concrete.

Test cubes shall be taken at each 100 m³ of placed concrete.

Concreting shall proceed without interruption. Cylinders for holding down bolts shall be placed as shown on drawings of typical or special solutions. Minor collapses of pit walls shall be filled with normal concrete mix without strutting. Concrete class will be MB15.

The quality of concrete and its constituents (cement, gravel, water) shall meet the following rules and standards:

a) Technical Code for Plain and Reinforced Concrete

b) Serbian standards (hereinafter SRPS).

Foundation tops will be related to railway line benchmarks.

Permissible tolerances for precast and cast in place plain and reinforced concrete foundations of designed dimensions are as follows:

- Cracks	not permitted
- Holding down bolts	vertical, straight with protected threads
- Openings for mast planting	± 10 mm by width
- Openings for planting of masts	± 10 mm by depth
- Cross fall and deviation of holding down bolts from a horizontal line towards the side opposite to main load direction	not more than 1:100
- Cross fall of foundation top and deviation of holding down bolts from a horizontal line towards main load direction	not permitted
- Foundation centre-to-track centre distance	+ 50 mm, - 0 mm
- Top foundation surface level	± 20 mm
- Rotation from a plane perpendicular to track centre line and around vertical axis to both sides	to 1 o

Masts can be fixed to foundations after the above inspection.

Measurement and Payment

Payment per m³ of concrete mix MB15 used for mast foundations.

12.6.03.02 Increased costs due to strutting

Description of works

The foundation parts protruding above the ground shall be concreted in strutting. The strutting shall accurately follow the shape and position of each foundation. Its striking can take place only when concrete achieves the necessary strength that will preserve concrete surface and edges from damage during strutting removal, but not earlier than 24 hours after concreting. Foundations may be loaded when concrete reaches 70% of its designed strength. After striking of strutting surface damages may be repaired if permitted by the Engineer pursuant to civil engineering rules.

Measurement and Payment

Per m² of area of the strutting used for foundation construction.

12.6.03.03 Finishing visible faces of foundation with 1:3 cement mortar, 2 cm thick in average

Description of works

Visible faces of foundations shall be finished with cement mortar. Finished foundation tops shall enable water runoff and shall contain a groove for earthing wire.

Measurement and Payment

Per m² of area of the strutting used for foundation face finishing.

12.6.03.04 Delivery and fixing of M 36/830 mm holding down bolts for masts with base plates

Description of works

Masts with base plates shall be fixed to foundation with holding down bolts M36, 830mm long, thread length 150 mm, with pits at bottom of steel Č0461, hot dip galvanized according to OCS Catalogue, No. 151100.

Holding down bolts shall be secured with nuts in a template. They shall remain strictly vertical during concrete placing and the distances to timbering shall be constantly monitored. Free bolt sections shall be greased and protected with suitable caps of tar paper or wrapped with paper and wire. Threads on bolts shall be inspected after removal of the above protection. If necessary threads shall be cleaned and finished with appropriate tool. Bolt accuracy shall be checked by tightening nuts to ends of threads. This done, fixing of masts may start.

Such free bolt sections shall be black and/or galvanized depending on the type of protection of the supporting structure to be fixed onto them.

Measurement and Payment

Per each delivered and fitted holding down bolt M36/830 mm and three nuts and two base plates.

12.6.04 MASTS AND PORTALS

12.6.04.01 Delivery and erection

Description of works

OCS masts shall be standard, of twin channel steel sections with steel rod bracing. They are available in several types, of standard height of high mast (V identification). Masts shall be selected to suit the OCS design. Anti-corrosive protection shall be in form of hot dip galvanizing. OCS masts shall fully conform to standard drawing TRI-501 in the Catalogue of 25kV, 50 Hz overhead catenary system.

Masts shall be erected fully as designed.

The following tolerances of designed dimensions are allowed for erected masts:

- Rotation of mast around its vertical axis to one or other side from a plane perpendicular to track axis, 1°
- Distance from inner face of mast to track centre line + 50 mm- 0 mm
- Rake of mast axis to all directions from designed axial position not more than 0.2 % of free mast height

Each mast inserted in foundation opening shall be temporarily made safe with wooden wedges and raked away from track while in the station areas each mast between tracks shall be temporarily raked in the direction of track axis or be strictly vertical.

When a mast is to be fixed onto holding down bolts each of its legs shall be secured with at least one nut. Pads can also be used for its vertical adjustment but more than three pads shall not be left on one bolt 10 mm thick altogether.

If protective zinc coat on a supporting structure or its parts is damaged they shall not be erected until damages are repaired. Anti-corrosive coat shall be carefully applied to such damaged spots

Measurement and Payment

Payment will be done per kg of delivered and erected OCS mast.

12.6.04.02 Impressing TOR, mast number and distance of mast inner face to track centre line on mast

Description of works

Each mast shall bear a serial number, danger sign for 25 kV high voltage, distance of mast inner face to track centre line and TOR sign, too. The signs shall be legible, indelible and inerasable. The sign shall be installed at the height of 1.5 m measured from the TOR.

Measurement and Payment

Payment will be done per each marked OCS mast.

12.6.05 ELECTRICAL INSTALLATIONS

12.6.05.01 Single cantilever assembly with brackets for twin channel masts or drop arms on portals

Description of works

Cantilevers for catenary system suspension shall be delivered according to standard designs in 25kV, 50Hz OCS Catalogue TR2-501 to TR2-522, and possibly in special designs shown on the relevant drawings. Cantilever brackets for masts shall be made of hot dip galvanized steel. Brackets shall be selected from among standard designs given in 25kV, 50Hz OCS Catalogue.

Bracket position may deviate from the designed one by ± 10 mm.

Cantilevers shall be assembled in the Contractor's workshop and together with other suspension assemblies transported so that no part suffers any damage.

Openings in suspension tubes shall be safely plugged to prevent humidity getting in.

Suspension assemblies shall be provisionally fixed to supporting structures until wires are pulled out so that they do not move, suffer damage or foul clear track profile

Measurement and Payment

Payment will be done per delivered, fixed standard or special cantilever assemble with bracket for mast.

12.6.06 RETURN CONDUCTOR AND EARTHING

12.6.06.01 Delivery and installation of bonds made of bare 35 mm² copper strand

Description of works

Metallic structures near an electrified railway line shall be earthed as designed. Unconnected structural parts shall have bonds of 35 mm² copper strand as shown on design drawings, cat. No. 651110 Catalogue of 25kV, 50Hz OCS on the understanding that strand insulation shall be cut out and thrown away.

The points where an earth wire is bonded to rails and structures earthed shall be accessible for inspection. Each strand shall be welded to structure by AL-thermal method, CADWELD.

Measurement and Payment

Payment will be done per each delivered and fitted bond of 35 mm², copper wire, 220 mm long.

12.6.06.02 Delivery and fixing of a full spark gap assembly for metalwork earthing

Description of works

The metalwork usually not bonded to rails shall be earthed via spark gaps. A spark gap shall be bonded to the rail foot inside as provided in the design. Spark gap characteristics shall be:

- Alternating response voltage - 220V;
- Max withstand voltage - 430V,
- 100% - impact response voltage - 1000V
- Apex value of short time withstand impact current - 8000A

Measurement and Payment

Payment will be done per each delivered and fitted spark gap and bracket.

12.6.06.03 Delivery and fixing bare galvanized steel strand, 95mm² on post supports for bonding metalwork to earth

Description of works

Metalwork shall be earthed by means of a galvanized earth wire, 95 mm², Cat.No.656200 with bonding material. On a concrete surface the wire shall be placed on posts at 1m spacing, Cat. No. 656300 while it shall be fixed to structure by means of Al-thermal welding method CADWELD.

Measurement and Payment

Payment will be done per piece and m of delivered, fixed and bonded earth wire FeZn 95 mm², with bonding material and posts on structure.

12.6.06.4 Delivery and installation of earthing assembly of bare galvanized steel strand, 95mm² buried in track formation and bonded to rail for supporting structures or other metalwork outside tunnels

Description of works

OCS supporting structures shall be earthen to rail with 95 mm² galvanized steel strand, standard design TR6-551 Catalogue of 25kV, 50Hz OCS, screwed to a plate on mast and welded to the rail outer side by Al-thermal CADWELD method. It shall be fixed with brackets to wooden sleeper (cat.No.650400) or concrete (cat.No.650500). For protection purposes it shall be buried 20 cm deep in the formation.

Measurement and Payment

Payment will be done per each delivered and fitted earthing wire, 3500 mm or 5000 mm long on average with brackets and fastenings.

12.6.06.05 Delivery and fixing of mechanical barrier of 50 x 50 x 1600 mm angles

Description of works

Earth wire shall be protected against mechanical damage at the point where it penetrates into soil with hot dip galvanized angles 50x50x1600mm, in strict accordance with Cat. No. 656600, 25kV, 50Hz, OCS Catalogue.

Measurement and Payment

Payment will be done per each delivered and fixed mechanical barrier for earth wire protection fixed to adjacent structure.

12.6.06.06 Delivery and fixing of danger warning plate Cat. JŽ 951101

Description of works

Danger warning plates shall be fixed on overbridge fences crossing an electrified line, Cat. No. 951101, Catalogue of 25kV, 50Hz OCS.

Measurement and Payment

Payment will be per each delivered and fixed warning plate with fittings, fixed to a structure next to it.

12.6.07 MISCELLANEOUS WORKS

12.6.07.01 OCS inspection, testing and energizing

Description of works

OCS internal inspection shall start as soon as the relevant OCS system is fully completed. The final internal inspection shall be performed by a commission whose members shall be:

- The Employer's representative
- The Contractor's representative
- The Engineer for civil works
- The Engineer for erection of OCS system
- Chief Site Engineer for civil works
- Chief Site Engineer for erection of OCS system

Prior to the final internal inspection of completed OCS the Contractor shall submit to the Engineer one copy of the design technical documentation containing modifications up to that date as well as who performed them and who permitted them.

The results of final internal inspection and possible comments shall be entered in the construction log book.

The following shall be checked:

- Whether the OCS is mounted in strict accordance with the design,
- Whether the equipment and materials comply with the design,
- Whether the work are of good quality and comply with this Technical Specification and engineering practice.

A check of compliance of OCS with the technical documentation shall include checks of:

- OCS sectioning
- Wire and conductor cross sectional areas
- Locations and positions of disconnecting switches
- Clear profile in all cross sections
- Safety clearances particularly on platforms, road-rail level crossings, in tunnels, on overbridges
- Accuracy of basic OCS dimensions
- Stagger and position of contact wire in the middle of span from a static pantograph centre line particularly in circle and transition curves
- Method and quality of bonds and connections, electrical and mechanical
- Return conductor and earthing
- Adjustment of overhead contact line equipment to suit the tables and drawings.

A check of equipment and material shall include checks of:

- Anti-corrosive protection of equipment
- The state of the erected and fitted equipment and materials provided by the Employer
- Quality of return conductor and earthing and protective measures
- Quality of works and of fitted equipment and materials provided by the Contractor

A check of workmanship shall include checks of:

- Method and fixing quality of suspension, tensioning and electrical sectioning assemblies,
- Reliability of wire splices and connections of the fittings
- Accurate positioning of wires between equipment and insulators
- Functionality of hand isolator drives, contact making, lubricated bases and friction faces and cleanliness of isolators and their contacts
- Treatment of wire ends
- Quality of repairs if any damages were inflicted in the course of installation.

The Commission shall set a date by which the Contractor shall repair and remedy the works according to comments given in the Minutes.

The Contractor shall act upon the comments given and invite the commission to repeat the checking procedure and check only the equipment to which the comments referred.

When the Commission confirm that the Contractor has incorporated the comments, the members shall sign the minutes on the final internal inspection of the installed OCS and the completed overhead contact line shall be ready for testing, technical inspection, energizing and trial operation.

TESTING

Testing means inspecting and testing OCS equipment prior to putting it under voltage and subsequent testing.

Prior to energizing, the OCS equipment shall be tested for:

- Mechanical properties,
- Earthing resistance measurements,
- Insulation resistance measurement.

Mechanical properties shall be tested at different running speeds under normal pressure and at reduced speeds under increased pressure exerted by a specified pantograph over points/ turnouts.

Earthing measurement shall be done not earlier than two days after rain. Measured value shall be smaller or equal to the designed one. Measurement of earth resistance shall strictly follow the method given in the design.

Measurement of insulation resistance of all OCS wires shall be done with 1000V megaOhm metre. Measured resistance value shall not be below 1 megaOhm for one feeding section.

After energizing the following shall be done:

- A check of voltage,
- Running of a special inspection car or an electrical locomotive
- Measurement of touch and step voltages

Voltages shall be checked against readings from the respective instruments.

A special inspection car or electrical locomotive will be used to monitor OCS performance at various running speeds up to maximum one at which current collection will be free from arcing between contact wire and pantograph. The following characteristic values shall be checked from an inspection car – running speed, variations of pantograph pressure on contact wire, variations of contact wire height, interrupted voltage at suspension points, stagger of contact wire, etc.

OCS performance shall be checked by a maximum specified number of locomotives coupled at the head of a freight train with only one pantograph raised on each locomotive. The maximum speed shall be as provided in the design.

Touch and step voltages shall be measured in normal operating conditions and at short circuit (artificial) longitudinally along the track, and crosswise

TRIAL OPERATION**General**

OCS equipment may be put under voltage and into trial operation only when all prerequisites for proper OCS performance on a track section are satisfied

Minimum OCS length on which a trial operation may start is one section.

Putting under voltage

A prerequisite to energizing OCS equipment will be the completion of all civil and fitting works, testing according to these Conditions and sending workers away from the site. The Contractor shall confirm to the Employer in writing that workers have left the site.

Prior to putting the OCS equipment under voltage all isolators shall be in OFF position and all temporary earthing removed.

The OCS equipment shall be put under voltage by the Employer and attended by the Contractor.

Tasks during a trial operation

The tests listed in this specification shall be undertaken during the trial operation.

Operation of disconnecting switches and section insulators shall be checked

Touch and step voltage values shall be measured.

Systematic records of faults shall be kept. Causes of faults shall be traced and removed

Measurement and Payment

Payment will be done upon completion of all works stated in the Item.

12.6.07.02 Works on 25 kV network and site safety**Description of works**

Power in OCS shall be temporarily turned off prior to work on 25 kV catenary system. Power shall be turned off by opening disconnectors in OCS or circuit breakers in substations. Each site shall be made safe with rods placed along its limits and earthing rods, Instructions 227 on electrical safety on electrified railway lines JŽ (ZJŽ No.287-8/78), Rulebook 227a on safety measures on single phase 25kV, 50Hz OCS JŽ (ZJŽ No.300-7), and Rulebook 228 for works on YR tracks electrified with 25kV, 50Hz. single phase system.

Measurement and Payment

Payment will be done upon completion of all works stated in the Item.

DESIGN FOR DISPLACEMENT AND PROTECTION OF THE EXISTING WATER PIPES**12.7/7.03.00 INSTALLATION WORKS****12.7/7.03.01. PROCUREMENT, TRANSPORT AND ASSEMBLY OF PIPES****Description of works**

Procurement, transport, distribution along trench and laying of water pipes into trench as designed. Pipes shall be carefully laid on a sand bed and aligned to designed line and grades. Work shall proceed fully as specified in the technical regulations for this type of pipes, drawings and the Engineer's instructions.

The price shall cover material, waste, distribution of pipes along trench, inspection of each pipe and joint, lowering on sand bed and joining

Material

- Pipes for low pressure of 10 bar
- Ø90 mm (DN90) (HDPE-100)

Measurement and Payment

Payment will be done per m³ of completely assembled pipes.

12.7/7.03.02. CAST IRON PIPE FITTINGS

Description of works

Cast iron pipe fittings for low pressure of 10 bars. Procurement, transport, distribution along and installation of pipe fittings into trench. Installation shall be made according to installation plan (for nodes). All flange joints out of manholes shall be coated with bitumen after completion of trial pressure test.

Measurement and Payment

Payment will be done per kg of completely installed pipe fitting.

12.7/7.03.03. POLYETHYLENE PIPE FITTINGS

Description of works

Polyethylene pipe fitting for low pressure of 10 bars. Procurement, transport, distribution along and installation of pipe fittings into trench. Installation shall be made according to installation plan (for nodes). All flange joints out of manholes shall be coated with bitumen after completion of trial pressure test.

Material

PEHD PE100

Measurement and Payment

Payment will be done per one completely installed pipe fitting.

12.7/7.03.04. EURO 20 VALVES

Description of works

EURO 20 valves (type 21). Procurement, transport and installation of wheel valves in manhole and valves with set of accessories out of manhole for operation pressure of 10 bars. After installation the valves shall be controlled and properly tested. All works shall be performed according to design documentation, current regulations for this type of works and the Engineer instructions.

Material

- EURO 20 Ø 80 mm

Measurement and Payment

Payment will be done per one completely installed valve.

12.7/7.03.05. CAST IRON LIDS

Description of works

Cast iron lids. Procurement, transport and fitting of cast iron lids for manholes of 625 mm, SRPS M.J6.226. Installation shall be performed according to design documentation and the Engineer's instructions.

Measurement and Payment

Payment will be done per one installed lid.

12.7/7.03.06. CAST IRON RUNGS

Description of works

Procurement, transport and installation of cast iron rungs, SRPS M.J6.285.

Measurement and Payment

Payment will be done per one installed rung.

12.7/7.04.00. PLAIN AND REINFORCED CONCRETE WORKS

For plain and reinforced concrete mentioned in this part of documentation the following will apply:

Material

The following applies to all items: works on concrete and reinforcement shall be performed fully in accordance with design documentation, structural analysis and current codes.

Concrete will be mixed, transported, placed and tested on test sample according to provisions of the Code of Technical Standards for Plain and Reinforced Concrete - PBAB 87 – Official Gazette of the SFRY, No. 11/87. Concrete mix will consist of aggregates and cement certified according to the current Serbian regulations. Concrete shall be mixed mechanically and compacted by vibration. The price of concrete includes formwork and scaffold. Measurement includes all works, materials, auxiliary tool, placing and curing of concrete and other company's costs and income.

Payment of fully completed work per m³ of placed concrete. Reinforcing bars shall be paid separately. The bars shall be free from rust and dirt, bent and fixed according to reinforcement drawings. Unit price of reinforcing bars includes placing of pads to achieve specified covers and proper position of reinforcing bars in the structure. All distribution steel and stirrups shall be firmly fixed to the main reinforcement to secure their proper position.

The Contractor is responsible for a quality of fixed reinforcing bars. Payment per kg of fixed bars regardless of complexity and reinforcing bar diameter according to tabulated weights.

12.7/7.04.01. LEAN CONCRETE BEDDING

Description of works

Lean concrete, class MB15, 10 cm thick, under the bottom plate of manholes and inspection shafts.

Measurement and Payment

Payment will be done per m³ of placed concrete, class MB15.



12.7/7.05.00. SUNDRY WORKS

12.7/7.05.04. GEODETIC SURVEY

Description of works

As-built survey. After laying of water pipes and prior to backfilling, pipelines, hydrants, manholes, house drains and other facilities in the network shall be surveyed.

After completion of survey, the As-built report shall be prepared and delivered to the Employer.

Payment per m¹ of surveyed pipeline.

Measurement and Payment

Payment will be done per m¹ of surveyed pipeline.

CIVIL ENGINEERING DESIGN OF TELECOMMUNICATION CABLE CONDUIT, Book 12, Volume 8**INTRODUCTION**

The Technical specifications describe in detail particular parts of the design, requirements for the execution of works and quality of performed works.

If this Technical specification does not cover some work, or does not define quality, testing of materials, safety or health and hygiene provisions, then relevant laws, rules, regulations, and standards shall apply. All works shall be performed in compliance with technical specifications, reviewed and verified designs and here mentioned laws, rules and standards.

These technical specifications will be applied to all civil works. General and special provisions given with the Bill of Quantities are integral part of these Technical specifications.

08.02.01.01.02 Positions does not contain any additional description

08.02.01.04.01. BRICKWORK

Building shall be carried out by qualified workers fully as stated in the current technical regulations and the Code of practices in civil engineering.

Brickwork shall exactly follow the plans; bricks shall be properly bonded in horizontal rows without pieces smaller than 1/4 of brick and such pieces shall not be laid one next to the other in a wall.

Vertical and horizontal joints shall be filled with mortar free of voids. Mortar in joints shall not be thicker than 10 - 12 mm. Outer joints shall be left empty by 15-20 mm to allow good bond during wall rendering.

Mortar escaping from joints still fresh shall be removed with trowel and wiped with hessian cloth.

Care shall be taken during wall building of the following:

- To align designed bonds in brickwork consistently and accurately over the whole wall area,
- To cut bricks with a machine, if necessary,
- To make joint strictly horizontal and/or vertical and continuous in width.

Measurement per m² or m³, which will be defined in the Bill of Quantities.

08.02.01.05. MISCELLANEOUS

Waterproofing of concrete faces in contact with earth shall be meticulously and accurately done according to the design requirements, bill of quantities and detailed drawings.

Used materials shall conform to the current standards and regulations, shall be accompanied with test certificates of accredited institutions, verified in use, durable same as the structure itself or designed to be replaceable.

Measurement per m² of coated area with all consumed quantities of materials, transport and labor. Unit price shall be as described above in this item per m².

08.02.01.05.01. WATERPROOFING

General provisions

The work shall be of good quality strictly according to designed detail. Waterproofing shall be done by qualified manpower with appropriate tools and materials, properly procured and stored complying to technical regulations, codes of practices and SRPS standards. The works only that will be executed properly and have the quality specified, requested or commonly expected in the regulations and design shall be measured.

Prior to the commencement of works the Contractor shall submit test certificates to the Employer for all materials he intends to purchase and use. Test certificates shall be issued by accredited institutions for this kind of works and shall not be older than one year counting from the date of their issue to the date of commencement of the works by the Contractor.

The contracted waterproofing items shall be performed according to the design drawings based on which the Contractor will prepare construction details and method statement for the whole structure or certain phases of the works, to be inspected by the Supervising Engineer and Designer. The Contractor shall be fully professionally and legally responsible for the above if the Designer or the Employer accepts his proposal as a better one than the design concept. The Waterproofing Contractor is particularly warned to pay full consideration to the following:

- Waterproofing may be done only in accordance with technically correct details, relevant regulations, instructions and by a verified, proper and usual method of work at the weather suiting them or with adequate protection in case of sudden weather changes or storm.
- Civil, finishing and other works preceding application of waterproofing layers or phases and either associated with them or in any other way depending on them technologically, and those works whose synchronized or later execution may cause damage to waterproofing shall be done in advance of the above, namely in an appropriate sequence agreed and approved.
- Performance of the civil, finishing and other works that may affect the quality, safety and durability of waterproofing shall be checked before it is commenced. The Waterproofing Contractor shall duly inform in writing the Main Contractor about his needs and the latter shall submit this report to the Supervising Engineer to inspect it together with other relevant procedures in the technology of works that usually precede waterproofing.
- All materials to be used shall be sound in every respect.
- Unsound materials (damaged, stuck together or failing to be of appropriate specified quality) shall not be stored, kept on site or placed
- Waterproofing shall be done in the way that its segments and layers as well as finished items fully conform to use, quality requirements, safety and durability.

Prior to starting any contracted waterproofing item, the base surface shall be dedusted and carefully and well cleaned from all dirt, loose dust particles, possible stains of oil, grease, acids etc. If these are not cleaned and removed they may form an interim layer between base and waterproofing and prevent a good bond. The base shall be if possible blown with compressed air and washed with a solution of caustic soda and water and some other efficient and approved agent.

08.02.01.05.02. FITTING OF LIDS

The following lids are used to cover manholes of telecommunication cable conduit:

- Light (~130 kg) for manholes in pavement and grassland
- Heavy (~280 kg) for manholes in pavement

The lids enable easy access to the manhole, more favorable bending diameter of telecommunication cables and manhole inspection. The lid shall prevent penetration of water and dirt into a cable conduit in case of precipitation and street washing.

The lids consist of the following elements:

- Light lid:
- frame
 - plate (cover)
 - rubber seal
- Heavy lid:
- frame
 - outer plate (cover)
 - plate (cover)
 - rubber seal

A frame shall be made of gray cast iron which quality shall comply to SRPS C J2.020/73.

A frame shall be even without any distortion, rectangular, with clean edges and grooves so that all plates uniformly rest on the frame without rocking. A groove with a rubber seal shall be conical, of uniform depth and width.

Lid plates shall be made of grey cast iron which quality shall comply to SRPS C J2.020/73. The plates shall be square without any distortion, with clean edges and appropriate number of adequately located ribs on the bottom side. Top plates shall withstand live load without any damage as follows:

- 12.5 t for plates in grassland and sidewalk
- 25 t for plates in pavement

To prevent slipping, the plate top surface shall have checkered-relief pattern. Sealing rubber shall be without neoprene-based textile insert.

The manufacturer shall complement, sort out and test a quantity prepared for delivery in accordance with these technical specifications and make a test book. The manufacturer shall have a test certificate issued by the authorized institution for tests which cannot be performed in the factory. Fabrication and dimensions shall be checked visually and by measuring dimensions according to documentation and with testing plate seat in the frame and the way plate opens and seals.

Cast iron lid shall be fitted to each manhole – light lid for manhole in sidewalks and heavy lid for manholes in pavement. The lid shall be mounted at height of 0.5 cm above the sidewalk and pavement level but in case of earth surface it will be mounted at height of 1 cm above the ground level. The lid seat shall be concreted with 1:4 mix of cement and gravel.

08.02.01.05.03. FUNNEL-LIKE OPENINGS

Funnel-like openings for pipes in the manhole wall shall be made for whole pipe profile with canted sides. All pipes shall be of same length i.e. aligned for easy mortaring.

08.02.01.05.04. MOUNTING OF CABLE AND CANTILEVER SUPPORTS

Cable supports shall be mounted on walls in telephone manholes and galleries to support cables which are laid there. The supports shall enable easy mounting and safe support of cables and joints. The cable supports consist of one or more components.

Simple support consists of a cantilever and shoe. The cantilever shall be made of appropriate steel section (pipes, Ø section, L section, T section, U section) of specified quality to support cables in manholes and galleries. One cantilever end shall have suitable shape to be mounted directly on the wall or fixed and/or screwed into seat previously placed onto wall. The other cantilever end shall be suitable finished with rounded edges to prevent cable damage of worker injury. Cantilever seat shall be made of steel sheet or casting and have suitable shape to fix or screw the corresponding cantilever. A shoe shall be flexibly mounted to ensure cable laying along the as large as possible surface. A base shall be made of a steel section of specified shape and quality and to enable easy mounting, fixing or screwing of cantilevers.

The manufacture shall complement and test a quantity of cable supports prepared for delivery and make a test book. Fabrication shall be checked by visually inspection of surfaces, complementing and marking while dimensions will be gauged in the appropriate way. The quality of used materials shall be controlled by insight into the factory test certificates and if they are not available, then by laboratory tests.

The lowest row of supports shall be mounted at height of 0.3 m above the ground level while the highest row can be at 0.3 m below the manhole ceiling. Spacing between rows can be 0.3 – 0.5 m. Spacing between supports depends on number and design of cables and can be 0.8 – 1.2 m.

DESIGN FOR DISPLACEMENT AND PROTECTION OF LINESIDE CABLES, Book 12, Volume 9

The missing technical specifications for items of the Bill of Quantities

12.09.01.02.18, 12.09.01.02.19, 12.09.01.02.20, 12.09.01.02.21, 12.09.01.02.22, 12.09.02.02.17, 12.09.02.02.18, 12.09.02.02.19, 12.09.02.02.20, 12.09.02.02.21, 12.09.03.02.14, 12.09.03.02.15, 12.09.03.02.16, 12.09.05.02.17, 12.09.05.02.18, 12.09.05.02.19, 12.09.05.02.20, 12.09.05.02.21, 12.09.06.02.16, 12.09.06.02.17, 12.09.06.02.18, 12.09.06.02.19

COPPER CABLE SPLICING IN A TRENCH

Description

Copper wires in cables shall be spliced by twisting. 0.8 mm diameter and thicker wires shall be soldered. The splices shall be insulated with small paper tubes. Splices in the form of single or multiple wire connectors and multiple modules will be permitted only if explicitly envisaged in the Technical description or specifically directed by the Engineer

Capacitive coupling shall be made for the purpose of crosstalk attenuation in low frequency range as described in the Technical description. Loading coils shall be inserted to reduce pair attenuation in low frequency range

12.09.05.01.09, 12.09.05.02.13, 12.09.05.02.22, 12.09.05.02.23, 12.09.05.02.24, 12.09.05.02.25, 12.09.05.02.26, 12.09.05.02.27, 12.09.05.02.28, 12.09.05.02.29, 12.09.05.02.30, 12.09.05.02.36, 12.09.05.02.37, 12.09.06.02.15, 12.09.06.02.20, 12.09.06.02.21, 12.09.06.02.22, 12.09.06.02.23, 12.09.06.02.24, 12.09.06.02.25, 12.09.06.02.26, 12.09.06.02.27, 12.09.06.02.28, 12.09.06.02.35, 12.09.06.02.36. Technical specifications for above mentioned items are given in BoQ.

LANDSCAPING DESIGN

GENERAL SPECIFICATIONS FOR LANDSCAPING

14.01.01. 14.01.02. 14.01.03. 14.01.04. 14.01.05. 14.01.06. LANDSCAPING WORKS

Description of works

Seedlings shall be planted in autumn when growing period is completed or in spring before the start of growing period.

Planting material shall be cultivated in the nursery-garden and properly developed with undamaged root system and aerial part without any entomological or phytopathological disease.

Planting material shall be picked from the nursery-garden and transported immediately prior to planting in permanent place.

If planting is not possible on the spot, planting material transported without baled turfs shall be stored in a clamp at once.

Fertilization with humus-peat fertilizer or well burned two-year manure shall be performed in the following way: at first, specific fertilizer quantity shall be mixed with humus earth and spread around and over the root system at the time of planting.

At the time of planting, seedlings shall be oriented toward marked cardinal point (north) to be at same position as in the nursery-garden thus enabling proper further growing.

Seedlings of deciduous trees shall be fixed by rubber clips with raffia strings or figure-of-eight rope to a stick of specified height with rounded top placed vertically to dominant wind direction prior to covering up the turfs in order to avoid root system damage.

Planting depth and/or position of root tip shall be by 2-3 cm below the level at which a seedling was during cultivation in the nursery-garden. It is expected that earth will be settled to a level of the root neck after planting and watering.

A seedling shall be permanently fixed to a stick 2-3 days after planting and/or settling of earth around the planted seedling.

Coniferous trees shall be anchored in three directions with pegs, wire and rubber clips placed around the tree.

After planting, the ground around seedlings of all vegetation categories shall be adequately prepared to ensure proper watering.

Each planting pit shall be cylinder-shaped with different diameter and depth depending on category:

High conifers	1.0 x 1.0 m ²	
Middle-high and low conifers		0.8 x 0.8 m ²
High deciduous trees		1.0 x 1.0 m ²
Middle-high and low deciduous trees		0.8 x 0.8 m ²
Shrubs and climbing plants		0.4 x 0.4 m ²

For different categories of planting material, each pit requires the following quantities of peat fertilizer:

For high conifers		20 kg
For middle-high and low conifers	10 kg	
For high deciduous trees		25 kg
For middle-high and low deciduous trees	15 kg	
For shrubs and climbing plants	3-5 kg	

Measurement

Measurement will be done per one seedling.

14.02.01. MAINTENANCE OF VEGETATION

Description of works

After complete cultivation of green areas they shall be intensively nurtured and maintained in order to facilitate adaptation of seedlings to the new environment and ensure quick growth and biologically strong vegetation.

In order to meet seedling needs and achieve the above-mentioned, the following shall be performed:

- Pruning the hedge
- Hoeing the seedlings of trees, shrubs, roses and hedge
- Grassland weeding out
- Grassland mowing, raking and rolling
- Watering of grassland and seedlings
- Nutrition and landscaping of flower gardens, change of seasonal flowers, weeding, hoeing, watering, etc.

Vegetation maintenance value is about 20% of landscaping amount for 1 (one) calendar year. Maintenance shall start from the day of technical inspection.

Planted material shall be maintained from the very beginning and the above stated percent serves for provision of financial resources for maintenance till acceptance of works.

During the defect liability period the Contractor shall eliminate at his expense all defects caused by unprofessionally performed works or planting of low-quality vegetation.

Measurement

About 20 % of the landscaping investment value shall be measured.

11.1.4.1 Procurement and placing of Ø100 plastic pipes for weepholes

Weepholes on the wall shall be spaced 2.5 m apart and leveled according to the design.

Measurement: Measurement will be done per sizes stated in the design. Measurement unit will be meter of length.

Payment: Unit price includes procurement, transport and placing of Ø100 plastic pipes. Unit price includes the item described above. Payment will be done per one meter of length.

11.1.4.2 Procurement and placing of Ø200 plastic perforated pipes

Pipes shall be laid over the water impermeable bedding and inclined as stated in the design. Filter layers shall be placed over the pipes.

Measurement: Measurement will be done per sizes stated in the design. Measurement unit will be meter of length.

Payment: The unit price includes procurement, transport and laying of Ø200 perforated plastic pipes. Unit price includes the Item stated above. Payment will be done per meter of length.

13.10.10 Procurement, transport and fitting of cast iron rungs, DIN 1212

Works shall be executed fully in accordance with technical regulations, drawings and the Engineer's instructions.

Measurement and Payment: Payment will be done per one fitted rung.

(12) General Specification

Equivalency of Standards and Codes

Wherever reference is made in the Contract to specific standards and codes to be met by the goods, materials to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are national, or relate to a particular country or region, other authoritative standards that ensure substantially equal or higher quality than the standards and codes specified shall be accepted subject to the Engineer's prior review and written consent. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer's consent. In the event the Engineer determines that such proposed deviations do not ensure substantially equal performance, the Contractor shall comply with the standards specified in the documents.

List of General Specification:

Section 01	Preliminaries
Section 02	Preliminary Works
Section 03	Earthworks
Section 04	Drainage
Section 05	Slope Protection
Section 06	Sub-base Layers
Section 07	Superstructure
Section 08	Concrete
Section 09	Asphalt Pavements
Section 10	Concrete pavements
Section 11	Structures
Section 12	Traffic Markings and Traffic Equipment
Section 13	Bridges
Section 14	Tunnels
Section 15	Telecommunications
Section 16	Electrical Installations
Section 17	Mechanical Systems

The Special Specifications should be read in conjunction with General Specifications and shall extend and modify them as appropriate.

Section 1 Preliminaries

Contents

- 1.1. Definitions and Interpretation
- 1.2. Scope of the Works
- 1.3. Documents on Site
- 1.4. Fulfilment of Contractual Obligations in Good Faith
- 1.5. Contractor's General Obligations
- 1.6. Contractor's Workers
- 1.7. Quality of Materials and Works
- 1.8. Facilities for the Engineer
- 1.9. Relocation of Services
- 1.10. Health and Safety
- 1.11. Quality Assurance Management System
- 1.12. Specifications and Standards
- 1.13. Specified Manufacturers
- 1.14. Environmental and Social Impact

1.1 Definitions and Interpretation

1.1.1 Definitions

Terms used in these Specifications are as defined in the Conditions of Contract with the following additions:

- "Special Specifications" shall, together with these General Specifications, comprise the "Specifications" or "Technical Specifications" for this Contract. The Special Specifications shall be read in conjunction with these General Specifications and shall extend and modify them as appropriate. The Facilities for the Engineer and Employer's Representative, Environmental Management Plan and Check List should be treated as "Special Specifications".
- "Works Manager" is synonymous with the term "Contractor's Representative"
- "Preliminary works" are those works and auxiliary structures of a temporary character that are performed in order to organize the Site and apply certain work execution technologies.
- "Designs" mean technical solutions and specifications for the execution of works adopted by the Employer. The designs include any alterations of and/or additions to the designs adopted by the Employer during the execution of works.
- "Technical Documents" means all designs for a structure.
- "Designer" is the organization that prepared the Technical Documents for the works within the scope of Contract.

1.2 Scope of the Works

1.2.1 The scope of the Works shall be as defined in Section 1.2 of the Special Specifications.

1.3 Documents on Site

1.3.1 Building Journal

The Contractor shall keep a Building Journal throughout the execution of works.

The Building Journal shall be kept in the form of a bound book with double pages (an original and copy); the copy being tearable from the book.

The Building Journal shall be kept by the Works Manager, or a person appointed by him, starting from the date of introduction of the Contractor into the work until the date of taking over of the works after their completion.

The Building Journal shall daily record data on the course and method of execution of the works, along with all those data that may affect the safety and quality of the works, such as the data on: inspection of all those works that will be impossible to inspect in later stages (foundation pits and sub-strata before the resumption of works, formwork and reinforcement before concreting, the subgrade before the construction of the pavement, masonry elements before plastering, clear profiles and rock masses in tunnels before lining, installations before sealing the insulation, before back-filling, etc.); sampling materials for testing; tests on the site; testing and compliance testing results; variations from the Technical Documents; weather conditions and temperature; any natural events and accidents; the delivery, origin, and quality of materials and equipment delivered to the site; spot heights, staking and the like; ground investigations; inspection of the site by inspection authorities and their findings; and on other works and events that affect the safety and quality of the works.

Furthermore, all those data that may serve as evidence in the calculation of executed works shall be entered into the Journal, such as the data on: alterations and amendments to the designs; halts and suspension of the works; the works that are stated in overhead hours; unforeseen and additional works; groundwater; alterations in working conditions; number of employees and their qualification structure; machines on the site; excavation levels; soil category; altered working conditions etc.

The Engineer and Contractor shall record any exchange correspondence through the Building Journal regarding the mentioned data and other problems, particularly regarding the meeting of deadlines, provision of necessary documents, elimination of identified defects, quality assessment, payment for works etc.; in particular, the Engineer shall record the issue of all necessary instructions to the Contractor in the Journal.

The Works Manager and Engineer shall daily confirm the accuracy of data entered within one day by affixing their signatures on these pages.

The Engineer shall have one copy of signed pages safeguarded with the Employer, and the other copy shall remain with the Contractor.

The data entered into the Building Journal shall not be corrected, altered, nor supplemented. Any corrections, supplements, or alterations shall be entered into the Journal with a new entry.

If any Republic or Provincial regulation in the territory where the works are executed has some other requirements regarding the keeping of Building Journals, the Contractor shall follow these requirements.

All entries into the Building Journal shall be considered as true, until proven otherwise. The costs of proving shall be borne by the party who entered untrue data into the Building Journal.

1.3.2 Measurement Book

The Contractor shall keep a Measurement Book, unless the works were contracted 'on a turnkey basis' or the like.

The administration of the Measurement Book, notices of measurements etc. shall be in full accordance with the Conditions of Contract. The Contractor's entitlement to payment for any Works completed and recorded in the Measurement Book shall be in full accordance with the Conditions of Contract.

Accurate data on measures and quantities of actually executed works shall be entered into the Measurement Book; the Book serves as evidence (document) for the statement and payment of the Works. If necessary, appropriate sketches shall be drawn in the Measurement Book as well.

The Contractor's Works Manager and the Engineer shall prepare necessary draft calculations that are considered as constituent parts of the Measurement Book, and these shall be kept in one copy on a copy of the Final Design.

All alterations shall be entered in several colours. A draft calculation may be accompanied with special key details with a reference to the Building Journal or Measurement Book, when, why and by whom the alteration was made. Draft calculations shall be signed by the Engineer and Works Manager.

The Measurement Book shall be kept in one copy, so that each item from the Priced Bill of Quantities shall be on a separate sheet. After the completion of final calculation, all sheets of the Measurement Book shall be bound together and submitted to the Employer.

Data for the Measurement Book shall be jointly collected by the Engineer and Works Manager, entering, near the end of each month, the quantities of works completed in that month, with calculation data for these quantities, and verifying with their signatures the accuracy of these data. All quantities stated in the Measurement Book that are impossible to check at a later stage, but are verified by the Engineer, shall be considered as finally determined quantities.

Any correction in the Measurement Book shall be signed and countersigned.

1.3.3. Other Documents

The Contractor shall have on the site at all times:

- The Building Permit, i.e. the general approval for the construction of the entire structure
- The Technical Documents based on which the Building Permit was issued
- Detailed Drawings with alterations and amendments added on the drawings
- The Documents from which it is possible to determine whether the works are executed according to current regulations, technical norms, and Serbian standards (rules, standards, compliance certificates, test results, etc.),
- The Decision on entry into the Serbian Business Registers Agency and appropriate building Licenses
- The Building Journal
- The Measurement Book
- The Act on assignment of the responsible Site Manager, with special contractual regulations or provisions
- The technical description of the Contractor's organization
- The Site organization scheme
- The programme (operational plan) of works,
- The financial spending plan, and
- Other documents if needed by the current regulations or the Contract.

1.4. Fulfilment of Contractual Obligations in Good Faith

1.4.1. Principles of honesty and good faith

Honesty and good faith are basic principles that the Contracting Parties shall follow in activities specified in the Contract.

1.4.2. Fulfilment of obligations

During the fulfilment of their obligations, the Contracting Parties shall act with due care required in business relations (due diligence), and in the fulfilment of obligations from their professional activity, they shall act with more care, according to professional rules and practices (due professional diligence). A Contracting Party shall not ask the other Contracting Party to fulfill his obligation, if the asking Party himself did not or is not ready to fulfill his obligation to which the fulfilment of the other Contracting Party's obligation is related, unless otherwise specified in the Contract.

A Contracting Party shall inform the other Contracting Party in a timely manner of any facts the occurrence of which affects the fulfilment of the Contract, such as obstacles to the fulfilment of Contract, changes in circumstances, etc.

The notifications shall be in writing, and therefore the other Party shall be considered as informed by an entry into the Building Journal.

1.5. Contractor's General Obligations

1.5.1. Notification and Clarifications

The Contractor shall timely, in writing and recorded in the Building Journal, notify the Engineer of all issues relevant for the fulfilment of contractual obligations, commencement of particular technological phases of works, sources for the supply of materials, shops and plants where preliminary works are performed, or where semi-finished and finished products are fabricated, and machines that the Contractor engages for the execution of works.

The Contractor shall timely ask the Engineer for any clarification of the Technical Specifications, Technical Documents, and other documents. If the Contractor fails to do so, he shall not have the right to any compensation due to the halt in works or modification of executed works due to a variation from documents or the Contract. The Engineer shall give the requested clarification and instructions to the Contractor in writing and recorded in the Building Journal.

1.5.2 Setting Out Of Work And Protection Of Survey Monuments

Immediately after receiving notice to commence the Works the Contractor shall carry out the following:

- (a) The Contractor shall carry out a thorough survey check of the coordinates and levels of the ground control traverse stations (primary beacons) against data supplied by the Engineer and will immediately report to the Engineer any discrepancies between the measured locations or levels of the ground control points and that data. The Contractor may expect that some of the stations will have been disturbed or destroyed. The Contractor and the Engineer shall agree either to disregard erroneous data or to substitute new values of coordinates and/or levels.
- (b) The Contractor shall establish construction control points along the length of the road alignment. These control points shall be located outside the area to be occupied by the Permanent Works, and successive points shall be mutually inter-visible and shall be at spacings and locations such that all future setting out can be carried out from them. The Contractor shall clearly mark and protect the construction control points, which shall comprise steel pins set in concrete, until completion of the Contract.
- (c) Coordinates and levels of the construction control points shall be determined by the Contractor, and notified to the Engineer, based on the ground control coordinates and levels supplied by the Engineer.

When a primary beacon is likely to be disturbed during construction operations, the Contractor shall establish suitable reference beacons at locations where they will not be disturbed during construction. Beacons shall be established on a steel pin set in concrete or a similar permanent manner as approved by the Engineer. No beacon shall be covered over, disturbed or destroyed before accurate reference beacons have been established and details of the position and levels of such beacons have been submitted to the Engineer and approved by him. The Contractor's reference beacons shall be of at least the same quality and durability as the existing beacons.

The Contractor shall, prior to any setting out, submit to the Engineer for his approval, the method of setting out he proposes to employ. The plan shall include the accuracy, positions of the various types of stakes, method of marking stakes, and methods to be used for protecting stakes, etc. No survey work shall proceed prior to the Engineer's approval of the Contractor's plan. At least 24 hours before he intends to survey any portion of the Works, the Contractor shall give written notice to the Engineer. Such notice shall include time, location and type of Works to be set out. The Contractor shall set out the Works and obtain approval of his setting out before proceeding with construction.

Special care shall be exercised during construction not to damage, displace or disturb property and trigonometrical survey beacons. If such beacons are disturbed or destroyed by the Contractor they shall be replaced without delay by a registered land surveyor at the Contractor's expense. In cases where displacement or of damage to such beacons is unavoidable the Contractor shall also be responsible for relocation or suitably referencing later reinstatement of such beacon at his own cost.

Accurate control of line and level shall be provided by the Contractor at all stages of construction. In respect of the road itself control shall be at 20 m intervals, or such closer intervals as may be directed by the Engineer on horizontal and vertical curves. After the clearing and grubbing and removal of topsoil and completion of any preparatory road bed treatment which may have been ordered by the Engineer, but prior to commencement of any earthwork operations, the Contractor shall level cross sections of the ground line. Wherever necessary, but particularly on completion of the subgrade and the base, the Contractor shall re-establish stake line pegs at sufficiently close intervals to determine accurately the edges of the base, surfacing and especially kerbing, guardrails and other road elements permanently exposed to view.

No work in connection with survey, setting out and with any requirement of this Section of the Specifications shall be subject to measurement or payment. All costs in connection with survey and setting out shall be deemed to be covered by the rates and prices included in the Bills of Quantities.

1.6 Contractor's Workers

1.6.1 Transport, Lodging, and Board

The Contractor shall, at his own expense, ensure the transport of works from the place of lodging to the site, and organize the accommodation and board for workers on the site, etc., in compliance with the regulations on associated labour, and regulations on occupational safety.

1.6.2 Works Manager

The Contractor shall ensure that the Works are managed directly by a competent person (Works manager) who will, in compliance with the law, have specific qualifications and experience with this type of works.

The Contractor shall retain in his organisation a management expert who is familiar with the FIDIC Conditions of Contract, whose duties will include liaison with the Engineer, attending meetings with the Engineer concerning all contract matters and obligations of the parties to the Contract; on the job training of Contractor's staff concerning project management, contract administration and quality assurance.

Three days before the commencement of Works, the Contractor shall submit to the Employer and the Engineer, in writing, the name of the responsible Works Manager. If in the course of works the responsible Works Manager is replaced, the Contractor shall immediately inform the Engineer thereof.

1.7 Quality of Materials and Works

1.7.1 Quality Control

Quality Control and Management shall include, but shall not be limited to, the conduct of laboratory testing of materials, semi-finished and finished products, and by the testing of completed works "in situ".

The Contractor shall execute the works in the order that ensures a good quality of performance, and timely inform the Engineer of the execution of each phase, for the purpose of determining the quality of works.

1.7.2. Control Testing

The Contractor shall provide a Site laboratory in accordance with the requirements of Sub-Clause 1.7.7 of the Technical Specifications and shall be responsible for staffing and equipping the laboratory in order that it can complete all the testing specified in the Contract at a rate compatible with the programmed rates of construction of the Works.

1.7.3. Independent Laboratory

The Engineer shall carry out control tests, through an Independent Laboratory, accredited in accordance with current regulations in operation in Serbia. The primary objective of the Independent testing shall be to establish the accuracy, or otherwise of the on Site testing, although the final assessment of quality of materials and works, and the results of control tests shall be considered as relevant.

The Independent laboratory shall execute testing at not less than 10% of the rate of testing stated in the Specifications for Site testing. The cost of all such Independent Testing shall be borne by the Contractor.

1.7.4. Testing Costs

The costs of pre-testing and regular testing and Independent testing of building materials, semi-finished and finished products shall be borne by the Contractor.

1.7.5. Approval of Materials for Use

The Contractor shall, before the delivery and/or use of adequate building materials, semi-finished, and finished products, provide from a professional, i.e. authorised Serbian institution the certificate on the completed pre-testing of quality and suitability of the materials, semi-finished and finished products he intends to use, and the Contractor shall submit them to the Engineer for check-over and approval.

The Contractor shall provide compliance certificates when so specified in the contract specifications.

The Contractor shall not use any building materials without the Engineer's approval, and if he uses them, he shall bear the risk and costs that may arise on such grounds.

1.7.6. Materials from Abroad

The contractor shall have the right to import, for the purpose of execution of works, the materials that cannot be procured in Serbia, in compliance with regulations on the import of goods. The imported materials shall be provided with compliance certificates issued by an organization registered in the Court Register for the testing of materials and constructions in Serbia, such certificates confirming that the materials meet the contract specifications.

1.7.7. The Laboratory and Laboratory Resourcing

The laboratory building shall comprise an internal floor area of at least 150 m² and a further external covered area of at least 30 m² and shall include the following rooms:

- 2 offices (one each for the Engineer and the Contractor) of minimum 15 m²
- 1 main laboratory room of minimum 50 m²
- 2 subsidiary laboratory rooms of minimum 20 m²
- 2 store rooms of minimum 10 m² each
- toilet facilities

Adequate light fittings shall be provided in each room together with sufficient power points to supply all equipment.

The laboratory provided by the Contractor shall be used exclusively for the selection, design and control testing of materials to be incorporated in the works.

The Contractor shall supply new furniture and equipment for the laboratory as listed in the Special Specifications TABLE 1.7.7 – A for use as directed by the Engineer. The Contractor shall provide additional furniture and equipment for his own use. (Materials testing equipment is addressed separately):

The laboratory shall be fully equipped to carry out all of the tests indicated below and the testing equipment provided shall conform in every respect to the standards listed. The Contractor shall provide sufficient quantities of testing equipment to meet the specified testing requirements, commensurate with his planned rates of production, including an adequate stock of breakable and consumable items. All furniture fittings and equipment provided for the laboratory shall be new, unless otherwise agreed by the Engineer. The Contractor shall submit the proposed layout and a full list of the equipment and furniture he intends to order, within 14 days of the receipt by the Contractor of the Letter of Acceptance, for the comment and approval of the Engineer. Such approval by the Engineer shall not relieve the Contractor of his responsibility to ensure that the laboratory is adequately equipped and the Contractor shall have no claim for delays resulting from the inadequacy of the testing facilities.

The Contractor shall be responsible for staffing the laboratory. He shall provide a suitably qualified and experienced and licensed senior laboratory technician and sufficient technicians and assistants to meet the testing requirements. It is anticipated that this will require not less than 5 technicians and 10 skilled assistants. Details of the proposed staffing shall be submitted to the Engineer for approval and he shall be entitled to ask the Contractor to remove or replace any member of the laboratory staff, whether previously approved or not, if in doubt about their competence. The Contractor shall have no claim for delays resulting from the inadequacy of numbers or inexperience of laboratory staff.

The Principal Offices:

General

An area of approximately 2000m sq. shall be allocated, from land acquired by the Employer for the construction of a fenced compound and, within it, Principal Offices for the Engineer in buildings of permanent and temporary construction. The Contractor shall be provided with a layout and detailed design drawings / specifications for the buildings as well as details of the provisions / furnishings selected by the design architects.

Paving shall be required over approximately 1500m.sq. of the allocated area and the remainder shall be landscaped and planted.

The Permanent Building

The furniture and equipment to be provided for the Permanent Building Offices, in accordance with this Technical Specification and Annex A1 in the Special Specifications, shall be handed over into the property of the Employer at the end of the Contract.

The offices in the permanent building shall include the preparation of all necessary working drawings as well as all of the provisions indicated in the designs, including but not limited to, the provision of all services and utilities, air conditioning and heating throughout, the work stations and furnishing, four telephone lines and connections to all offices, provision of a file server and computer networking of the work stations, printers etc., fire extinguishers, smoke alarms and fire exit signs according to the Fire Authority regulations or, otherwise, as directed by the Engineer, doormats in the entrances, a boot scraper and 6 lever security locks on the entrance doors.

The Office of the Chief Resident Engineer :

As shown in the drawings, the office of the Chief Resident Engineer shall be a minimum 20m.sq., and provided / furnished with equipment listed in Table CRE in the Special Specifications.

The Offices of Senior Engineering Staff :

As shown in the drawings four offices for Senior Engineering Staff shall be a minimum of 12 m.sq., and each one provided / furnished with:

- (a) 1 x work station, comprising of a 1.6m x 0.80m x 0.75m high, executive desk with a 1.2m x 0.6m x 0.68m high, computer table, a 3 drawer lockable cabinet 0.45m x 0.47m x 0.57m high and an upholstered executive office chair with arm rests.
- (b) 1 x 4 drawer lockable steel filing cabinet
- (c) 1 x double door cupboard with shelves (matching the desks), 0.90m x 0.45m x 1.40m high.
- (d) 2 x standard, matching chairs for visitors
- (e) 1 x Computer Pentium 4 at 2.9GHz or higher, hard disk 80 GB, monitor TFT LCD 17", DVDRW, floppy drive, modem/fax/voice 56k linked to the office network.
- (f) 1 x telephone set with contact saving, re-dial and call-back functions
- (g) 1 x Wall clock
- (h) 1 x Heavy duty document hole punch 'SAX 608' or equivalent
- (i) 1 x Stapler 'SAX 620' or equivalent
- (j) Name plate on door
- (k) 1 x Paper trays, 3 tier
- (l) 1 x Waste paper basket
- (m) 1 x 2.4m x 1.2m pin board
- (n) Set of coat hooks
- (o) 1 x indoor evergreen plant (approx 1.5m in height)

The Offices of Engineering Staff:

As shown in the drawings four offices for Engineering Staff shall be 15 m.sq plus, and each one provided furnished with :

- (a) 3 x work stations, each comprising of a 1.6m x 0.80m x 0.75m high, desk, a 3 drawer lockable cabinet 0.45m x 0.47m x 0.57m high and an upholstered office chair with arm rests.
- (b) 2 x 4 drawer, lockable steel filing cabinets
- (c) 1 x double door, lockable steel wardrobe cabinet, 0.90m x 0.45m x 2.00m high
- (d) 2 x standard, matching chairs for visitors
- (e) 2 x Computers Pentium 4 at 2.9GHz or higher, hard disk 80 GB, monitor TFT LCD 17", DVDRW, floppy drive, modem/fax/voice 56k linked to the office network.
- (f) 1 x telephone set with contact saving, re-dial and call-back functions
- (g) 1 x Heavy duty document hole punch 'SAX 608' or equivalent
- (h) 1 x Stapler 'SAX 620' or equivalent
- (i) Name plate on door
- (j) 3 x Paper trays, 3 tier
- (k) 3 x Waste paper basket
- (l) 1 x 2.4m x 1.2m pin board
- (m) Set of coat hooks

2.6 The Secretaries' Office

As shown in the drawings the office for Secretarial Staff shall be 15 m.sq plus, and provided/furnished with :

- (a) 2 x work stations, comprising o a 1.6m x 0.80m x 0.75m high, executive desk, with a 1.2m x 0.6m x 0.68m high, computer table, a 3 drawer lockable cabinet 0.45m x 0.47m x 0.57m high and an upholstered office chair designed for typists.
- (b) 4 x 4 drawer, lockable steel filing cabinets fitted for hanging files
- (c) 1 x double door, lockable steel cabinet with shelves, 0.90m x 0.45m x 1.40m high.
- (d) 1 x double door cabinet 0.90m x 0.45m x 0.73m high, with work surface top, containing 1 x electric kettle, 12 cups, 12 tea spoons, 1 tray and 4 dish towels.
- (e) 2 x standard, matching chair for visitors
- (f) 2 x Computers Pentium 4 at 2.9GHz or higher, hard disk 80 GB, monitor TFT LCD 17", DVDRW, floppy drive, modem/fax/voice 56k to act as server for the other computers and equipment in the network
- (g) 1 x laser fax/printer/scanner HP LaserJet 3015 with USB cable or equivalent
- (h) 1 x photocopier Canon NP-7161 with document feeder or equivalent
- (i) 1 x telephone set KX-T7630 or equivalent
- (j) 1 x Document shredder, 'bis Rabbit' or equivalent
- (k) 1 x Document binding machine 'Leitz CB600 DL.' or equivalent
- (l) 1 x Heavy duty document hole punch 'SAX 608' or equivalent
- (m) 1 x Stapler 'SAX 620' or equivalent
- (n) Name plate on door
- (o) 4 x Paper trays, 3 tier
- (p) 2 x Waste paper basket
- (q) 1 x 2.4m x 1.2m pin board
- (r) Set of coat hooks
- (s) 2 x First Aid Set

The secretaries' office shall be so arranged as to provide for and control the reception of visitors into the foyer and their admittance into the offices.

The Conference Room

As shown in the drawings, the conference room shall be a minimum of 30m.sq., provided/furnished with :

- (a) 1 x executive quality conference table
- (b) 12 x chairs of a compatible quality
- (c) 1 x double door cupboard with shelves (matching the table), 0.90m x 0.45m x 0.85m high.
- (d) 1 x set of telephone conferencing equipment

The Foyer

As shown in the drawings, double doors shall separate the foyer from the entrance and the foyer shall be furnished with

- (a) 4 x chairs for visitors
- (b) 1 x coffee table
- (c) 1 x indoor evergreen plant (approx 1.5m in height)
- (d) 1 x 2.4m x 1.2m pin board for safety regulations, the fire escape plan etc.

The Server Room, Store Room, Drying Room, Kitchen, Wash-rooms / Toilets etc

The ancillary office provisions shall be as shown in the drawing and the provisions / furnishing shall be as specified by the architects.

Maintenance General

The provisions that the Contractor is required to make for maintaining and cleaning all of the offices of the Engineer shall include for all necessary repair works as well as the provision of all necessary cleaning equipment, rubbish bins and materials as well as the provision of liquid soap for hand washing, dish washing etc., lavatory cleaner and brushes, toilet paper, the daily provision of clean hand towels, fly spray, the extermination of any rodents and any other such incidentals as the Engineer may reasonably require for maintaining decent conditions for the operations of the offices.

1.8.1.2 Protective Equipment for the Engineer

General

The contractor shall initially provide the Engineer with protective clothing and equipment, as follows, and, as the Engineer considers necessary, provide replacement items under the provisions for maintenance of the Engineer's facilities. Prior to making this provision, the Contractor shall obtain a list of appropriate sizes from the Engineer. As and where the Contractor's methodology, activities or planned testing programme may require additional protective equipment (such as gloves, ear plugs, goggles, torches etc), the Contractor shall make these available to the Engineer as and when the need arises.

List of Protective Equipment is shown in Table LPE in the Special Specifications.

1.8.1.3 Surveying Equipment for the Engineer

General

The Contractor shall provide and maintain, for the use of the Engineer throughout the term of the Contract and until all measurement relevant to the Final payment Certificate has been completed and agreed, two sets of precise survey equipment as well as all of the ancillary and consumable items, attendance and assistance necessary to measuring the works, determining the necessary scope and quantities of any works and determining the precise levels and locations of any parts of the Works.

At the end of its term of use, the survey equipment shall be returned into the property of the Contractor. The following list of equipment is intended to be indicative of the principal requirements for each set and does not impose any limit upon the Contractor's selection of a fully operative sets of total station and associated equipment from a recognized manufacturer :

Precise Survey Equipment

Two complete sets of equipment are to be provided, according to the list shown in Table PSE in the Special Specifications. One set shall be provided for the initial survey works and the second set shall be provided in accordance with instructions issued by the Engineer.

1.8.1.4 Vehicles for the Engineer

The Contractor shall provide the Engineer with new cars acceptable to the Engineer, having the following characteristics:

- 4-door, mini-bus with minimum 10 seats, AC, central locking and ABS braking, with engine capacity exceeding 1990 cc [Type A]
- 5-door car, with four / five seats, AC, central locking and ABS braking, with engine capacity exceeding 1600 cc [Type B]
- 5 door car, with 4 seats, AC, with engine capacity 1400 - 1600cc, to be delivered to the site office of the Engineer [Type C]

When no longer required by the Engineer for the supervision of the Works, but no later than the end of the Defects Liability Period, the ownership of the above vehicles shall be transferred to the Employer who will then become responsible for fuel servicing, repair, maintenance, insurance and miscellaneous costs.

They shall be delivered (with registration plates, vehicle licence, and be fully and comprehensively insured) prior to the Commencement of works on site.

The Contractor shall be responsible for provision of fuel, lubricants, servicing, repair, maintenance and comprehensive insurance of the vehicles of the Engineer. Reimbursement of maintenance, insurance and fuelling costs shall be by a charge against the provisional sum allowance.

In the case of accidental damage, the Contractor shall be responsible for reinstatement of the damaged vehicle to its original condition. The Contractor shall supply temporary replacement vehicles during periods when the cars are immobilised.

1.8.1.5 Miscellaneous Services for the Engineer

The Contractor shall supply all necessary stationery and office consumables for the Engineer's staff on site including A3 and A4 sized paper for photocopier, notebooks, pads of writing paper, file holders, lever arch files, ball pens, highlighter pens, pencils, erasers, staplers and staples, punchers, clips, adhesive tape, marking pens, wipers, printer toner, etc. Reimbursement of the costs of supply shall be by a charge against the provisional sum allowance.

1.9 Relocation of Services

Whenever an existing over-ground or underground installation carrying services is to be diverted in order to perform the Works, the Contractor shall arrange for this work to be carried out by the owner of the service, or as directed by the Engineer in accordance with the Works scheduled to be carried out by the Contractor in the Bills of Quantities and in these Technical Specifications.

The Contractor shall provide attendance as necessary and shall be responsible for taking all measures to provide the protection of such installation and for the consequences of damages that could appear.

The Contractor shall take whatever measures are necessary to avoid damage to any pipes, cables or conduits, telegraph or telephone installations, poles or pylons etc.

It will be the responsibility of the Employer and the Engineer to obtain prior approvals from the owners of services regarding the relocation of existing installations but the Contractor shall be responsible for agreeing the programme of the work and for paying any necessary costs and fees, when instructed by the Engineer.

Whenever the Contractor, during the execution of the Works, finds additional installations that require to be moved or protected, he shall immediately inform the Engineer; the Engineer will accordingly notify the Employer in order to obtain the necessary approval. Unless decided otherwise by the Employer, the Engineer and the service owner, the removal or protection works will be carried out by the service owner.

A Provisional Sum is provided in the Bill of Quantities covering the costs for design and execution of diverting, removing or protecting such installations.

If any service installation exists but does not require to be diverted, it shall be the Contractor's responsibility to protect the service while working near it, all to the approval of the service owner and the Engineer.

The Contractor shall inform the relevant offices immediately in the event of any damage being caused by him to pipelines, cables or other such installations on Site and shall immediately arrange for the performance of necessary repairs at his own cost.

1.10 Health and Safety

The Contractor shall appoint an experienced Accident Prevention Officer and take all necessary measures to provide for the health, safety and welfare at work of all his employees and of all other persons on the Site or, otherwise, affected by the Works including:

- (i) The provision and maintenance of plant and systems of work that are, so far as is reasonably practicable, safe and without risk to health;
- (ii) Arrangements for ensuring, so far as is reasonably practicable, the safety and absence of risks to health in connection with the use, handling, storage and transport of articles and substances;
- (iii) The provision of such protective clothing and equipment (such as hard hats, reflectorised clothing and steel capped boots) first aid, medical and health services, information, instruction, training and supervision as is necessary to ensure, so far as is reasonably practicable, the health and safety at work of all persons employed on the Works;
- (iv) The maintenance of all places on the Site in a condition that is safe and without risks to health and the provision and maintenance of access to and egress from such places that are safe and without risk.

The Contractor shall provide sanitary conveniences for the use of all persons employed on the Works in such a manner and number and at such places as shall conform to the statutory or other appropriate regulations and the whole shall be to the approval of the Engineer.

The Contractor shall maintain such conveniences in a satisfactory and sanitary manner and all such conveniences shall be removed at the completion of the Works and the sites restored. The Contractor shall remove immediately from Site any employee found to have committed a nuisance on the Site or adjoining lands and the Contractor shall not again employ him on the Works without approval of the Engineer.

1.11 Quality Assurance Management System

In pursuance of Sub-Clause 4.9 of the Conditions of Contract Part 1, The Contractor shall institute a Quality Assurance system to demonstrate compliance with the requirements of the Contract. Pursuant to the 1st paragraph of Sub-Clause 7.4, the Contractor shall institute a Quality Assurance system having the consent of the Engineer that is:

- (a) Designed to demonstrate that the materials used and his adopted methods, procedures and controls combine to produce works and workmanship with less than statistically significant risk that the works will fail to be in accordance with the Contract
- (b) Verified by a programme of confirmatory tests carried out in an independent laboratory.

The Contractor shall be wholly responsible for ensuring that the quality of all materials and workmanship shall be in accordance with the Specification and to the satisfaction of the Engineer.

The Contractor shall carry out his own inspection of materials and workmanship and satisfy himself that they meet the specification before offering them to the Engineer for acceptance or payment.

The Contractor shall prepare and submit to the Engineer within 60 days of the Letter of Acceptance a written quality assurance management system (QAMS) similar to that described in ISO 9000 series. This shall show the Contractor's Site organisation and responsibilities for all members of the Contractor's organisation to check and report on the quality of materials and workmanship.

For each elemental task to be performed by operatives carrying out a construction operation there should be listed a quality check that he and others perform to ensure that that task is fully and correctly completed. The management system shall contain a check-list of quality checks for each operative, ganger, supervisor, foreman, inspector, etc.

The Engineer will issue non-conformance notices if any work materials, workmanship or any other thing is not in accordance with the Contract. Until such a non-conformance is rescinded, the Engineer will not certify any payment for the work or thing affected.

The QAMS proposed shall show the procedures for communication with the Engineer. The QAMS shall be operated and maintained by the Contractor's Quality Controller.

The Contractor shall within 28 days of the date of the Letter of Acceptance, submit to the Engineer the names, CVs and duties of all key personnel whether or not they are related to quality assurance directly.

1.12 Specifications and Standards

In the execution of the Works, the Contractor shall comply with these Technical Specifications.

The Contractor shall also comply with the laws, technical standards and regulations regarding the quality of materials and works in force in Serbia.

All references to technical standards shall be taken to refer to the latest approved published version of each standard as at a date 28 days before the latest date for submission of tenders for this Contract.

Whenever in these Technical Specifications a specific Serbian standard is identified and another equivalent internationally recognized standard may be proposed for acceptance, the Engineer shall determine which standard may be used in consultation with the Employer and the Designer as appropriate.



1.13 Specified Manufacturers

Where, in the Specifications, any manufacturer's name may be referred to in relation to any product or material that is merely to provide an example, setting the required standard of product or material. The manufacturer referred to in the Specifications shall not be considered to be nominated. The Contractor is entitled to propose a different manufacturer subject to his demonstrating the item, he intends to procure, to be an equivalent product or material in full compliance with the specified standards and subject to the approval of the Engineer.

1.14 Environmental and Social Impact

1.14.1 General

The Contractor shall comply with the guidelines of the Environmental and Social Impact Assessment (EIA) already completed for this project, in accordance with the requirements of the Employer.

The Contractor should also comply with the guidelines of the World Bank, EBRD and EIB in this regard as well as those for resettlement and rehabilitation of the affected population.

The design should include appropriate cost-effective mitigation measures, which should form part of the project cost.

An Environmental Management Action Plan (EMAP) shall be prepared by the Contractor incorporating proposals concerning the implementation, management and monitoring of the proposed environmental components of the project.

1.14.2 Environmental Protection Plan

Within one month of his arrival on site the Contractor shall submit an Environmental Protection Plan with operational details of his proposals to the Employer and the Engineer for approval. The Plan shall comply with the requirements of Environmental Management Action Plan that is included in this contract document.

1.14.3 Environmental Officer

The Contractor shall have on his staff on Site for the duration of the Contract a designated officer qualified to promote and maintain sound environmental management during construction and specifically the implementation of the approved Environmental Protection Plan. This officer shall have authority to issue instructions and shall take precautionary measures to prevent environmental damage, including but not limited to the establishment of environmentally sound working practices and the training of staff and labour in their implementation.

1.14.4 Resettlement Liaison Officer

The Contractor shall have on his staff on site at least one individual who has had practical experience in the public consultations, management and implementation of a Resettlement Plan. The Contractor's Resettlement Liaison Officer will be required to coordinate with the Employer and the Engineer, to assist the Employer in its duties, to implement and complete the Resettlement Plan for this project, and to maintain good public relations throughout the contract period.

1.14.5 Environmental Protection during Construction

The Contractor shall use such construction methods and shall maintain all borrow/stockpile/spoil disposal area so as to assure the stability and safety of the Works and any adjacent feature, to assure free and efficient natural and artificial drainage and to prevent erosion.

The Engineer and the Employer have the power to disallow the methods of construction and/or the use of any borrow/stockpile/spoil disposal area if in their opinion the stability and safety of the Works or any adjacent feature is endangered, or if there is undue interference with the natural or artificial drainage, or if the method or use of the area will promote undue erosion.

Borrow areas and quarries shall be sited, worked and restored in accordance with the Specifications. Spoil shall be disposed of at approved disposal sites prepared, filled and restored in accordance with the related Specification requirements.

Following excavation for the works, the Contractor shall take all steps necessary to complete drainage and slope protection works in advance of each rainy season. Erosion or instability or sediment deposition arising from operations not in accordance with the Specifications shall be made good immediately by the Contractor at his expense. The Contractor shall also take all steps necessary to complete drainage in advance of each winter rainy season in the areas excavated for borrowing materials.

Notwithstanding approval of the intended method of working, the Contractor shall at all times be responsible for constructing the earthworks in accordance with the Specifications, the Design and his working drawings.

The Project area can experience inclement weather, climatic seasonal variations, and heavy snowfall. It will be deemed that the Contractor is familiar with these conditions and has formulated his work programme considering possible loss of time due to these causes, and it shall be the obligation of the Contractor to revise his work programme and enhance his construction efforts as necessary to ensure timely completion of the work scheduled for each working season.

Where directed by the Employer, the Contractor shall establish vegetation on fill slopes, cut slopes or less, worked out borrow pits, and other areas which may include roadway shoulders and verges, spoil disposal areas, stockpile areas, quarries, access tracks, plant sites, camps, landslide scars, gullies, and stream and river banks. Prior to placing topsoil and/or establishing vegetation on embankments, all fill material not compacted to the required standards shall be removed from the side slopes.

The Contractor shall be responsible for supplying sufficient planting material to carry out all re-vegetation work, and shall establish and operate plant nurseries as necessary and shall make his own arrangements for procuring cuttings, slips and seed for growing.

1.14.6 Prevention of Pollution

The Contractor shall ensure that his activities do not result in any contamination of land or water by polluting substances. He shall implement physical and operational measures such as earth dikes of adequate capacity around fuel, oil and solvent storage tanks and stores, oil and grease traps in drainage systems from workshops, vehicle and plant washing facilities and service and fuelling areas and kitchens, the establishment of sanitary solid and liquid waste disposal systems, the maintenance in effective condition of these measures, the establishment of emergency response procedures for pollution events, and dust suppression, all in accordance with normal good practice and to the satisfaction of the Engineer and the Employer.

1.14.7 Protection of Trees and Vegetation

Unless otherwise provided in the Specifications, the Contractor shall ensure that no trees or shrubs or waterside vegetation are felled or harmed except for those required to be cleared for execution of the Works. The Contractor shall protect trees and vegetation from damage to the satisfaction of the Engineer and the Employer.

The Contractor shall be responsible for obtaining any necessary felling permits and for ensuring the disposal of felled trees in accordance with prevailing regulations. No tree shall be removed without the prior approval of the Engineer and the Employer.

In the event that trees or other vegetation not designated for clearance are damaged or destroyed, they shall be repaired or replaced by the Contractor at his own expense to the satisfaction of the Engineer and the Employer.

1.14.8 Use of Wood as Fuel

The Contractor shall not use or permit the use of wood as a fuel for cooking, space and water heating in all his camps and living accommodations. Any wood so used must be harvested legally, and the Contractor shall provide the Engineer and the Employer with copies of the relevant permits if required.

1.14.9 Fire Prevention

In addition to the provision of adequate fire-fighting equipment at his offices, workshops, construction areas and other facilities to the satisfaction of the Engineer and the Employer, the Contractor shall take all precautions necessary to ensure that no vegetation along the line of the road outside the area of the permanent works is affected by fires arising from the execution of the Works.

Should a fire occur in the natural vegetation or plantations adjacent to the project area for any reason the Contractor shall immediately take all measures to suppress it. In the event of any other fire emergency in the vicinity of the Works the Contractor shall render assistance to the civil authorities to the best of his ability.

Areas of forest, scrub or plantation damaged by fire considered by the Engineer and the Employer to have been initiated by the Contractor's staff or labour shall be replanted and otherwise restored to the satisfaction of the Engineer and the Employer at the Contractor's expense.

1.14.10 Restricted Areas

In undertaking the Works, the Contractor shall be aware that the Engineer and the Employer may not grant permission for temporary facilities including but not limited to borrow pits, quarries, and labour camps (except for watchmen) and ancillary activities in forested areas or land officially declared as forest.

The Engineer and the Employer may also prohibit or restrict the Contractor's activities in other ecologically, culturally or historically sensitive areas, which become known to them during the course of the project. The location of any such areas shall be notified to the Contractor by the Engineer and the Employer at the earliest opportunity.

1.14.11 Relations with Local Communities and Authorities

In siting and operating his plant and facilities and in executing the Works the Contractor shall at all times bear in mind and to the extent practicable minimise the impact of his activities on existing communities.

Where communities are likely to be affected by major activities such as road widening or the establishment of a camp or quarry or extensive road closure or bypassing, he shall liaise closely with the concerned communities and their representative and if so directed, shall attend additional meetings arranged by the Engineer and the Employer to resolve issues and claims and minimise impacts on local communities.

Any problems arising from his operations and which cannot be resolved by the Contractor shall be referred to the Engineer and the Employer. The Contractor shall be responsible for any compensation due or reinstatement necessary with respect to any damage caused by him to areas outside the Site and no separate payment will be made in this regard.

1.14.12 Water Supply for Construction

The Contractor shall make his own arrangements at his own expense for water supply for construction and other purposes. Only clean water free from deleterious materials and of appropriate quality for its intended use shall be used. In providing water the Contractor shall ensure that the rights of and supply to existing users are not affected either in quality, quantity or timing.

In the event of a dispute over the effect of the Contractor's arrangements on the water supply of others, the Engineer shall be informed immediately and shall instruct the Contractor as to appropriate remedial actions to be undertaken at his expense.

Environmental Mitigation Action Plan (EMAP)

Project Actions/ Environmental Attributes	Contractor's Mitigation Measures	Responsibilities
ENVIRONMENTAL MITIGATION PLAN FOR CONSTRUCTION STAGE		
Setting out and clearing operations of ROW	<ul style="list-style-type: none"> • Statues and roadside shrines are to be relocated to adjacent locations in close consultation with local community leaders. • Re-location of utilities to adjoining areas of the Project Highway • Permission for tree felling is to be obtained from the Forest Department • During right of way clearing operations, any treasure trove, slabs with epigraphical evidence or edicts, sculptural or any material that are found and appear to have historical importance, it should be brought to the notice of the Engineer. 	<p>The Employer will be required to initiate the actions for seeking the permission for tree felling and re-location of the public utilities within the corridor.</p> <p>Environmental Officer under the Employer will co-ordinate and ensure implementation and ensure adequacy & appropriate implementation</p>
Diversion of traffic	<ul style="list-style-type: none"> • Appropriate traffic diversion schemes shall be implemented so as to avoid inconvenience due to project operations to present road users, particularly during night time. • Proper diversion schemes will ensure smooth traffic flow minimises accidents, traffic snarl ups, and commotion. • The diversion signs should be bold and clearly visible particularly at night. 	<p>Contractor is responsible for implementation subject to approval from the Engineer.</p>
Construction Camp Sites	<ul style="list-style-type: none"> • The construction campsites are to be located away from any local human settlements and preferably located on lands, which are not productive presently. The camps shall have adequate water supply, sanitation and all requisite infrastructure facilities. The water supplied to the construction camps shall be free from Arsenic contamination. The camps shall have septic tank/soak pit of adequate capacity so that it can function properly for the entire duration of its use. 	<p>All facilities are to be planned and implemented by contractor subject to approval by the Engineer and the Employer.</p> <p>The Engineer and the Employer will monitor and ensure appropriate implementation.</p> <p>The Engineer and the Employer will visit the camp sites for inspection and compliance by the Contractor.</p>
Haulage roads	<ul style="list-style-type: none"> • The alignment of haulage roads shall be finalised to avoid agricultural lands to the extent possible. In unavoidable circumstances, suitable compensation may be paid to people whose land will be temporarily acquired for the duration of operations. The compensation shall cover for loss of income for the duration of acquisition and land restoration. • Prior to construction of roads, topsoil shall be preserved or atleast shall be used for any other useful purposes rather than allowing its loss by construction activities. • Water tankers with suitable sprinkling system are to be deployed along the transportation links. Water, may be sprinkled for at least 6 times per day all along the route to suppress the airborne dust due to the truck movement particularly on unpaved roads. Roads, which are subjected for huge material movement, provision for sprinklers can be made which may become economical as compared to water sprinkling by tankers • The vehicles deployed for material transportation shall be spillage proof to avoid or minimise the spillage of the material during transportation. In any case, the transportation links are to be inspected at least twice daily to clear accidental spillage, if any. • The borrow and material dumping sites must be access controlled to keep away-unauthorised entry of people, livestock and any other stray animals. 	<p>The planning, design and construction/up-gradation of existing roads to be used as haulage roads are responsibilities of the Contractor subject to approval by the Engineer.</p> <p>The Engineer will regularly monitor and ensure appropriate implementation by the Contractor.</p> <p>The Contractor will co-ordinate regularly with the local population to ensure that their interests are protected and no social resentment arises.</p>
Quarries	<ul style="list-style-type: none"> • Material, particularly aggregates shall be sourced only from licensed quarries. • Quarries, which have occupational safety procedures/practices in place only, are to be sourced for materials and regular inspection shall be carried to ensure compliance of safety procedures/practices by quarry agencies subsequently. • In case, unlicensed quarries are to be chosen for viable 	<p>The selection of quarries and material selection will be the responsibility of the Contractor subject to approval of the Engineer.</p> <p>The Engineer will monitor and ensure appropriate implementation of mitigation actions by the Contractor.</p>

Project Actions/ Environmental Attributes	Contractor's Mitigation Measures	Responsibilities
Work sites	<p>reasons, ensure compliance of all measures mentioned above.</p> <ul style="list-style-type: none"> All personnel in work sites shall have protective safety equipment like helmets, boots etc so that injuries to personnel are avoided. No personnel should be allowed to work at site for more than 10 hours per day. Personnel who are likely to be exposed to noise levels beyond stipulated limits shall be provided with protective equipment like ear protectors etc and regularly rotated. Regular water sprinkling of water shall be ensured so that dust levels are kept to minimum. 	<p>All facilities are to planned and implemented by the Contractor subject to approval by the Engineer.</p> <p>The Engineer will monitor and ensure appropriate implementation by the Contractor.</p>
Construction Equipment and Vehicles	<ul style="list-style-type: none"> All equipment/vehicles deployed for construction activities shall be regularly maintained. Vehicles/equipment deployed for construction activities shall be regularly maintained for smooth operation, a measure contributing to air quality and noise Vehicles/equipment shall be regularly subjected for emission tests and shall have valid POLLUTION UNDER CONTROL certificates. Revalidation of certificates shall be done once in a month. All vehicles deployed for material movement shall be spill proof to the extent possible. In any case all material movement routes shall be inspected daily twice to clear off any accidental spills. 	<p>Contractor is responsible for ensuring provision of facilities subject to approval by the Engineer.</p> <p>The Engineer will monitor and ensure appropriate implementation by the Contractor.</p>
Water resources & Drainage channels	<ul style="list-style-type: none"> Adequate precaution is to be taken to prevent oil/lubricant/hydrocarbon contamination of channel beds. Spillage if any, shall be immediately cleared with utmost caution to leave no traces. Channel beds are to be cleaned up and restored to its previous state after completion of construction. Adopting mitigative measures like construction of coffer dams, cessation of operations intermittently for limiting turbidity, limiting hours of operation to day time hence recuperation of turbidity, strict prohibition of disposal of solid and liquid waste disposal into waters etc, good sanitary and hygiene practices on river beds etc can largely minimize impacts on water quality during rehabilitation/repair of bridges across the water bodies. 	<p>The planning, and construction/up-gradation of existing/new cross drainage structures roads are responsibilities of the Contractor subject to approval by the Engineer.</p> <p>The Engineer will regularly monitor and ensure appropriate implementation by the Contractor.</p>
Borrow areas	<ul style="list-style-type: none"> Borrow areas are to be demarcated with signboards. All operational areas are to be access controlled. The top soil recovered from borrow areas are to be restored or to be used for turfing of embankment(s) of Project highway All equipment deployed for excavation shall have appropriate monitoring and control facilities to improve accuracy of positioning and excavating depths. Scrapping and tamping of the borrowed areas shall be carried out to minimise localised depressions and render a smooth profile. Limit operations to day hours only. Rotation of personnel should be considered to minimise exposure of noise levels beyond limits. Provide protective gear like ear protectors if necessary to operating personnel are likely to be exposed to noise levels beyond threshold limits All equipment deployed shall be well-maintained and meet emission norms of diesel vehicles. Demarcate areas identified for operations and install signboards prohibiting unauthorised movement of local population. All borrow areas are to be re-vegetated. The side walls shall have gentle slope. 	<p>Sourcing of borrowing materials and all related activities like planning & deployment of the most optimum number of vehicles without disregarding the existing users in case of existing linkages and construction/up-gradation of existing/new haulage roads subject to approval by the Engineer.</p> <p>The Engineer will monitor and ensure appropriate implementation by the Contractor.</p>
Air Quality & Noise	<ul style="list-style-type: none"> All operational areas under project development like borrow areas, haulage roads, work sites, construction camp sites, hot mix plants, etc are to be regularly monitored (at least ONCE in a week) for air quality parameters such as SPM, RPM, SO₂, NO_x, HC, CO etc. This will ensure identification of operations/areas of concern with regard to air pollution. Mitigation measures such water sprinkling for dust suppression, permitting construction equipment/vehicles having POLLUTION UNDER 	<p>Contractor is responsible for ensuring a occupationally healthy environment for all personnel irrespective of category subject to approval of the Engineer.</p> <p>The Engineer will independently monitor these parameters at least once a month</p>

Project Actions/ Environmental Attributes	Contractor's Mitigation Measures	Responsibilities
	<p>CONTROL certificates will reduce work area concentration of air pollutants like RPM, SO₂, NO_x, HC, CO etc. and therefore does not contribute to build up of pollutants</p> <ul style="list-style-type: none"> • Like for air quality, all operational areas under project development shall be monitored for noise levels representing all hours of a typical work shift. • This will ensure identification of operations/areas of concern with regard to noise pollution. Operational areas include, work sites, haulage roads, hot mix plants, quarries, borrow sites etc. mitigation measures such provision of ear plugs, rotation of personnel, ensuring regular maintenance/lubrication, limiting operations to day time etc will contain noise levels to permissible/threshold limits. 	
Soil erosion and conservation	<ul style="list-style-type: none"> • Measures to ensure embankment stabilisation including selection of less erodable material, good compaction, re-vegetation, placement of gabions /riprap or any suitable measures around bridges and culverts etc are included in technical specifications and contract documents. The engineering measures for countering soil erosion, slope protection, drainage wherever required considered for project highway and detailed in Project design documents. • Many of impacts on soil can be significantly mitigated by some of the following measures <ol style="list-style-type: none"> a) Minimising area of ground clearance only to the extent required b) Balancing the filling and cutting of earth to the extent possible c) Avoiding creation of cut slopes and embankments which are of an angle greater than natural angle of repose for locally available soil type d) Replanting disturbed area(s) immediately after disturbance due to construction has stopped and NOT after construction has been completed. 	<p>Erosion control/embankment protection measures as governed by local site conditions shall be prepared by Contractor and subject to approval of the Engineer</p> <p>The Engineer will monitor and ensure appropriate implementation by the Contractor.</p>
Hot Mix Plants	<ul style="list-style-type: none"> • Hot mix plants shall be atleast 500m away from any human settlements and preferably located on leeward side. • As mentioned else where under this section all such plant/sites shall be located on barren/uncultivable lands. Diversion of cultivable/agricultural lands, shall not be allowed unless otherwise warranted by specific local conditions 	<p>Contractor is responsible for ensuring a occupationally healthy and hazard free environment for all personnel irrespective of category and also for communities in and around operational areas</p> <p>The Engineer will monitor and ensure appropriate implementation by the Contractor.</p>
Loss of Fertile soil	<ul style="list-style-type: none"> • Clearing operations within the right of way and at all places of operational areas like borrow areas, work sites, labour camps, construction of new/up-gradation of existing to new haulage roads, hot mix plants, storage areas etc shall consider preservation of fertile soil • As a first option, topsoil should be restored to its initial place after the specific activity is completed for which the area was vacated, or for enriching some other place like embankment slopes for turfing/erosion protective measure. The topsoil can also be used for supporting re- plantation activities within right of way 	<p>Contractor is responsible for ensuring a proper utilisation of fertile soil under approval of the Engineer</p> <p>The Engineer will monitor and ensure appropriate implementation by the Contractor.</p>
Loss of access	<ul style="list-style-type: none"> • The construction works shall not lead to temporary loss of access from one side of project highway to the other side. • Efforts shall be directed for minimising such situations even if it amounts to small deviation for project operations. • The local people shall be taken into confidence through opening up of communication with local population and/or community leaders 	<p>Contractor is responsible for ensuring minimum disturbance to local populace due to operations and provide alternatives wherever access is temporarily disrupted due to operations and restore it as soon as possible and subject to approval of the Engineer.</p> <p>The Engineer will monitor and ensure appropriate implementation by the Contractor.</p>
Location of campsites, storage depots,	<ul style="list-style-type: none"> • The location of campsites, storage depots shall preferably on unproductive/barren lands. • All fuel loading, unloading, storage areas shall be spill proof, leakage proof and carried out on impervious/paved areas. • The sites shall have suitable system to drain storm water, sanitary facilities and shall not contaminate any near by water courses/drains 	<p>Contractor is responsible for ensuring suggested actions and subject to approval of the Engineer.</p> <p>The Engineer will monitor and ensure appropriate implementation by the Contractor.</p>

Project Actions/ Environmental Attributes	Contractor's Mitigation Measures	Responsibilities
Storage of hazardous materials	<ul style="list-style-type: none"> • The site shall also have a system for handling any emergency situation like fire, explosion etc. • All areas intended for storage of hazardous materials shall be quarantined and provided with adequate facilities to combat emergency situations complying all applicable statutory stipulations • The personnel in charge of such areas shall be properly trained, licensed and with sufficient experience. • The areas shall be access controlled and entry shall be allowed only under authorization 	<p>Contractor is responsible for ensuring a occupationally healthy and hazard free environment for all personnel irrespective of category and also for communities in and around all operational areas subject to approval of the Engineer.</p> <p>The Engineer will monitor and ensure appropriate implementation</p>
Roadside amenities and service stations	<ul style="list-style-type: none"> • All parking bays, service stations and rest places planned under project development shall have appropriate water, sanitation facilities and paved surface with facilities for removal of hydrocarbon and oil & grease content. 	<p>The contractor is responsible for implementation of appropriate designs and as directed by the Engineer.</p> <p>The Engineer will monitor and ensure appropriate implementation by the Contractor.</p>

Section 2 Preliminary works

Contents

- 2.1. Geotechnical investigations
- 2.2. Setting out
- 2.3. Site Equipment
- 2.4. Removal of Shrubs and Trees
- 2.5. Clearance of Site
- 2.6. Preparation of Existing Pavement
- 2.7. Demolition of Existing Pavement

2.1. Geotechnical investigations

2.1.1. Scope and purpose

2.1.1.1. Introduction

These works cover all additional geotechnical investigations that are carried out during construction, and may, in the form of observations and proper measurements, be studied even after completed construction, if the geological conditions and type of structures require so, and if so specified in the design. As a rule, these additional works are carried out only if not performed during the designing stage, or if, in the course of works, unforeseen problems come up, and also for the purpose of the monitoring of construction control.

2.1.1.2. Purpose

The purpose of geotechnical investigations is: to verify assumptions given in the design; to determine differences between the type and the condition of soil (geological medium) during the execution of excavation works (for cuts, bridge foundation, retaining structures, drainage, tunnels, etc.), and the data obtained through investigations performed for the purpose of designing; to determine necessary geotechnical parameters during and after construction (most frequently variable with time, climate, and hydrological conditions). During construction, these parameters are most often determined by field tests, and also by laboratory tests on representative samples. The geotechnical control of quality of executed works during construction (quality of used geological-building materials and their incorporation into the works) shall be performed according to the quality requirements given for particular types of works (material for embankments, and compaction of embankments, both those made of earth, and those made of stone, etc.), and technical regulations, standards, and provisions set in the technical specifications.

2.1.2. Investigations Related to Construction of Embankments, and Slopes of Cuts and Embankments

2.1.2.1. Quality Control of Materials from Cuts and Borrow Pits for Construction of (Stone and Earth) Embankments

2.1.2.2. Settlement of Soil under Embankment

Checking the soil under embankment (after top soil stripping), its bearing capacity, geotechnical parameters, groundwater table, the need for drainage or other forms of drying out, i.e. measures for speeding up its consolidation under the embankment's weight. Checking the time flow of the settlement of soil under embankment. Comparing the behaviour of the embankment during the construction with calculation values given in the design. The need for interventions during construction and for alterations in the design. The occurrence of instability of soil and the embankment above it, caused by cutting and filling, not specified in the design, and additional geotechnical investigations for the remedy of such stretches.

2.1.2.3. Checking Stability of Slopes

Checking the stability of slopes (particularly those of cuts), and of the excavation of cuts and cut-and-fills. Defining the types of instability of slopes (the type of deformation, the shape and depth of sliding surfaces, groundwater table, and other influences). Determining the parameters of shearing resistance in and out of the sliding surface, pore pressure and other hydraulic forces. For solid rock masses, checking the system of fracture (discontinuity), and climatic possibilities of potential sliding surfaces. Shearing resistance along the discontinuity.

2.1.2.4. Settlement monitoring

The measurement, during construction, of vertical movement (settlement) and horizontal movement (sliding), particularly for high embankments built on soil of a low bearing capacity (compressible soil). The control of devices for reducing settlement and hastening consolidation (vertical drains, etc.). The measurement of horizontal movement for retaining structures. The measurement of changes in pore overpressure and moisture.

2.1.2.5. Control

The control of work of drainage systems during construction (and particularly later on, after completed construction). The control of forces in anchors, if applied in the construction of retaining and other structures.

2.1.3. Geotechnical Investigations During Construction

For undertaking geotechnical investigations during construction, aside from exploratory drilling, field tests are recommended as well: penetration (static and dynamic), field vanes, pressiometers, observation wells (piezometers) and non-destructive hardness tests. These tests are simple and easy to perform, provide a certain continuity in the depth of ground (which is particularly important), and are easy to perform during construction.

2.1.4. Scope and Type of Geotechnical Investigations During Construction

The need for geotechnical investigations during construction depends on the complexity of structure and ground, and cannot be predicted neither by scope nor by type. Nevertheless, the design should indicate some stretches that shall be investigated additionally. Control observations and measurements on behaviour during construction (and later on) shall be indicated in the design and included in the Priced Bill of Quantities.

The type and scope of geotechnical investigations shall be defined in the design of investigations, and control works, by type and scope, in accordance with the design, and shall be defined by the Engineer.

The preparation of the design of investigations, and the execution of geotechnical works, in terms of rights and obligations, are stipulated by the Law on Geological Investigations, and as directed by the Engineer.

2.1.5. Records

During construction, it shall be necessary to keep records and a summary of geotechnical investigations carried out during construction, for the purpose of control of performed works, as well as alterations and amendments of the design, all of which shall be submitted to the Engineer.



2.1.6. Legislation

All these geotechnical works and investigations are stipulated in the current technical legislation, the Law on Geological Investigations, and the Law on Planning and Construction, the Rules about technical standards for designing and executing works of the foundation of building structures, and relevant SRPS (Serbian Standards) and shall be as directed by the Engineer.

In special cases, when such investigations go beyond the scope of existing technical legislation and standards, or they are not available, the Engineer shall select a testing method, and decide the importance of its application, and issue instructions accordingly.

2.2. Setting out

2.2.1. Description

This work covers the setting out of road alignment, all geodetic measurements related to the transfer of data from designs onto the site, or from the site into drawings, and the maintenance of set out marks on the site throughout the work process – from the commencement of works to the handover of all works to the Investor. The work also includes the taking over and maintenance of all submitted basic geodetic surveys and drawings, setting out on the site handed over by the Engineer on behalf of the Investor to the Contractor at the beginning of works.

The scope of work shall fully meet the requirements of construction, control of works, statement of works, and other reasons necessary for the work.

2.2.2. Handover and Taking-Over of Road Alignment

The Engineer shall hand over to the Contractor a set out road alignment with all necessary data in writing. The road alignment shall be set out on the site with all data in writing. The road alignment shall be marked on the site with wooden stakes, 4*4 cm, or iron wedges $\varnothing 10$ mm, or cut into stone with a carved cross that shall be painted with minium. Main marks shall each have a stake with a nail on it. On the right side of stake, looking in the direction of increasing chainage, at 45° angle, at the 20 cm distance from the stake, there is a small wooden board carrying the number of cross section, painted with minium on the top of it. The hand over procedure shall be carried out with a protocol on taking over.

The Contractor shall survey the status of the site handed over together with the Engineer and take it as the agreed basis for all measurement.

The road alignment is set out at spacing determined by terrain features, but not larger than 50 m.

Service connections are set out along the edge of speed change lane, i.e. right along the centre line of the service.

The Engineer shall hand over to the Contractor traverse points on the site, each marked with a concrete pillar, 12*12*50 cm, with a hole in the middle and a buried centre mark, or a gas pipe $\varnothing 1$ " in populated places, or on roads. In special cases, traverse points are cut in stone and marked with a cross. The traverse is tied to trigonometric points calculated according to the Gauss-Kruger, with tolerance values according to the rules for a traverse network of the 1st order.

The Engineer shall hand over to the Contractor a drawing of the road alignment containing the following attachments:

1. Location plan, scale 1:1000, indicating the centre line, chainage, road alignment elements, and elements of drainage structures to recipients. The location plan also contains the sketches for the tying of main traverse points, including the data required for setting out.
2. Computations for main points, i.e. in electronic computation, the coordinates of main and auxiliary points with chainage, and the coordinates of apices.
3. The list of traverse points, i.e. apices, with their coordinates and topography.
4. The list of bench marks, with their height levels and topography.

The Contractor shall, after the completion of subgrade, renew the road alignment (horizontally and vertically) based on the sketch of setting out from traverse points. The accuracy of the renewed road alignment shall be checked by the Engineer. The centre line shall be renewed as well, before placing the finishing course of pavement structure.

From the date of handover, the Contractor shall protect all traverse points and bench marks. If any data on the site become lost, changed (a traverse point, bench mark), the Contractor shall restore them at his own expense. The regularity of the point restoration process may be reviewed and checked by the Engineer.

2.2.3. Setting out Cross Sections

The Contractor and the Engineer both have the right, if not satisfied with proposed cross sections from the final design, to repeat surveying, levelling or tacheometric, of cross sections – the ground line normal to the road centre line, and to design cross sections on scale 1:100 (the same as in the design), however, all revisions shall remain subject to the final approval of the Engineer.

For the slopes of cuts and fills, it is necessary to set out sections needed for construction with gradients as given on the cross sections.

The section of a slope and the ground shall be defined by computation, taking into account the given changes of grade on slopes. Set out sections, as a rule, shall be made with laths, 2.4/5 cm, and small wooden wedges, 5/5cm, indicating the edges and gradients of slopes. For high cuts or fills, the cross sections may be spaced at not more than 50 m. The gradient of a slope shall imply the line of a cut or fill, with top soil stripped, and without the curvature at the bottom or on the top of the cut.

2.2.4. Protection of Set Out Centre Line

When the Contractor takes over a set out centre line, regardless of the configuration of ground, he shall secure, on both sides, each cross section at such a distance from the end of cut or fill, to ensure its undisturbed position until the completion of construction. Each securing point shall be protected with a triangle made of laths 2.4/2.5 cm. A securing stake, 5/5 cm, shall have a nail and be painted with minium on the top. Each securing point shall be double levelled.

Next to the triangle, to the left and right of the centre line, a small board shall be placed, with the minimum painted number of the cross section (in large digits), and its chainage below the number.

2.2.5. Control during Construction

Throughout construction, the Contractor shall control the set out data on road alignment and restore all marks on the site all the time, regardless of the cause of damage. In case of any alterations to the design, the Contractor shall repeat all the works under 2.2.3. and 2.2.4., if this would be necessary with the alteration in the design. The Contractor shall submit all setting out data to the Engineer for approval, and allow him to use all set out marks he may need.

The Contractor shall not start work until he receives the consent of the Engineer to the setting out control. Within three days of the Contractor's submission, the Engineer shall give such a consent or make an entry in the construction journal of the requirements that the Contractor shall have to meet for the purposes of being granted such a consent.

2.2.6. Setting Out Structures

The Contractor shall, based on data mentioned under 2.2.2., set out all structures according to his needs, but shall propose to the Engineer a setting out plan, with all necessary data in terms of Sub-Sections 2.2.3. and 2.2.4. The setting out of cross sections, the securing of a set out centre line, and control shall be carried out under the same conditions as the setting out of road alignment, but adjusted to the construction requirements applicable for structures.

2.2.7. Taking over after Completion of Works

After the completion of works, the Contractor shall hand over the finally set out road alignment at the road centre line, and traverse points and bench marks in terms of Sub-Section 2.2.2., while supplementing them with the data for structures. Cross sections shall be marked along the pavement edge. This shall be entered into a protocol on hand-over / taking over.

2.2.8. Payment

The staking works shall not be paid separately, but included in the offered price.

2.3. Site Equipment

Before the commencement of construction, the Contractor shall submit to the Engineer the organization plan (machines needed to execute the works, auxiliary structures and equipment, time schedules, etc.).

The specified machines, auxiliary structures and equipment, and the entire organization of construction work shall enable the execution of works in full compliance with the design and these Technical Specifications, following the time schedule that will ensure a timely completion of works.

The Engineer shall have the right to ask for alterations in the proposed organization plan, if such plan does not match the conditioned progress of works and technical specifications for the construction of this structure.

The Engineer shall issue an approval for the commencement of works, as soon as he ascertains that the machines, auxiliary structures, equipment and devices specified in the plan are in place and ready for work.

In the course of works, the Contractor shall keep the machines, auxiliary structures, and equipment in a good working order, in order to avoid any possibility of jeopardizing the agreed time and technical specifications for the construction of this structure.

These works shall not be paid separately, but included in the offered prices.

2.4. Removal of Shrubs and Trees

2.4.1. Description

This work includes the removal of shrubs, up to 10 cm thick, felling of trees of any thickness, with pruning and cutting trunks to a specified length, and the digging, pulling out and removal of stumps of new and previously cut trunks, and all other works that are needed because to technical conditions. The surfaces that need to be cleaned or uncovered shall be shown on drawings, or determined by the Engineer before the commencement of works.

The clearing up or uncovering of surfaces shall include the clearance of surfaces from trees, shrubs, waste, and any other excessive vegetation, including the digging up of stumps, and the removal of roots and all other harmful materials left behind the removal of shrubs, trunks, and stumps.

2.4.2. Procedure

The removal of shrubs, trunks, and stumps shall be performed on all indicated, i.e. specified surfaces, and in those places specified by the Engineer for certain trunks and stumps.

The trunks for which the Engineer specifies so, shall be left, and thus shall not be damaged. To prevent any damage to the trunks that will stay, other trunks shall be cut down so as to prevent such damage. If it is necessary to prevent any damage on other trunks or property, trunks shall be cut down carefully from the top down. Surfaces excavated for the road shall be cleared from all stumps and roots to the depth of 50 cm below the finished levelled surface, except on rounded surfaces of cuts and fills where they can be cut flush with the ground surface.

All stumps and roots to the depth of at least 20 cm below the future finished foundation soil, i.e. at least 50 cm below the roadbed shall be removed from the surfaces of foundation soil from which any non-bearing layers of foundation soil shall be removed, or those surfaces of foundation soil that will have to be tamped.

Holes from the removal of stumps and roots on the surfaces below future embankments shall be filled with earth material and tamped well. Cut trees and stumps shall be hauled to appropriate places along the road alignment, so that they not interfere with the execution of works, and shall be delivered, with the quantity recorded, to the Engineer or any other person specified by the Engineer.

2.4.3. Measurement

The cutting of shrubs and trees, the digging up, pulling out and removal of stumps of new and previously cut trunks, with all works mentioned under 2.1 and 2.2., shall be measured in meters of length of the final length of the constructed basic road alignment, this length also includes the works on regulation of water courses, local roads, etc., i.e. they are not measured separately.

- 2.4.4. **Payment**
The quantities defined under 2.4.3. shall be paid at a unit price given per 1 km of the road alignment from the negotiated Priced Bill of Quantities, and the price is a full compensation for all working procedures mentioned under 2.4.1. and 2.4.2. as needed to complete the works, and as approved by the Engineer.

2.5. Clearance of Site

- 2.5.1. **Description**
The work includes the excavation and dismantling of traffic signs, demolition of walls, demolition of existing pavement structures, removal of kerbs, demolition of fences, demolition of buildings, or any other similar obstacles, materials, or waste that would interfere with the execution of works in any way, or stay after the completed construction of the structure. The work excludes any removal of facilities in use, such as: power lines, or high-voltage and low-voltage lines, telephone lines and cables, water supply pipelines, cemeteries that need to be relocated or reconstructed, but includes parts of those facilities, such as foundations or parts of structures made of massive stone material, concrete, bricks, or similar, that need to be demolished after the relocation or reconstruction of the mentioned lines and facilities. This work, unless otherwise specified on drawings, shall include the removal of existing buildings that interfere with the work subject to the approval of the Engineer.

- 2.5.2. **Procedure**
The clearance of site works shall be performed on all designated or determined surfaces, as approved by the Engineer, that need to be cleared for the execution of construction works, or for the sake of aesthetics of the immediate vicinity of the road, and on all surfaces to be used by the Contractor in the course of works.

The digging up and dismantling of traffic signs, crash barriers, and other fences, marker posts, direction signs, kilometre marks, and similar, shall be performed so that all their components remain undamaged and reusable. For that purpose it is necessary to determine, before dismantling, and in agreement with the Engineer, which elements should be kept, stored and protected against deterioration, and which of them can be disposed of, i.e. eliminated. The place of storage shall be approved by the Engineer, and the Contractor shall temporarily store dismantled pieces, in the warehouses, accessible for transport, until the pieces are taken over by the Engineer. The date of taking over shall be determined by the Engineer.

The demolition of walls and structures of any kind shall be performed in a way that ensures the least possible damage to adjacent structure, or agricultural land - crops, or the existing road.

The removal of kerbs, demolition of fences, buildings, and similar obstacles shall be performed so that the mentioned obstacles are removed entirely and do not affect either the construction or quality of works, or the aesthetic appearance of the road and its surroundings.

Parts of any structures, various lines, installations, that need to be reconstructed for the sake of road construction, and that have foundations or massive structural parts such that they are impossible to dismantle or cut to be removed, shall be removed in a similar way as other removal, i.e. site clearance works.

The work method shall be determined by the Contractor and submitted for the approval of the Engineer, while observing all regulations of occupational safety, and preventing any damage to someone else's property. Any damaged caused due to the work shall be at the Contractor's expense only. All materials can be used for the contracted work, except for the material that shall be taken over by the Engineer. Buildings shall be demolished in such a way to preserve the material as much as possible.

- 2.5.3. **Measurement**
All this work, except for the demolition of entire buildings, shall not be measured separately, but included in the item covering excavation works, as its constituent part. The demolition of residential and economic buildings shall be measured in square metres of actually demolished floor surfaces of the buildings, as per their outside walls, and as approved by the Engineer. The removal of foundations of already demolished buildings shall not be measured separately, but included in the item covering excavation works.

- 2.5.4. **Payment**
All this work, except for the demolition of entire buildings, shall not be paid separately, but included in the unit price given for excavation work, thus taking that the Contractor received the full compensation for all work procedures mentioned under 2.5.2., or needed to complete the works.

The demolition of buildings (residential and economic) shall be paid at the unit price for 1 sq.m. of floor surface from the Priced Bill of Quantities and as approved by the Engineer. The price includes all works foreseen under 2.5.2. for the storage of demolished materials in a place approved by the Engineer, and the Contractor shall have no right to claim any compensation or additional payment for that. The demolition of facilities put up by the Contractor for his own needs shall not be paid, and they are at the Contractor's expense.

2.6. Preparation of Existing Pavement

- 2.6.1. **Description**
This work includes all phases for the preparation of existing pavement surface, if it is to be overlaid with a new pavement structure.

- 2.6.2. **Procedure**
If the existing pavement made of mechanically stabilized materials is directly overlaid with a new macadam-type pavement structure, it shall be scarified at 25 cm spacing at most. In other cases, the existing pavement shall be cleaned and washed, and its width levelled, before applying new layers. If asphalt layers are to be applied over the existing asphalt pavement, the pavement shall be thoroughly cleaned from dirt, washed, and sprayed with emulsion in the amount of 150 gr/m². If the existing pavement is made of cement-concrete, the preparatory procedure shall be performed according to a separate design.

All procedures to be adopted shall be subject to the prior agreement and approval of the Engineer.

2.6.3. Measurement and Payment

The measurement is performed in m² of scarified, i.e. cleaned and prepared pavement, and as approved by the Engineer.

2.7. Demolition of Existing Pavement

2.7.1. Description

This item includes the demolition of an existing pavement structure on surfaces specified in the design, or where directed by the Engineer, and the selection, loading, transport, and unloading of material at the dump site approved by the Engineer.

2.7.2. Work procedure

The existing pavement structure shall be demolished mechanically, layer by layer.

Bulldozers, graders, loaders, etc. shall be used for demolition. For asphalt layers, hot or cold planing machines can be used, if the existing asphalt is to be recycled.

Material from each particular demolished layer shall be gathered into piles and loaded onto trucks immediately, taking care not to mix different materials.

Materials from particular courses can be reused for the construction of a new pavement structure, if they meet required quality criteria.

When demolishing an existing pavement structure, the Contractor shall take care of existing installations, not to damage them (water supply, sewerage, electrical installations, telecom installations, etc.). Any damage caused due to breakdowns, or repairs of breakdowns, shall fall at the Contractor's expense.

2.7.3. Measurement and Payment

The measurement is performed in m² of demolished pavement structure as approved by the Engineer, including loading, transport, and unloading of demolished material at the dump site that is to be approved by the Engineer.

Section 3 Earthworks

Contents

- 3.1. Topsoil Stripping
- 3.2. Bulk Excavation and Haulage
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- 3.6. Replacement of Removed Soil of Insufficient Bearing Capacity
- 3.7. Levelling of Ground
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3.1. Topsoil Stripping

3.1.1. Description, Scope and Contents of Works

The work includes the stripping of topsoil obtained from bulk excavation on the road alignment and in borrow pits, and under embankments up to 40 cm thick, including transport or mechanical pushing to a roadside stockpile, within the road's right of way. All work shall be completed in line with the design, these Technical Specifications, and SRPS.U.E1.010. If topsoil and soil suitable for being used as subsoil-foundation soil cannot be visually differentiated, the depth of the topsoil layer shall be determined in the laboratory by testing the organic matter content (JUS U.B1.024, soil with organic content exceeding 6%).

3.1.2. Execution of Works

The stripping of topsoil, up to 40 cm thick, shall be performed wherever necessary to prepare the subsoil – foundation soil. Topsoil shall be stripped down to the subsoil –bearing soil, as specified in the design and these Technical Specifications. All excavated material shall be stockpiled along the road alignment, out of the roadbed surfaces, in order to ensure that any later use of the material and access to it remain unobstructed. The haulage, i.e. pushing of material to stockpiles shall be performed carefully in order to preserve the quality of stripped topsoil for the later landscaping of slopes and green surfaces, as to avoid the mixing of that material with other non-topsoil material. Topsoil shall be stockpiled in such a way as not to jeopardize the stability of slopes and to enable the runoff of water

3.1.3. Measurement

This work shall not be measured for payment, but any achieved thickness of topsoil shall be indicated on cross sections and submitted for the approval of the Engineer.

3.1.4. Payment

The stripping and stockpiling of topsoil, protection of stockpiles during the execution of construction and other works, including the clearing of the entire site after the removal of stockpiles are included in the offered unit price for bulk excavation and filling, and shall not be paid extra.

If the measurements performed in the course of works show that the actual topsoil stripping is less than the designed amount, the excess topsoil and omitted excavation, or less topsoil and excess excavation, shall then be determined and calculated and submitted for the approval of the Engineer.

3.2. Bulk Excavation and Haulage

3.2.1. Scope and Contents of Works

The work includes any bulk excavation of all types of earth materials specified in the design, including the haulage, or pushing of excavated materials to fills, stockpiles, or special-purpose stockpiles, depending on how the material will be used in the execution of works. These works include any excavation of cut and fills, cuts, borrow pits, training of water courses, road detouring, and bulk excavation during the development of structures. All excavations shall be performed according to sections, described levels, gradients specified in the design, taking into account the required features for a purposeful use of excavated material, as specified in these Technical Specifications.

3.2.2. Regulations Applicable for the Execution of Works

SRPS U.E1.010 Earthworks in Road Construction.

3.2.3. Execution of Works

As a rule, excavation shall be performed with machines and other devices, reducing any manual work to a necessary minimum.

Excavation in hard stone material shall be performed by mechanical drilling, deep and ordinary blasting, and re-blasting for larger rocks, if so required for an intended use of excavated materials. It shall also be necessary to take into consideration mechanical pushing, loading of material, and transport to a place where it would be used, or to a stockpile, including unloading. All excavated materials shall be adjusted to the requirements for intended uses according to the design and these Technical Specifications, both for embankments and for processing into aggregates for the blanket course, and so on, and shall be sorted by quality, subject to the approval of the Engineer.

All excavations shall be performed according to the sections, foreseen height levels, and specified gradients as per the design and the Engineer's instructions. When performing excavations, it shall be necessary to take necessary protective measures for full safety at work and ensure all necessary protection for existing structures and communications.

In this stage of work, an efficient drainage of the roadbed shall be ensured. Work hindered due to the occurrence of water in drilling shall not be paid extra.

Gradients of excavation slopes shall be developed as per the design and/or Engineer's instructions. That work shall also require the clearing of all inadequate places in rock material, which requires special protection and safety solutions, such as the stabilization of disturbed zones, pockets, caverns, water sources, etc., if such works are not already envisaged within other works, such as, for instance: the protection of cut slopes in accordance with the conditions of soil material, geological findings, and other occurrences in excavations, which shall be taken into consideration by the Contractor in the course of works, because of which the Contractor shall have no right to the adjustment of unit prices.

During the execution of works, it is necessary to prevent any undermining, disbalance, or damage of excavation slopes specified in the design. The Contractor shall remedy each such case as instructed by the Engineer, without the right to claim any compensation, or approval of payment for larger or unforeseen works.

For any excavation with the use of explosives, the Contractor shall hire trained and qualified specialists for such works, and also have a valid certificate for that. When using explosives, it is necessary to act in compliance with applicable regulations for such works, ensuring a proper handling of explosives, and the protection of surroundings, structures, roads, and people. In blasting operations, in the same way as during the execution of excavation works, all impacts that would disturb traffic, people, and the environment, should be minimized by providing, among other things, all necessary traffic and safety signalling in accordance with a special approval issued by competent authorities, which should be provided by the Contractor and submitted for the approval of the Engineer.

If such disturbances occurred, the Contractor should eliminate them immediately at his own expense.

3.2.4. Haulage of Local Materials for Aggregates and Testing

Before and during the works, all changes in excavation, i.e. in the quality of earth materials shall be appropriately sampled for the testing of their usability for applications for which they are intended. Compliance certificates shall be provided from competent authorities in terms of the usability of materials from every major cut, or in places where local materials could be used for blanket course, concrete, and asphalt aggregates. If there is an intention to use excavated materials for such purposes, loose clayey layers shall be removed before blasting, and used for fills or stockpiled on a special place proposed and/or accepted by the Engineer. In that case, the Contractor shall, at his own expense, compensate for material for fills in the amount taken for other needs. The production of aggregates for concrete and asphalt from local materials is allowed only if their washing prior to use is foreseen.

3.2.5. Balance of Earthworks and Borrow Pits

If, according to the balance of earthworks specified in the design, there is a lack of material on the road route, and the design does not define any borrow pit in its proximity, the Contractor shall propose the location of borrow pits and request the approval of the Engineer. As a rule, all borrow pits shall be specified in the design.

If the Contractor is of the opinion that there is a more favourable borrow pit for him than the one foreseen in the design, the Contractor shall, at his own expense, prove the quality and quantity of material, and based on that ask the Engineer to give his approval for the use of that borrow pit, and acquire the land at his own expense.

Before starting to use the borrow pit, the Contractor shall submit to the Engineer, for approval, a proposal with the location plan and cross sections of the borrow pit according to which the excavation will be carried out, unless otherwise specified in the design.

The location plan shall also have a place indicated for the stockpiling of topsoil and other unusable materials, and the method of final restoration of the borrow pit after its closure for use.

Based on that proposal, the Engineer and Investor shall consider permission for its use.

The Contractor shall ask in due time for any subsequent extension or deepening of borrow pits, in order to obtain the Engineer's approval. All other expenses due to the works not covered in the Investor's approval for land use shall be at the Contractor's expense, including any indemnity for destroyed crops and soil, and for any other resulting damage to borrow pits and surrounding land.

Before starting to use a borrow pit, the Contractor shall survey the ground together with the Engineer. These surveys, approved and signed by both parties, will serve as a basis for the calculation of used quantities of materials, taking into consideration the transport and distance. The Contractor shall prepare a proposal for the restoration of borrow pit after its closure for use. After obtaining the Engineer's approval, the Contractor shall restore the borrow pit according to the approved plan (levelling and humification).

The opening and use of borrow pits shall be carried out properly, with necessary gradients, to ensure smooth runoff of precipitation and seepage water. This also prevents the waterlogging of materials in borrow pits, and makes easier the work in wet weather.

The material proved as unsuitable for the construction of roadbed shall be removed. The Contractor shall form stockpiles where approved by the Engineer and/or foreseen in the design. Unless otherwise determined, excess materials shall first be used to extend the embankment and create parking places and belvederes. Places for such and other stockpiles shall be submitted for approval by the Engineer.

Stockpiles shall be formed in such a way as to prevent landslide, and after the completion of works they shall be levelled and restored according to the Engineer's instructions. For all stockpiles not specified in the design it is necessary to prepare a design at the Contractor's expense.

For borrow pits and stockpiles specified in the design or by the Engineer, the Investor shall bear the costs of land acquisition or compensation, and the Contractor shall bear the expenses of compensation for destroyed crops and land out of the boundaries of borrow pits and stockpiles.

For borrow pits and stockpiles determined at the Contractor's proposal, all buying, compensation, and similar expense, and all related expenses due to the change of location shall be borne by the Contractor, if the Investor has already made available a necessary borrow pit and/or stockpile.

3.2.6. Measurement

The measurement of quantities for the calculation of excavation works shall be performed based on the actual volume of excavation, measured in an original natural condition, based on the measurements of cross sections after topsoil stripping, and after the final excavation within the design framework, and/or changes approved by the Engineer. Any quantities excavated in excess of the designed ones shall not be paid if they were caused by the Contractor's fault. The following criterion shall be adopted for the quantification of different types of earth materials in excavation:

According to cross sections, the quantities of particular types of earth materials shall be determined in the course of construction, in a percentage of the entire surface of cross section, which makes the basis for determining total quantities for each type - category.

For the bulk excavation in mixed material, the categorization of excavations is obligatory, and, whether there is the Contractor's request or not, it shall be performed in due time, and, for finished excavation facilities, in the next month for the past month at the latest, and, for excavations performed in the current year, until the preparation of the statement for payment.

The categorization of excavations shall be performed by the Engineer and the Contractor's authorized representative. The Contractor shall prepare a protocol on its work, and based on accepted percentage values, through the protocol, the Engineer shall calculate categories and enter them in the Measurement Book (GN 200 is applicable).

Lenses, nests, and caverns within certain types of earth materials, not in excess of 1 m², shall not be subtracted when determining the area and/or volume, but larger surfaces shall be subtracted from the areas of particular types.

Voids above 1 m² shall be subtracted. All excavated material used for any purpose other than for the embankment, and if not compensated for by the Contractor from a borrow pit, shall be subtracted when determining the quantity of total excavation mass.

The excavation from borrow pits not used for the embankment shall be subtracted during the quantification.

3.2.7. Payment

The payment shall be made per m³ of original natural excavation per unit price from the agreed Priced Bill of Quantities, separately for each type of earth material. This price includes topsoil stripping with stockpiling, protection, development, and clearing of slopes from all unstable blocks and slide, levelling of all excavated and adjacent surfaces, humification and grassing over the slopes, all works on excavation with loading, haulage, and unloading of material in places specified for its use according to the balance of earthworks – including the works under 2.4. and 2.5., and the Contractor shall have no right to claim any extra compensation for that work.

STD given in the tender document (Contractor's Priced Bill of Quantities) is approximate, and serves for a temporary calculation of works. STD is the distance between the mass centre of earth mass in original natural state, and the mass centre of the mass after transport and according to the plan of earthworks. After the completion of all excavation works on the route and in borrow pits, the actual STD shall be determined, and according to it, the transport of masses shall be finally calculated, and/or the prices (estimate ±) from the Priced Bill of Quantities adjusted. For borrow pits and stockpiles, this unit price also includes works on the final development of terrain. The construction of berms shall not be paid extra, neither shall the quantities of works be calculated separately, since this work shall be paid within the price of bulk excavation and/or the price of fills, when, according to the design, berms are formed by filling and tamping the material. The formation of berms in case of filling and tamping the material is the same as for the horizontal parts of road shoulders.

The extension of cuts for the sake of borrow pits shall be paid as the excavation in cuts. If borrow pits are located out of the road alignment, the volume of excavation from the borrow pits shall be calculated based on the quantity of fill in compacted state, performed from the material from a borrow pit applying the principle that 1 m³ of compacted fill is equal to 1 m³ of excavation in the borrow pit. If a fill is made from a cut along the road and from a borrow pit, it is necessary to make the fill from the road excavation first, and then from the borrow pit, unless otherwise required by the Engineer. The reason for this is to accurately determine the volume of fill made from excavations along the road route, and the missing volume to be filled from the borrow pit. This shall be supported with evidentiary statements, both in the Measurement Book and in the design (cross sections). These quantities shall be determined by the Engineer applying the same procedure as for the categorization of bulk excavated materials.

3.3. Formation of Subsoil

3.3.1. Scope and Contents of Works

Subsoil is original natural soil on which the embankment is founded (constructed). The work includes tamping, scarifying, if needed to dry or wet natural soil in the thickness specified in the design (approximately 30 cm), or the improvement of soil of insufficient bearing capacity by applying geotextile or PVC foil.

The regulations for the control of quality of materials are:

- SRPS U.B1.010 - Sampling
- SRPS U.B1.012 - Determination of soil moisture
- SRPS U.B1.014 - Determination of specific gravity of soil
- SRPS U.B1.016 - Determination of bulk density of soil
- SRPS U.B1.018 - Determination of granulometric composition
- SRPS U.B1.020 - Determination of consistency limits
- SRPS U.B1.024 - Content of combustible and organic matter
- SRPS U.B1.038 - Determination of optimum water content

If the composition of soil – subsoil of embankment is such that an embankment cannot be constructed directly over it (saturated soils, slurry soils, soils of organic origin, and similar), before constructed the embankment it is necessary to prepare, i.e. rehabilitate subsoil in the way specified in the design, or as determined by the Engineer.

Regulations for the control of quality for incorporation are:

- SRPS U.B1.010 - Sampling
- SRPS U.B1.012 - Determination of soil moisture
- SRPS U.B1.016 - Determination of bulk density of soil
- SRPS U.B1.046 - Determination of the modulus of compressibility

3.3.2. Criteria for Assessing Quality of Work

Before starting the filling work, the cleared and levelled foundation soil – subsoil shall be compacted in accordance with the following requirements:

The required minimum % of density (degree of compaction) according to the standard Proctor procedure (and/or other methods):

- | | |
|--|------|
| a) original natural soils composed of cohesive earth materials, with the designed embankment not higher than 2.00 m | 100% |
| b) original natural soils composed of cohesive earth materials, with the design embankment higher than 2.00 m | 95% |
| c) original natural soils composed of noncohesive earth materials, with the designed embankment not higher than 2.00 m | 100% |
| d) original natural soils composed of noncohesive earth materials, with the design embankment higher than 2.00 m | 95% |

If the compaction of noncohesive materials is checked with the plate-bearing test, the same requirements shall apply as for embankments of corresponding height, as defined under 3.4.5.3.



The height of embankment is considered the height from the height level of prepared subsoil – foundation soil, to the height level of finished formation level (subgrade), at its lowest part.

Tests shall be performed each 40-50 m¹ of prepared subsoil.

3.3.3. Measurement

This work is measured per m² of actually prepared subsoil as approved by the Engineer.

3.3.4. Payment

This work shall be paid per m² of prepared subsoil. In the case of replacement of material of poor quality in subsoil, the payment shall be made as defined under 3.4.

3.3.5. Application of Geotextile and PVC Foil

3.3.5.1. Scope and Contents of Works

Geotextiles are placed on foundation soil of insufficient bearing capacity, in order to improve its soil mechanics properties, and reduce remedial works.

The functions of geotextiles are:

- To separate the foundation soil from the embankment layers;
- To ensure unobstructed flow of groundwater from the foundation soil in embankment and vice versa;
- To strengthen the foundation soil in order to take over a portion of stress induced by embankment load;
- To prevent suffosion of fine particles of material in embankment due to the change in surface water level.

Before placing a geotextile it is necessary to level the ground, clear it from roots, large boulders, and sharp stones, and fill large depressions.

The geotextile is placed in such a way as to form an overlap of adjacent strips that is joined together. The overlap is secured by placing small heaps of embankment material along it, at each 1 - 2 m, in order to prevent it from moving. The geotextile is joined together by sewing, so that those ends that are to be joined together are placed face to face and bent in the width 100 mm, with the seam parallel to the edge of joined surfaces at the distance of 50 mm from the edge. Seam strength shall be 50% of the tensile strength of geotextile.

After completed joining, the geotextile shall be covered with the first layer of fill, so that vehicles run over the fill, not over the geotextile. The filling is performed from the ends toward the centre, in order to keep the surface tight. Its ends overlap the first layer and are covered with the next layer.

3.3.5.2. Acceptance of Geotextile

After the unloading of rolls on site, it is necessary to check their quantity, and whether they meet the technical specifications given in the design.

3.3.5.3. Storage of Geotextile

It is of key importance to ensure the protection of geotextile against damage before its placement. Since the product is delivered in a protective shop packaging, it is necessary to check whether it is damaged, and if there are damages, these shall be repaired. It is particularly important to protect the geotextile against UV radiation and moisture. In contact with moisture, the geotextile (particularly unwoven) absorbs the moisture, sometimes even until the rolls become soft, which makes it impossible to check its weight and to place it, particularly at low temperatures. Furthermore, it is necessary to protect the geotextile from getting dirty with mud, because this will reduce its filtering properties.

If the geotextile becomes damaged, the damaged parts shall be removed.

3.3.5.4. Quality Assessment Criteria

The geotextile rolls shall be arranged so that they could be checked and sampled for laboratory tests.

Each roll shall bear the following data:

- Manufacturer's name
- Commercial name
- Production method
- Fabric composition
- Mass per unit of area
- Nominal thickness
- Roll dimensions and weight

Aside from a general check on the site, it is also necessary to check the mass per unit of area, with the accuracy of up to 10 gr/m²

All other tests shall be performed in a laboratory, and they shall meet the following standards:

- Normal thickness
- Pore size
- Filtering properties
- CBR penetration
- Tensile strength
- Skidding in soil
-

Samples are taken from each roll, and all tests are performed in compliance with IGS standards.

3.3.5.5 Procedure

Geotextile rolls have the same weight that mainly ranges from 75 to 150 kg. Lighter rolls shall be placed manually, and heavier—mechanically.

3.3.6 Application of PVC Foil

3.3.6.1 Scope and Contents of Works

Waterproofing PVC foils shall also be placed under the embankment to prevent the penetration of water into the ground.

3.3.6.2 Material

Materials manufactured in our country are based on soft PVC, with a layer of unwoven PES textile.

3.3.6.3 Execution of Works

The material is supplied in rolls, 30-50m. Two workers are needed for its placement. If one roll is not sufficient, another one is added next to it, with simple overlapping. The overlaps shall be 5-10 cm wide. It is joined with strips of lioplast 16 or PVC foil, with hot air, or by adhesion.

3.3.7 Measurement

This work shall be measured per m² of geotextile or PVC foil as approved by the Engineer.

3.3.8 Payment

The work is paid at the unit price per square metre, according to actually executed works.

3.4 Construction of Embankments

3.4.1 Embankments from Earth Materials

3.4.1.1 Scope and Contents of Works

The construction of embankments includes the filling, spreading, rough and fine levelling, wetting, and compaction of fill material, according to dimensions specified in the design. All works shall be executed in accordance with the design, these Technical Specifications, and SRPS U.E1.010 – Earthworks in road construction.

When constructing an embankment using dredged sand, the works also cover the humification of slopes in a 20 cm thick layer.

3.4.1.2 Material

For the construction of embankments, all inorganic materials of specified quality shall be used.

Organic waste, roots, turf, i.e. material that would, in time, due to biochemical actions, change its mechanical and physical properties cannot be incorporated into embankments.

The material for construction of embankments can be obtained from cuts on the road route, borrow pits, and by dredging sand from the Sava or Danube rivers "on site" or from a stockpile of dredged sand.

3.4.1.2.1 Regulations for Control of Quality of Materials

- SRPS U.B1.010 – Sampling
- SRPS U.B1.012 – Determination of soil moisture
- SRPS U.B1.014 – Determination of bulk density of solid particles
- SRPS U.B1.016 – Determination of bulk density
- SRPS U.B1.018 – Determination of granulometric composition
- SRPS U.B1.020 – Determination of consistency limits
- SRPS U.B1.024 – Determination of combustible and organic matter
- SRPS U.B1.038 – Determination of optimum water content.
- SRPS U.B1.042 – Determination of California Bearing Ratio (CBR%)

The determination of content of organic and combustible matter, as well as changes in soil volume shall be resorted to only in specific cases (suspicious materials).

3.4.1.2.2 Classification of Materials

For the classification of materials for construction of embankments, a universal terminology according to the USCS and AASHTO classification (attached tables) and the Casagrande plasticity chart will be used.

3.4.1.2.3 Preliminary Testing of Materials for Embankments

When testing earth materials for their suitability for embankments, all materials from cuts and borrow pits with cohesive soil, including cohesive materials in mixed materials, shall be tested. The following tests are necessary:

1. Natural moisture
2. Proctor test (max. dry bulk density and optimum moisture)
3. Granulometric composition, and degree of non-uniformity.
4. Atterberg's limits of consistency: liquid limit, flattening limit, plasticity index, and Casagrande frost criterion.
5. Based on above mentioned, to determine the group index (I_g).

These preliminary tests should be described through the design, in the soil mechanics report.

3.4.1.2.4. Criteria for Assessing Quality of Materials before Incorporation

- Moisture of materials shall be such that during compression it is possible to reach the specified quality (close to an optimum), Minimum bulk density achieved in the laboratory applying the energy $E=600 \text{ kN/m}^3$ should be:
 - For fills up to 3 m 15.0 kN/m^3 ,
 - For fill over 3 m 15.5 kN/m^3 ,
- Optimum moisture lower than 25%;
- Liquid limit lower than 65%;
- Plasticity index lower than 30%;
- Degree of non-uniformity "U" not lower than 9;
- Content of organic matter lower than 6%;
- If an embankment is made of non-cohesive materials, the size of grain shall not be greater than 2/3 of the layer thickness, i.e. 40 cm, except in the final layer of the embankment where the largest grain shall not be larger than 10 cm.
- Only materials of proven stability in the roadbed can be used for embankments (dredged sand, ash, slag etc.).

When testing earth materials for their suitability for embankments, materials from every cut and borrow pit shall be tested, and at every change of material. Tests shall be performed on at least two samples for every type of material.

When testing sands obtained by dredging for their suitability, the check shall be performed at every 50000 m^3 .

- The mentioned tests shall be performed even if there are soil mechanics tests given in the design.

3.4.1.3. Haulage and Filling

The haulage and filling of materials over a prepared foundation soil, or on an already built layer of fill may start only after the Engineer has approved the lower layers.

When constructing an embankment from dredged sand from a stockpile, the haulage of material shall not be performed over a rolled layer, but shall be dumped over the end.

Every single layer shall be spread in the longitudinal direction, horizontally, or at gradient at most equal to the designed longitudinal gradient. Every single layer, in crosswise terms, shall have a two-sided or one-sided 4% grade. That grade is needed for the runoff of atmospheric water, due to which the surface of layer, when incorporating cohesive earth materials, shall be spread and tamped immediately (daily).

Every single layer shall be filled according to the designed cross section. The approaching ways for transport vehicles shall be as uniformly distributed as possible all across the width of formation level.

The height (thickness) of every spread layer shall be in compliance with the tamping effect by depth of the used tamping device, type of fill material, and segregation occurrences.

If there are requests and possibilities for the construction of embankments in layers thicker than 30cm, the Engineer may approve such request if the Contractor meets the following requirements: on a trial section 30-50 m long, using mechanical devices for the compaction of embankments, to determine: thicknesses, mechanical equipment, number of passes, properties of material with the compaction moisture of every layer at five places, at least 2 of which are in the bottom half of the layer. The entire process of adopting the thickness via a trial section shall be subject to the approval of the Engineer. Based on results, the Engineer shall enter the necessary findings and give his instructions through the Building Journal. Any extraordinary expenses of the work on the trial section shall be borne by the Contractor, but the constructed layer, if on the road route and if the compaction is satisfactory, shall be accepted as constructed fill subject to the approval of the Engineer.

Every type of material to be incorporated in an embankment shall be tested on the trial section, while adopting machines according to the procedure described in the previous paragraph.

3.4.1.4. Compaction

Every layer of embankment shall be compacted in full width with an appropriate mechanical device, while tamping, as a rule, from the edge toward the centre. All places inaccessible for machines, or places where the use of heavy tamping devices would be unsuitable for other reasons (filling behind structures, retaining walls, etc.) shall be tamped with other suitable devices or methods, the use of which shall be subject to the approval by the Engineer.

Every layer of embankment shall be wetted or dried to optimum moisture in compliance with preliminary tests, using the type of material that can be tamped to the required degree of compaction. If after tamping and quality control, the filling of the next layer is not undertaken immediately, but after a longer period, under different weather conditions, before filling it is necessary to re-check the quality of compaction. In such case, the work may start only when the test proves, once again, the quality of compaction.

In case of the use of cohesive materials, when weather conditions make the compaction impossible, it is allowed to use other procedures, such as, for instance, stabilization, treatment, or replacement of materials that will be required by the Engineer, with the expense borne by the Contractor. When a risk of rain is present during the daytime, the Engineer shall, if needed, decide on the suspension of further filling work, without any compensation of expenses. On an embankment made of cohesive materials, the top surface layer shall be levelled and rolled with a lightweight smooth roller (3-5 tons), so that the surface is at 2 - 5% grade on one side, smooth and free from deflections that could collect atmospheric water. Before filling a new layer, it is necessary to roughen such smooth surface in order to achieve better bonding between layers. This also applies for other major interruptions in works on the construction of embankments, due to the end of construction season, etc.

Filling shall be carried out so that layers are, longitudinally, as horizontal as possible, and to avoid any sudden changes in height between layers of different height, constructing them at a gradient that could still allow a proper compaction work.



The filling work shall be stopped at any time when it is impossible to achieve satisfactory results, particularly because of rain, high groundwater, or some other atmospheric disasters. The Contractor shall not have the right to any compensation on such grounds.

Filling material shall neither be incorporated on frozen surfaces, nor on snow and ice.

On any ground of a grade higher than 20°, fills shall be placed on stepped cuts about 2 m wide, cut into the terrain on which the embankment is constructed. Side surfaces of the stepped cuts shall be constructed at 2:1 gradient, with a step grade of 4% and a downhill gradient.

When the ground has a gradient higher than 30°, the stepped cuts shall be made without any intermediate space, and when the ground has a gradient between 20 and 30°, a space up to 1 m wide shall be left between each two steps. The crossfall of stepped cuts in cohesive material shall be made with a 4% grade from the slope (side of cut). If these works on the construction of steps are not specified in the design, they shall be determined by the Engineer, and the Contractor shall execute them.

The finishing layer of earth embankment, 50 cm thick, shall be made, if possible, using rock or gravel material from excavation on the road route. If this is impossible, then from excavation in a borrow pit, if specified so by the Engineer.

If the pavement structure is not sized with the finishing layer of rock material, and there is a possibility to achieve a more cost-effective sizing, the Investor shall have the right to make necessary changes, and the Contractor shall proceed according to the modified solution (earthworks balance and finished road level). The provisions given under 3.6. shall apply to everything else.

3.4.1.5. Quality Control for Incorporation

3.4.1.5.1. Regulations for Control

- SRPS U.B1.010 – Sampling
- SRPS U.B1.012 – Determination of soil moisture
- SRPS U.B1.016 – Determination of bulk density of soil
- SRPS U.B1.046 – Determination of modulus of compressibility with a round plate

3.4.1.5.2. Criteria for Assessment of Quality for Incorporation of Cohesive and Mixed Materials with up to 20% Rock Material Description

The requirements: minimum % of compaction per standard Proctor's procedures $E=600 \text{ KN/m}^2$

- | | | |
|----|---|------|
| a) | Embankment layers, over 2.0m from the embankment bottom to the height of 2.00 m below the pavement | 95% |
| b) | Layers of embankments up to 2.00 m high, and layers of higher embankments, from the formation bottom layer – subgrade, to 2.00 m below the pavement | 100% |
| c) | For dredged sand | 97% |

3.4.1.5.3. Criteria for Assessment of Quality for Incorporation of Non-cohesive Mixed Materials with over 20% of Rock Material

A minimum required value of the modulus of compressibility (MC) for non-cohesive and mixed materials of different granulometric composition shall be determined according to the following criteria, with a plate, Ø30 cm.

- For mixed materials with 20-35% of rock materials $MC = 25 - 30 \text{ MPa}$
- For mixed materials with 30-50% or rock materials $MC = 30 - 35 \text{ MPa}$
- For mixed materials with over 50% of rock materials at optimum or close moisture $MC = 40 \text{ MPa}$

For coarse-grained crushed rock materials (grain size over 200 mm) and mixed materials, the control of compaction may also be performed, if needed, applying volumetric methods, or the modulus of compressibility (Standard SRPS U.B1.046).

3.4.1.5.4. Humification of Embankment Slopes

For an efficient protection of slopes of embankments made of dredged sand, after the removal of loose non-compacted material for embankment slopes, the slopes shall be humified with a 20 cm thick layer. Grass shall be sown on this topsoil.

3.4.1.5.5. Scope of Regular Control Tests

The compaction of embankment layers shall be tested at every 50-100 m with two tests in the immediate vicinity, giving one result.

The moisture of material shall be tested daily. The construction of the next layer may not start until the required quality of the previous layer has been proven and approved by the Engineer.

If, in control tests, the Engineer determines major variation of results from the specified values, he may subsequently change the scope of testing. In agreement with the Engineer, the quality of incorporated layers may also be determined applying other accepted methods. In that case, the criteria of quality for incorporation shall be stated, along with the method and scope of testing, in agreement with the Engineer.

3.4.1.6. Acceptance of incorporated material

Every layer of embankment shall be subject to approval by the Engineer as specified under 3.4.1.5., in compliance with specified criteria.

The Contractor shall remedy, i.e. eliminate, any identified defects with respect to the mentioned quality requirements to the full satisfaction of the Engineer.

3.4.1.7. Measurement

The quantity of incorporated material shall be measured in m^3 of actually incorporated quantities within the project, excluding the topsoil layer on embankment slopes, but including the shoulder core, and as approved by the Engineer.

3.4.1.8. Payment

Quantities determined as per 3.4.1.7. shall be paid at agreed prices for 1 m³ of incorporated fill material.

The contract prices shall include all works on topsoil stripping, spreading, wetting or drying, compaction, construction of stepped cuts and fills, levelling of embankment slopes and shoulders with the accuracy of ± 5 cm with respect to the designed embankment slopes, humification and grassing of slopes, and other works from this description, including all materials and labour, transport and haulage, and the Contractor shall have no right to claim any extra monies for the construction of embankments.

Materials of poor bearing capacity (of poor quality) in subsoil shall be replaced with other materials with favourable soil mechanics properties. The excavation of materials shall be paid per item of excavation of material of category III and IV, i.e. V and VI, if the replacement is performed using rock or gravel materials and if approved by the Engineer.

The construction of embankments, when for the replacement of subsoil materials of category III and IV are used, shall be paid at the price for construction of embankment from materials of category III and IV increased by 20%, if the replacement is performed with materials of category V and VI or gravel material, the construction of embankments shall be paid at the price for construction of embankment using materials of category V and VI increased by 20%, subject to the approval of the Engineer.

For the replacement of material of poor bearing capacity in the subgrade, at places of cut-and-fills and cuts, completely everything said for the replacement of material of poor bearing capacity in subsoil, for the construction of embankment, shall apply. The excavation in subgrade and subsoil, for the sake of replacement of material, shall be paid at agreed unit price for bulk excavation on the road alignment in the corresponding category, subject to the approval of the Engineer.

The calculation of filling quantities shall be determined according to cross sections, and these quantities do not include the quantity of topsoil on slopes and shoulders. The calculation of filling quantities shall include the part of embankment constructed in the place of stripped topsoil in subsoil. The work on topsoil stripping and humification of slopes and shoulders is included in the unit price for the construction of embankments. If the topsoil stripping under embankment is in thickness greater or less than the designed one, evidentiary statements shall be used as a basis to calculate excess or omitted topsoil stripping, i.e. excess or omitted construction of embankment which shall be submitted for the approval of the Engineer.

The construction of finished layer according to 3.4.1.4. shall be paid at contracted unit price for adequate category (bulk excavation and excavation in embankment).

3.4.1.9. Construction of Embankments from Aerated Concrete (Gas-Concrete) Blocks

3.4.1.9.1 Description

On soil of insufficient bearing capacity, with low possibilities of accepting the load, the highway embankment could be made of materials lighter than the conventional ones: clayey-silty and sandy-gravelly materials. Among lighter materials that could be used to construct the roadbed is aerated concrete (gas concrete).

3.4.1.9.2 Quality Requirements

Aerated concrete (Gas concrete) is a material composed of:

- Sand with a high silicium oxide content
- Industrial ash and slag
- Calcium oxide,
- Cement, and
- Al powder

The proportions of mentioned materials shall be such that the following physical/mechanical and resistance/deformability characteristics are obtained in gas concrete:

- Bulk density 4-5 kN/m³
- Percentage of pores with respect to solid ingredients < 80%
- Average compressive strength (as per YTONG norm SB) > 100kN/m²
- Modulus of elasticity > 1700 MN/m²
- Water absorption < 8% of volume

3.4.1.9.3 Execution of Works

For the construction of roadbed, gas concrete is used in blocks, 2.00*1.00*0.50 m.

The construction of gas-concrete roadbed shall start on a layer of sandy-gravelly material, min. 50 cm thick.

The blocks shall be laid so as to achieve bonding between them both in longitudinal and transverse directions. Each gas concrete block shall be mechanically bound at 8 places with adjacent blocks using steel dowels, in order to achieve horizontal and vertical stiffening, as specified in the design. The arrangement of blocks, as well s dimensions and shape of steel dowels shall be as given in the design.

The gradient of gas concrete embankment slope shall be 1:1

The slopes of embankment made of gas concrete blocks shall be protected with a layer of expanded clay, at least 25 cm thick. The layer of expanded clay shall be topped with a layer of topsoil, 20 cm thick, and the surface shall be grassed, as described in this section.

The top surface of gas concrete embankment shall be covered with a concrete slab, 10 cm thick, reinforced in the middle with a wire mesh $\varnothing 238 \times 238$. The concrete slab shall be made of concrete, class 30. Expansion joints on the slab shall be left at every 10 m. The expansion system shall be performed as per the design. Below the surfaces of shoulders and (green) reserve, no concrete slab shall be constructed. A

specifically designed pavement structure shall be constructed above the slab. The reinforced concrete slab shall be cured according to the instructions given under item 5.

3.4.1.9.4. Measurement

The work is measured in m^3 of the constructed gas concrete embankment as approved by the Engineer.

3.4.1.9.5. Payment

The price per $1 m^3$ of placed gas concrete includes all work and material needed to construct this item, namely:

- Sandy-gravelly bedding
- Construction of gas-concrete embankment
- Facing of slopes with a layer of expanded clay
- Reinforced-concrete slab, 10 cm thick
- Steel dowels, etc.

The price shall include the purchasing costs of materials, external and internal transport, and workmanship.

3.5. Wedges along Structures

3.5.1. Description

Wedges along structures are constructed in order to eliminate pavement deformations on the transition from the embankment to the structure.

3.5.2. Execution of Works

Deformations along a structure result, partially, due to the settlement of soil under the embankment, and mostly due to the settlement (consolidation) of subsoil. In order to make the subsoil settle as much as possible before the construction of pavement structure, wedges shall be constructed in one of the following ways:

- If the structure is completed before the construction of embankment, the wedge shall be constructed at the same time as the embankment.
- If the structure is not completed, and the embankment is being constructed, the embankment shall be constructed as close to the structure as possible, so that the subsoil could consolidate as quickly as possible (See Section 8.4.5.2.3.).

The size of wedge depends on the height of structure and length of transition plate, and accordingly, its maximum dimensions can be: height 1.5 m, length in base 2.0 m, slope gradient 1:2, and minimum dimensions for wedges are: height 0.5 m, length in base 0.8 m, and slope gradient 1:2. Pipe culverts placed in embankments and cuts shall be constructed without wedges.

The pavement structure on the wedge section and somewhat further shall be constructed as late as possible, due to the consolidation of embankment and subsoil.

3.5.3. Material

The material used for wedges shall meet the quality of material specified for the upper road base of the pavement structure, fully in accordance with Sub-Section 4.3 of these Technical Specifications.

3.5.4. Execution of Works

The wedge shall be constructed in layers, up to 50 cm thick. The compaction of material by layers along structures is performed in the same way as the compaction of a layer in the pavement structure. Other materials shall be compacted according to requirements specified in the design.

3.5.5. Testing

The testing of wedge compaction shall be performed as specified in Sub-Section 4.3. of these Technical Specifications.

3.5.6. Compaction Criteria

A minimum compaction of layers on the finished layer is 70 MPa, and at every 0.5 m of depth, it falls by 10MPa.

3.5.7. Measurement

The measurement of quantities under this item shall be performed per cubic metres of incorporated materials, according to specifications for embankments and as approved by the Engineer.

3.5.8. Payment

The payment is made at the contracted unit price that includes the procurement, transport, and incorporation of materials, and all finishing works, as for the construction of embankments.

3.6. Replacement of Removed Soil of Insufficient Bearing Capacity

3.6.1. Replacement of removed soil of Insufficient Bearing Capacity with a layer of Sandy-Gravelly Material

3.6.1.1. Description

For the permanent stability of embankment, the material below the future embankment shall be replaced to the designed depth and as directed and approved by the Engineer.

3.6.1.2. Materials

Material shall be in compliance with the intended use and meet the requirements set in SRPS U.B1.018; B.B8.004, and B.B8.044.

3.6.1.3. Execution of Works

The excavation and transport of material shall be performed mechanically, and transported to a specifically designated stockpile. After the completed excavation, LIO 300 geotextile shall be placed over the levelled surface of excavation, and backfilled with sandy-gravelly material.

to the ground level. After reaching the ground level, a finishing layer shall be placed using the material of the same quality, 0.40-0.50 cm thick (as per the design). Further works on the construction of embankment shall be executed using designed materials.

This section of embankment shall be constructed in a layer of 0.50 m of length, free from the presence of water in excavations (if present, it shall be removed).

Compaction shall be performed until reaching the modulus of compressibility $M=75$ MPa.

3.6.1.4. Measurement and Payment

The works are measured in m^3 and as approved by the Engineer. The price of works includes the pumping of water from excavation during the placement, the procurement, transport and placement of sandy gravel, the levelling of finishing layer, and the preparation for "carpeting"

The procurement and placement of geotextile shall be calculated extra and paid per m^2 and as approved by the Engineer.

The excavation of material, transport to stockpile, and levelling of stockpile shall be calculated as for bulk excavation.

3.6.2. Construction of Carpet from Sandy-Gravelly Materials

3.6.2.1. Description

On the road route section where specified so, a layer of gravel – carpet shall be constructed.

On the road route section where soil of insufficient bearing capacity was replaced, the carpet shall be placed directly on the replaced sandy-gravelly material.

On the road route section where soil of insufficient bearing capacity was not replaced, and where specified so in the design, after stripping the topsoil, LIO plastics, LIO 300 type, shall be placed and topped with a gravel carpet, thickness as per the design, over which the embankment is constructed.

3.6.2.2. Materials

The material shall be in compliance with the intended purpose and meet the requirements set in SRPS U.B1.018; B.B8.004, and B.B8.044.

3.6.2.3. Execution of Works

Topsoil shall be stripped mechanically and transported to a specifically designated stockpile. After completed stripping, LIO 300 geotextile shall be placed on the levelled excavation surface, and covered with a carpet made of gravelly material. Thickness of layers is defined in the design and on cross sections.

Compaction shall be performed until reaching the modulus of compressibility $M=75$ MPa.

3.6.2.4. Measurement and Payment

The works are measured in m^3 and as approved by the Engineer. The price includes all work on carpeting, including procurement, transport, and placement.

For the work on the stripping of topsoil, its transport to a stockpile, and the levelling of the stockpile, Sub-Section 3.1. shall apply.

3.7. Levelling of Ground

3.7.1. Description

For better drainage and future landscaping it is necessary to level the ground. If it is a partially used and deformed ground, it shall be levelled by digging and levelling to the depth of 1 m, closing any cracks, and grading the surface to have slopes everywhere (without any depressions) in order to make drainage as efficient as possible.

All levelling works shall be subject to prior inspection, agreement and approval of the Engineer.

3.7.2. Materials

Materials used for levelling shall be those present on the site, by removing excess materials and transferring them to depressions.

3.7.3. Execution of Works

The works shall be carried out mechanically, and the levelling shall be performed to the designed levels. Filled depressions shall be compacted using the same machines as used for excavation.

3.7.4. Measurement and Payment

Measurement and payment shall be carried out per m^3 of excavated, levelled, and, using the same machines, compacted materials, and as approved by the Engineer. The price includes all expenses related to full execution of this operation.

3.8. Monitoring Instrumentation

3.8.1. Introduction

This section of the Specification describes the requirements for the installation and operation of monitoring instrumentation related to the construction of earthworks where this may be instructed by the Engineer.

3.8.1. Definitions

- "Settlement gauges" - Measuring devices for vertical displacement of earthworks

- "Inclinometers" - Devices to record horizontal displacements of earthworks by measuring inclinations of a flexible tube installed inside a vertical borehole
- "Piezometers" - Pore-pressure measuring devices. Most commonly the open hydraulic piezometer or standpipe. However for a short response time, closed or "constant volume" piezometers can be used.

3.8.2 Instruments

The Contractor shall provide for approval of the Engineer full details of the measuring devices and ancillary equipment that he intends to use together with details of authorised suppliers prior to the purchase of such equipment.

3.8.3 Transport, handling and storage

Transport, handling and storage of instrumentation equipment shall be carried out in accordance with the supplier's requirements

3.8.4 General Execution/ construction of the work

Where required by the Contract or instructed by the Engineer, the Contractor shall supply and install earthworks monitoring instrumentation and shall provide details of the qualified staff who will record and report the results of such monitoring.

The Contractor shall submit a programme and detailed proposals for installation of the instruments, the taking of readings and the periodic checking of the equipment for accuracy, for the approval of the Engineer not less than two weeks before he proposes to commence the work, unless otherwise stated in the Contract

The Contractor's proposal shall include full details of the types of instrumentation, method and equipment for installation and plans and sections showing the geometrically coordinated locations of instrumentation.

The Contractor shall ensure that any boreholes used to house instruments shall be kept free of any loose material before and while such instruments are placed.

During the installation of instruments the Contractor shall ensure that such work does not damage the completed works. Should damage occur the Contractor shall submit his proposals for remedial works to the Engineer for approval

3.8.5 Access for monitoring

The Contractor shall provide suitable access to instruments for monitoring staff at all times.

3.8.6 Protection of instruments

Following the installation of instruments the Contractor shall carry out his works in such a way that instruments are not damaged.

Instrumentation and/or boreholes with measuring devices inside them, shall be protected by three 100mmx100mm wooden stakes, arranged as a triangle, 1.8m long, embedded in concrete footings at least 300mm deep, strip-painted in red and white, or any similar arrangement. The Contractor shall replace damage or missing stakes as soon as these are identified.

3.8.7 Reporting results

The Contractor shall provide a full report of instrumentation monitoring once a month or as otherwise required by the Contract or by the Engineer

The report shall include but not be limited to the following:

- 1) Details of the recording staff
- 2) Description of the location of instrumentation together with supporting plans and sections.
- 3) Date, time and weather conditions when the readings were taken.
- 4) Condition of the measuring equipment and if damaged reasons for damage.
- 5) Observed data from the settlement gauge, inclinometer or piezometer.

3.8.8 Calibration of instruments

When first installed, the instruments shall be calibrated and validated in accordance with the supplier's recommendations and the Contractor shall report the results to the Engineer.

The Contractor shall carry out full calibration and validation of any instrumentation added or replaced during monitoring and shall report the results to the Engineer.

The Contractor shall carry out periodical checks on the accuracy of the instruments as stated in his agreed programme.

3.8.9 Measurement and Payment

The supply, installation, operation and maintenance of the Monitoring Installations shall be based on the related items in the Bills of Quantities or as otherwise determined by the Engineer in accordance with the Contract.

Section 4 Drainage

Contents

- 4.1. Roadbed Drainage
- 4.2. Filter layers
- 4.3. Drainage Ditches
- 4.4. Closed Storm Sewer System
- 4.5. Relocation of water supply and sewerage systems

4.1. Roadbed Drainage

4.1.1. Scope and Contents of works

The roadbed drainage shall be performed according to details from the final design and Engineer's instructions, and includes:

- Construction of full drainage systems including outlets from the roadbed;
- Construction of sewer systems for draining cuts and cut-and-fills;
- Construction of ditches (covered under 3.12.);
- Construction of gutters (covered under 4.10.);
- Regulation of water sources (covered under 3.14.).

4.1.2. Materials

All used materials shall be in compliance with JUS, i.e. relevant requirements from particular Sub-Sections of these Technical Specifications, depending on the type of material, and the Contractor shall prove the usability of materials with prior tests which shall be submitted for the approval of the Engineer.

4.1.3. Execution of Works

4.1.3.1. Excavation

The excavation shall be carried out according to dimensions given on drawings from the final design and the Engineer's instructions.

The excavation of channels also includes any strutting of trenches needed for the protection against collapse, and water pumping.

Material excavated from trenches shall be used for backfilling and/or hauled to a place approved by the Engineer, which is included in the price of excavation works.

4.1.3.2. Placement of Sand Layer

Spreading sand over the trench bottom (excavation of sewers), below the bottom of inspection manhole, and below concrete elements for surface water runoff, shall be performed in thickness specified on drawings from the final design. Sand shall be free from organic matter, non-plastic, and with a maximum grain size of 10 mm.

4.1.3.3. Construction of Bedding for Pipes

The construction of a bedding layer from concrete or clay, under and around pipes shall be performed according to details given on drawings from the final design, with slopes from trench walls toward the pipe. The class of concrete is specified in the design.

Clay material shall have characteristics of high-plasticity clay, and the moisture of material during placement shall be within the range of $\pm 2\%$ of optimum moisture according to the Proctor procedure. Clay material shall be placed in 10 cm thick layers, and compacted at 95% using the Proctor compaction method.

The bedding shall be laid only after the excavation of drainage trench in full length and after its approval by the Engineer according to height levels and longitudinal gradients that shall match the designed ones.

4.1.3.4. Pipe Laying

Drainage pipes and connections, collecting pipes, and sewer pipes shall be laid over prepared bedding previously approved by the Engineer. Pipes shall be laid so that they lie on the same centreline and at the same gradient as specified in the design.

Pipes can be made of concrete, plastics, or asbestos-cement ("Salonite"). The type and size of pipe shall be specified in the final design. On the motorway section out of the protection zone of Belgrade water supply company, instead of pipes, a French drain can be constructed from concrete square prisms, as per the design. Drainage pipes shall be perforated on the upper half, and if this is not in compliance with the specified standards, the Engineer shall instruct the Contractor to redo perforation.

The joints of drainage pipes shall not be sealed, except inlets into manholes etc. Sewer pipes shall be joined together with couplings, or by sealing joints in the way specified in the final design. Pipes shall be laid so as to prevent the accumulation of mud in already laid pipes.

Sewer pipes used to carry away the content from collecting drainage pipes and/or shafts shall be placed according to details from the final design in appropriate dimensions and at appropriate longitudinal gradients. The construction of outlets from the road bed shall necessarily include the construction of concrete outlet end.

If the drainage, in exceptional cases, shall be constructed in sections, not in full length, then the reference level shall be precisely defined for each section, and it is also necessary to ensure that the drainage system is buried in a water-impermeable layer in its full length.

4.1.3.5. Filter material

Filters above drainage pipes shall be constructed according to details from the final design. The granulometric composition of filter material shall depend on material around the drainage trench, and shall fully meet criteria applicable to filtering joints (JUS U.S4.062 and Sub-Section 4.2. below). The Contractor may propose another solution as well. The quality of incorporated materials shall meet standards and these Technical Specifications for particular filter materials.

The drainage filter layers shall be compacted with lightweight compactors at 70% of the standard Proctor, in such a way as not to damage and displace laid drainage pipes.

Particular types of drainage material shall be laid in layers, according to dimensions specified in the design.

4.1.3.6. Inspection manholes

Inspection manholes (shafts) shall be constructed from finished concrete elements, or concreted in situ, according to details given in drawings from the final design, and the work covers: excavation, formwork, concreting (assembling), transport, procurement and placement of covers, and all other works needed to complete the job. The finished elements shall be fabricated with necessary branches as per position and dimensions, in order to avoid any subsequent boring.

If subsequent boring occurs, the joints shall be performed in a good quality manner. Step irons shall be installed too. Foundation elements of prefabricated shafts shall be laid on a concrete bedding, and separate elements shall be fitted over 'tongue and groove' joints, while other joints may be sealed with a sealing compound.

4.1.3.7. Filling

After the construction of the filter layer, drainage trenches shall be backfilled as specified in the design, after the approval of performed filtering fill by the Engineer. Rock used for filling shall be durable and meet the specifications given under 5.2.1.1.20.

Drainage trenches shall be capped with clay or turfing, in order to prevent the penetration of surface water and accumulation of mud in the drainage system.

4.1.3.8. Placement of Clay Plug

A clay plug shall be placed over the drainage system fully in accordance with details from the design, in order to block the penetration of surface water and enable the treatment of land in the zone of rehabilitation. It shall be made of local clay materials of good workability (medium plastic clays, loess, etc.). It shall be tamped in 20-30 cm thick layers, manually or mechanically, to 90% of bulk density of natural original material.

4.1.4. Testing

The quality of materials and finished products for all works under 3.7.3, shall be tested according to standards and provisions of these Technical Specifications.

For prefabricated elements, before using them, the Contractor shall provide compliance certificates from Sub-Section 8.3.4.1. of these Technical Specifications for the approval of the Engineer.

Monolithic concrete shall be tested according to requirements specified in Section 5 of these Technical Specifications.

All tests shall be completed to the full satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

4.1.5. Measurement

Excavation shall be measured in m³ of actually executed works in original natural soil, according to dimensions from the design and as approved by the Engineer. Excavation down to the subsoil level shall be measured as bulk excavation.

Drainage pipes (together with connections), outlets (with outlet ends), sewer pipes, French drains, and inspection manholes shall be measured in m¹. Filtering, backfilling of drainage system and clay plugging shall be measured in m³, in tamped condition.

No measurement for payment purposes shall be made for the transport and haulage, reinforcement, strutting, water pumping, work in wet soil, formwork, scaffolds, bedding made of clay, concrete, or sand, joining of pipes and connections, strengthening, inspection manhole covers, trench turfing, since all these works are to be included in the unit price.

4.1.6. Payment

Executed works shall be paid at unit prices from the Bill of Quantities for respective types of works and according to measurements from Sub-Section 3.7.5. The unit prices shall include the procurement of all necessary materials, all transport and haulage operations, and the entire work related to the completion of a certain item of works under 3.7.3, and the Contractor shall have no right to claim any extra payment. Works that are not measured shall be included in contracted unit prices and shall not be paid extra.

4.1.7. Vertical Gravel Drains Ø20 cm

4.1.7.1. Description

In order to speed up consolidation at places where soil is not to be replaced, vertical gravel drains – gravel piles are foreseen for construction to a depth indicated on cross sections.

4.1.7.2. Materials

Materials shall meet the standards for building materials of the kind, according to JUS U.B1.018; B.B8.004, and B.B8.044

4.1.7.3. Execution of Works

Vertical drains shall be constructed using a Ø200 mm tubing and a 350 kg drop hammer dropped from the height of 6 m. The tubing shall be placed in a vertical position with a gravel plug formed in it at its bottom end by light tamping. After that, the tubing – steel pipe, is hammered down through the formed plug to reach the required depth. Then the plug is forced out with the same hammer, while pulling out the tubing, putting gravel into the tubing, tamping it, while constantly pulling out the tubing. The quantity of gravel is variable, depending on geological conditions, and amounts to at least that much gravel as may fit into the tubing in compacted condition.

If plastic drains are envisaged, the Contractor shall recommend the technology and equipment that shall be subject to approval by the Engineer.

The Contractor may also recommend another way to construct vertical drains within the contract price limits, and subject to the Designer's and Engineer's approval.

4.1.7.4. Measurement and Payment

Measurement and payment shall be made in m³ of constructed drains as approved by the Engineer. The price shall include all work operations, costs of equipment, and procurement and transport of materials needed to complete this item of works.

4.2. Filter layers

4.2.1. Description

This work shall include the procurement and placement of rock or gravel material for filter layers that are built behind retaining walls, for drainage in places specified in the design, and for the construction of footways. The place of construction of filter layers and a required granulometric composition shall be defined by the Engineer as per the design, based on the granulometric composition of material in foundation soil.

The entire work shall be executed in accordance with these Technical Specifications and dimensions indicated in the design.

4.2.2. Applicable Regulations

- SRPS B.B0.001 – Natural aggregate and rock, sampling
- SRPS B.B8.038 – Determination of muddy ingredients in aggregate
- SRPS B.B8.039 – Approximate determination of contamination with organic materials
- SRPS B.B8.040 – Testing of sand contaminated with organic matter
- SRPS U.B1.018 – Determination of granulometric composition
- SRPS U.B1.046 – Determination of the modulus of compressibility applying the round plate-bearing method
- SRPS U.S4.062 – Construction of filter layers behind walls

4.2.3. Materials

The primary choice for filter layers are natural sandy-gravelly, sandy, or crushed materials.

If using other materials, the Contractor shall submit to the Engineer a compliance certificate on the usability of such material for filter layers, and shall obtain the Engineer's approval in writing.

4.2.3.1. Sandy-Gravelly Material

This material may be composed of grains of gravel, sand, and filler material in such ratio that, depending on the granulometric composition of soil material, the requirements from Sub-Section 4.2.4 of these Specifications are met.

4.2.3.2. Mixed Material

The mixed material shall be composed of grains of gravelly or crushed stone material that may be added, if needed, to natural material in order to obtain the granulometric composition as specified in Sub-Section 4.2.4. of these Specifications. The materials may be mixed during sieving, crushing, or on the site, as chosen by the Contractor.

4.2.4. Quality of Materials

The materials for filter layers shall meet the following requirements.

- Not to contain any organic impurities
- The granulometric composition of filter material shall meet the following criteria:
 1. $D_{15}^f / D_{85}^f \leq 5$
 2. $D_{50}^f / D_{50}^s \leq 25$
 3. $D_{15}^f / D_{15}^s \geq 5$
 4. $D_{85}^f / \max d_p$
 - D_{15}^f , D_{50}^f , and D_{85}^f are the sizes of grains read from the grain size distribution chart for filter material, where the passability through sieve is 15% and/or 50% of the total mass.
 - D_{15}^s , D_{50}^s , and D_{85}^s are the sizes of grains read from the grain size distribution chart for foundation soil, where the passability through sieve is 15%, 50%, and 85% respectively, of the total mass.
 - $\max d_p$ is the largest aperture on the perforated part of drainage pipe
 5. The granulometric line for filter material shall be approximately parallel to the granulometric line for foundation soil.

6. For vertical filters, the granulometric composition of material shall be composed of one fraction that shall match the medium into which the material is to be placed. Gravelly material for filter layers shall be tested, before use, according to the requirements set in these Technical Specifications, on at least three samples for each material.

All tests shall be completed to the full satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

4.2.5. Procedure

4.2.5.1. Source of Materials

The Contractor shall notify the Engineer of any place from which the material for filter layer is to be obtained, inform him about necessary tests, and obtain approval from the Engineer to use the place. Borrow pits and quarries shall be first cleared in a proper way.

4.2.5.2. Compaction of Materials

4.2.5.2.1. Construction of Filter layer for Footways

Before setting to construct a blanket course, it is necessary to perform a fine grading of the subgrade according to height levels indicated on cross sections with the accuracy of 1 cm, and final rolling of the graded surface to reach the required compaction as per the design and these Technical Specifications.

The prepared subgrade, previously approved by the Engineer, shall be covered with a layer of sandy-gravelly material of required thickness. The spread material shall be compacted using appropriate equipment to the required compaction.

The constructed blanket course shall be maintained within the designed profile and with required compaction until the commencement of work on the next layer.

4.2.5.2.2. Compaction of Material in Other Filter layers

After finished spreading of each layer of material it is necessary to grade it and then compact it in full width using appropriate equipment for compaction.

All places inaccessible for compaction with a roller shall be compacted with other equipment for compaction.

The usability of equipment for compaction and the technological procedure shall be previously tested on a trial area, and the results shall be submitted to the Engineer for his written approval.

4.2.5.3. Quality Control

At the beginning of placement of filter material, it is necessary to check its granulometric composition and the granulometric composition of foundation soil.

Samples shall be taken at least at every 50 m³ of filter material, and obligatorily for every separate structure, regardless of the quantity of filter material. If there are any major variations in results, the Engineer shall increase the number of tests at the Contractor's expense.

The compaction of filter layer shall be controlled on its surface, i.e. every layer shall be controlled, if possible. Control methods and criteria shall be defined by the Engineer depending on field conditions.

The compaction of spread material for footways shall be performed with appropriate equipment at 95% compaction according to the modified laboratory procedure (2.75 MN/m²).

All tests shall be completed to the full satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

A layer constructed below the specified standards shall be removed and replaced at the Contractor's expense.

4.2.6. Measurement and Payment

The quantity of placed filter material shall be measured per m² of actually executed works within the project as approved by the Engineer, and for filter materials for footways the measurement shall be carried out per m² of the constructed layer in designed thickness, also as approved by the Engineer.

Payment shall be made at the contracted unit price per m³ or m² of incorporated filter material. The contracted price shall also include all other expenses related to the procurement, placement, transport, etc., and the Contractor shall have no right to claim any other compensation for the final completion of works.

4.3. Drainage Ditches

4.3.1. Scope and Contents of Works

This Section includes the works on construction of drainage ditches of different structure, according to detailed design drawings, namely:

- a) Excavation for drainage ditches
- b) Lining of drainage ditches with concrete
- c) Lining of drainage ditches with stone:
 - on sand bedding
 - on concrete bedding
- d) Stabilization of drainage ditches
- e) Lining with prefabricated elements
- f) Humification and grassing.

4.3.2. Material

All used materials shall be of good quality and their functional performance in compliance with Yugoslav regulations and standards, as well as these Technical Specifications.

4.3.3. Execution of Works

4.3.3.1. Excavation

Ditches shall be excavated before starting the construction of embankment. The excavation shall be carried out precisely according to details from the design. All excavation surfaces, both the bottom and slopes, shall be flat and of required slope and grade, in order to prevent any collection of water or crumbling of soil.

All (manually or mechanically) excavated material shall be used for embankments or other particular works, or transported to stockpiles approved by the Engineer.

If weather or climatic conditions have an adverse impact on excavated surfaces, their lining shall be continued immediately.

4.3.3.2. Lining of Drainage Ditches with Concrete

This work shall be executed as per the design, with construction joints made at every 3.0 m and filled with sealing compound. Concrete shall be compacted by vibration, and the surface shall be homogenous, flat, and pore-free.

4.3.3.3. Lining of Drainage Ditches with Stone

It is performed in a thickness specified in the design, at least 15 cm, on a 10 cm sand bedding, in compacted condition, covered with a layer of cement mortar, 3 cm thick, on which rubble is laid. Joints shall not be wider than 2 cm and shall be filled with 1:3 cement mortar. The work shall be executed precisely according to detailed drawings and instructions from the design, and/or Sub-Section 8.3.3. of these Specifications.

4.3.3.4. Lining of Drainage Ditches with Stone over Concrete Bedding

Drainage ditches shall be lined with stone, in thickness as per the design, over concrete bedding, with joints filled with 1:3 cement mortar, which shall be performed according to detailed drawings and instructions from the design, and/or Sub-Section 8.3.3. of these Specifications.

4.3.3.5. Stabilization of Drainage Ditches

It is performed using 1:3 cement mortar (30 l m²), and local material (on the site); the layer shall be rolled, and then sprayed with a semi-stable bituminous emulsion (0.7 kg/m²). The bottom of ditch shall be of width as per the design, and its sides shall be secured with a dry-stone lining of thickness and width as per the design. Everything shall be performed according to detailed drawings and instructions from the design.

4.3.3.6. Lining of Ditches with Finished Concrete Elements

It shall be performed according to details from the design. The quality of concrete and finished elements shall meet the requirements from Section 5 of these Specifications.

Concrete elements shall be laid over a sand layer according to elements from the design. Joints shall be filled with a sealing compound. Sills for fixing shall be constructed as per the design.

Humification and grassing of ditches (those not to be lined) shall be carried out according to Sub-Section 3.11. of these Specifications.

4.3.4. Quality

All finished surfaces of ditches shall be constructed according to the design, at required longitudinal gradients, crossfalls, and surface areas. The requirement is to ensure perfect drainage, and it is, therefore, not allowed to leave any uneven areas that would prevent water from running off, or cause the sedimentation of muddy material.

Every layer of bedding and lining shall be of thickness in conformity with measurements from the design and these Technical Specifications, and no variation shall be permitted.

4.3.5. Quality Control

The Contractor shall control the reference level and gradient regularly to the full satisfaction of the Engineer.

If these works are not executed according to the required quality, the Engineer shall instruct the elimination of defects at the

Contractor's expense.

Control tests shall be performed at every 250 m^l.

All tests shall be completed to the full satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

4.3.6. Measurement

The amount of work approved by the Engineer shall be measured:

- Excavation in cubic metres of actually excavated ditch as per the design, particularly by groups of different categories. Excavation to the subgrade level shall be calculated as bulk excavation;
- Lining in square metres of actually completed lining, measured in extended width and actual length as per the design and by lining type;
- Stabilization in metres of length - m^l of actually stabilized ditch as per the design.

4.3.7. Payment

Quantities determined according to Sub-Section 4.3.6 of these Technical Specifications shall be paid at contracted unit prices for respective types of works, except for humification and grassing, which is included in the unit price of excavation. Furthermore, the unit price for the lining of ditches with finished concrete elements shall also include the fabrication of fixing sills (excavation and concreting). The unit price includes all works that are, directly or indirectly, related to a full completion of works, i.e. to all materials, labour, transport, transfer, and everything else required for a full completion of works, and thus the Contractor shall have no right to claim any compensation for that work out of the contracted unit price.

4.4. Closed Storm Sewer System

4.4.1. Earthworks

4.4.1.1. Excavation Works

Introductory Notes

Open excavation works cover:

- a) Excavation of trenches applying a proper method according to the soil mechanics properties of the ground, including loading and haulage;
- b) Protection of trench walls;
- c) Drainage of seepage and ground water.

The works may be executed according to the approved and authorized:

- a) Final Design or Detailed Drawings (hereinafter: the design) containing appropriate longitudinal and cross sections with levels and necessary dimensions; and
- b) Construction organization plan that defines: the method of excavation, including types of machines and equipment, organization of transport, technical solutions and approvals for any protection and security measure in the zone of construction site.

Excavation shall be performed according to gradients and dimensions indicated in the design or to the level and dimensions approved by the Engineer.

Incorrect excavation shall not be accepted, and works caused by incorrect excavation shall be at the Contractor's expense. Excessive or incorrect excavation (if the channel bottom level is deeper than specified in the design) shall be filled with gravel and compacted well with vibrosoil compactors, fully as instructed by the Engineer.

Only when bedding is prepared in this way and approved by the Engineer, the next phase may start – construction of collectors.

A trench for laying a pipeline may be excavated manually or mechanically. The width of trench is conditioned by the pipeline diameter and shall be at least 0.80 m. The trench bottom shall be excavated with the accuracy of +5 cm. For deeper excavation, in excess of 1.0 m, the trench shall be strutted, if required due to the stability of ground. Excavated material, used to backfill the pipeline after its assembly, shall be stockpiled on one side of the trench, protected against failure, and dumped at least 1.0m away from the edge of trench. The other side of trench is "reserved" for the stockpiling of piping material. As a rule, all piping material to be used (pipes, couplings, etc) shall be completed on the route before excavating the trench.

The Construction Organization Plan shall ensure that traffic is diverted (for structures built in urban zones) to the unoccupied part of road. Access to all buildings shall be ensured in case of fire fighting, rescue of people, delivery of goods, etc. The Contractor shall take measures and ensure conditions that the usual traffic regime near the site is not disturbed longer than approved by the Engineer. Any material and other consequences of such disturbance of traffic shall be at the Contractor's expense, if he fails to observe adopted construction measures, procedures, and timing in the course of works.

In his work programme, the Contractor for installation works shall foresee and coordinate all related works, both if he performs them on his own or with the assistance of other contractors.

The Contractor shall be responsible for an ongoing coordination and execution of:

- a) main works on installations, and
- b) related works – relocation of all types of installations, protection of structures, reinstatement of pavement, etc.

When excavating the trench, the Contractor shall take care of any circulation of traffic that may cause a collapse of trench and jeopardize the safety of workers. The Contractor shall take special measures for full safety at work on all sections of the excavated trench to the full satisfaction of the Engineer.

If the trench is excavated in the zone of existing installations (power supply, telecom, gas, hot water, water supply, and sewerage), the routes of which are not specified on the site, before the commencement of works it is necessary to define their position by digging up across the route. The uncovered installations shall be surveyed geodetically, and the data shall be submitted to the organization in charge of their maintenance, i.e. organization that will synchronize the existing and designed installations. The excavation of trenches shall start on checked sections following the adopted method, and subject to the Engineer's approval.

Regardless of requirements based on which the Contractor shall obtain the approval for every work plan, arrangement of machines, and progress method, the Contractor shall bear the sole responsibility for the work method, good performance, a timely completion of work, and for safety and protective measures during the execution of works.

These Technical Specifications regulate only major issues that define the method and quality of excavation work. Any other issue not specified herein is subject to relevant technical norms, standards, regulations, and rules, and the approval of the Engineer.

Categorization of Excavated Material

This description adopts a unique categorization of soil, such as "excavation in soft ground", and covers all excavation works in soil, clay, debris, river load, decomposed rock, and other similar materials in which the Contractor may excavate mechanically or manually. Excavation in soft ground includes all round stones and solid blocks found in original natural material, not exceeding 0.75 m³ in volume.

The categorization in excavation work may be defined by mutual agreement in a protocol, with a mandatory presence of the Engineer.

The Engineer shall inspect the bottom of excavated trench, and certify that by making an entry into the Building Journal.

Shoring and Protection of Working Cross Section

The Contractor shall shore and strengthen the excavated surfaces of the trench as stated in the design and these Specifications.

The Contractor shall, fully in accordance with regulations, shore and strut the sides of trench using boards, beams, and wedges for trenches deeper than 1.0m. Shoring shall be such as to meet requirements from the Law on Safety at Work, i.e. shall be 100% safe for life of people working in the trench. The degree of trench protection depends on the material in which the trench is excavated, and on its strength. The trench shall be protected with horizontal and vertical planks fixed with lateral beams and strutted with round timber. Formwork shall "stick out" from the trench at least 0.20m. Earth thrown out shall be protected against collapse.

Spacing between planks shall not exceed 1.50m. Ladders shall be used to climb down to the trench, and all excavations shall be protected with fencing. Every day, before the commencement of works, formwork shall be checked, and any defects removed immediately. The check shall be thorough after heavy rainfall and longer interruptions in work. Findings shall be stated in the Building Journal.

The Contractor shall advise the Engineer if he finds the approved type of shoring inadequate for soil conditions, and the Contractor shall check and change the shoring within 12 hours or as otherwise directed by the Engineer.

The Contractor shall be responsible for the stability of structures and safety at work, and if there is a hazard of caving in, the Contractor shall take appropriate protective measures.

The Contractor shall control, maintain, and renew shoring, to the full satisfaction of the Engineer.

Depending on geotechnical and hydrogeological conditions, an assessment shall be carried out by the Contractor in order to determine the type and strength of shoring, and a maximum time allowed from the moment of excavation to the time of shoring, and this assessment shall be submitted for the approval of the Engineer.

Blanket Course

For pipes to rest better, and to achieve more uniform load all along the pipeline, it is necessary to construct a blanket course. The blanket course shall be prepared carefully and made of sand spread all across the trench, with 10 cm thickness for pipelines up to 500 mm, and 20 cm thick for pipelines over 500 mm. Sand shall be free from stones, or any other objects that might damage a pipeline or its insulation. The blanket course shall be compacted mechanically, and where this is impossible, by standard hand compaction.

Disposal of Materials

Excavated materials shall be disposed of on locations approved by the Engineer. The disposal shall be performed in such a way that stockpiles are always dewatered and levelled. Their slopes, just as stockpiles themselves, shall be stable. The disposal of material shall not cause any landslide of the ground on which the stockpiles are located, or of the surrounding ground. In case of a landslide of the surrounding ground due to a careless disposal of material, the Contractor shall take, at his own expense, all remedial measures instructed by the Engineer.

Sometimes, the Contractor shall also dispose of excavated material on temporary locations approved by the Engineer. After the completion of planned works, when there is no more need for a temporary disposal of excavated material, the Contractor shall haul all remaining material to permanent dump sites and level them in a way approved by the Engineer.

Transport of Pipes

When taking over pipes, each delivery shall be checked carefully to determine whether it is complete and undamaged or not. Damages on pipes are usually caused by mishandling during transport and unloading. Pipes shall be unloaded and reloaded under a constant control of a qualified person, particularly assigned for that task. Pipes shall be stacked on a completely flat base, in the shape of a prism.

Pipes and all fittings and couplings shall be stored so that their inside cannot become dirty. It is necessary to take care that pipes do not become dirty with soil, mud, oils, grease, paint, and similar material. When loading and transporting pipes, it is necessary to take care that they are not drawn over the loading surface of a transport vehicle or over the ground. The contractor for assembly work shall observe instructions given by the supplier of pipes, as well as the way of handling piping material during transport and storage.

When storing pipes, they shall be stacked so that they lie on a flat ground in their full length. Rows of pipes shall be supported laterally. An alternate arrangement of sockets will ensure that each particular layer of pipes rests almost completely. Rubber seal rings shall not be exposed to sunrays for a longer time.

4.4.1.2. Sidefilling and Backfilling of Pipelines

Backfilling works include:

- a) Taking over of material from a stockpile of excavated material, or from a borrow pit, and
- b) Backfilling of trenches, applying appropriate procedures for incorporation of material.

Backfilling works on the remaining part of a trench shall be performed in accordance with specifications given in this Section, drawings, or as instructed by the Engineer.

Joints on a pipeline shall remain uncovered in order to be checked during trial pressure testing. The Contractor is particularly warned not to start the backfilling of trenches before all test pressure checks have been performed, and before concrete in anchor blocks and structures (inspection manholes, overflow and other structures) on the pipeline has achieved the required strength.

All tests shall be completed to the full satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

If the securing of transition or permanent points hinders (prolongs) the execution of works, then, subject to the Engineer's approval, it is allowed to secure these points on a temporary basis.

After completed test pressure checks and securing permanent and transition points, the backfilling shall be resumed with material that shall not contain stones larger than 5 cm.

Gaps between the pipeline and the trench wall shall be filled with sandy material in layers up to 25 cm thick, and compacted. The layers shall be spread and compacted mechanically or applying other approved methods, alternately from the left and right side of the pipeline.

The compaction of a spread section shall meet the specified compaction requirements, particularly on road sections, and on sections in the green belt.

Embankments above pipelines shall be constructed in layers not thicker than 30 cm, with proper mechanical compaction. Filling material shall be taken from a stockpile of excavated material or a borrow pit, if in compliance with requirements for specified compaction. Only inorganic material free from topsoil and muddy components may be used. It is necessary to achieve the compaction $M_e=39.2N/mm^2$.

Backfilling on road sections shall be performed with gravel, in accordance with requirements for renewed pavement. The layers shall not be thicker than 30 cm, and it is necessary to achieve the compaction of $M_e=60N/mm^2$. A backfilled layer shall be spread longitudinally in the entire trench width, and compacted immediately.

The compaction of spread material shall be checked regularly, registering the test results.

All tests shall be completed to the full satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

The compaction of incorporated material shall meet specified compaction requirements, both on road sections and in the green belt.

Haulage of Excessive Excavated Material

The haulage of excavated materials includes loading, transport of excavated material to a stockpile approved by the Engineer, unloading of material, and levelling of the stockpile.

4.4.2. Groundwater Drainage and Pumping

During the execution of works, the Contractor shall drain and pump water in order to ensure a smooth execution of works. The drainage of foundation pit and/or trench shall be performed using hand pumps or mobile pumps. Within the Construction Organization Plan, the Contractor shall enclose a drainage plan. In the preparation of plan, gravity drainage shall be used wherever possible. If this is impossible to manage, the Contractor shall construct drainage channels to a shaft (collector) and a system of pumps for the removal of water from the shaft (trench).

In the project organization study, the Contractor shall propose a groundwater drainage and pumping system that shall be submitted for approval by the Engineer before the commencement of works.

The amount of water not exceeding 15 l/s on the entire section (or a certain location) shall be considered as normal inflow, and the drainage of this amount of water shall not be paid extra, but be included in the unit price.

The amount of water in excess of 15 l/s, measured on the control point inlet, shall be paid within special items of works.

The Contractor shall maintain installations and pumping facilities so that, at any time, they can remove water in amounts up to 30 l/s.

4.4.3 Assembly Work

Before unloading it is necessary to check if pipes are in good condition.

Unloading, as well as relocation, lowering of pipes into a channel, and pipe laying shall be performed using appropriate cranes, trench digger, loaders, or equipment for precision lifting (all this depending on the diameter and material of pipeline), thus excluding any damage to the pipeline. It is not allowed to lay pipes by jerking them or dropping them to fall down freely.

Cables and ropes shall be used to hang pipes. Pipes shall not be unloaded and placed into the trench with a longitudinally inserted rope or with several pipes in one grip.

4.4.3.1 Pipe Joining

Spigot-and-socket and ogee joints, along with a sealer (rubber ring) make a structural whole of the pipeline.

Sealing rubber rings are of solid structure and made of material resistant to chemicals and aging. They are delivered together with pipes.

When joining and sealing, it is necessary to take care of the following:

- Only clean and dry sealers may be used, and sealing surfaces on the socket or free end shall be cleaned and dried.
- A sealing ring shall be placed straightened up (untwisted) and uniformly stretched at the very end of the free end of pipe.
- Before joining, a pipe hanging from the unit for pipe transfer and laying shall be straightened horizontally and vertically (according to the pipeline alignment) and carefully brought to an already laid pipe (sealing surfaces shall not be damaged at any cost).

4.4.3.2 Testing of Pipeline for Water-Tightness

The hydraulic testing of sewerage (i.e. testing of pipeline for water-tightness) shall be carried out after the assembly of pipeline, with the trench partially backfilled.

All tests shall be completed to the full satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

4.4.4 Sewer System Structures

Inspection manholes shall be constructed in places of horizontal and vertical transitions, at joints of two and more pipes, and on straight sections if they are longer than specified. They are built from reinforced concrete pipes – finished prefabricated rings (and a cone-shaped segment, 1.0m long, at the end), Ø1000mm, with incorporated step irons and a reinforced concrete ring and cast iron cover.

Inside walls of inspection manholes are plastered with cement mortar and trowel finished. The bottom of inspection manhole is at the level of the lowest pipeline and half-round gutters are constructed in it for joining all pipelines that run into that manhole.

To construct an inspection manhole, it is necessary to dig a round hole, 1.50m in diameter. Trench sides shall be almost vertical (5:1), so that in case of emergency, the excavated trench could be strutted. The bottom of trench shall be covered with gravel, in a 10 cm layer, and, on top of it, a bedding made of lean concrete (concrete class MB15), 10 cm thick.

4.4.5 MEASUREMENT AND PAYMENT

Works on water supply and sewerage shall be executed fully in accordance with the Design that has passed technical control and agreed Bill of Quantities and subject to the approval of the Engineer. Integral part of the agreed Bill of Quantities is complete design including specifications for materials, bill of quantities and all necessary details and drawings.

All works shall be carried out according to the Engineer's instructions, and no changes or major phases (such as backfilling of ditch, checking of pipes and installations) shall be carried out without him. This Bill of Quantities and specifications for giving over and execution of works are integral part of the construction contract.

Unit rates for these items of work in Bill of Quantities are the Contractor's selling prices and they include:

- a) All necessary preparatory and final works that include high-quality and fully completed job.
- b) All costs of execution of works: labour, material including distribution, equipment, formworks and scaffolding, prefabricated elements, assembly costs, transport, setting, as well as all other costs according to the valid regulations for price structure.

- c) The Contractor is obliged to perform, at his own expense, testing of pipes, installations and sanitary facilities in accordance with the existing technical regulations: water supply shall be tested on pressure set and submitted for approval by the Engineer, and sewerage tested with gauge pressure not less than 1.5 m.

The Contractor is obliged to perform, at his own expense, disinfection of all pipeline installments, water supply, as well as test analysis of water upon completion of works, which shall be stated in construction diary with documentation on water analysis attached. Only after this, technical control and taking over shall be carried out.

It shall be necessary to create committee report on control of water supply and sewerage system in the presence of the Engineer, and the representative of the Employer.

- d) Excavation costs include excavation of ditches with parallel vertical cutting of side ends and bottom of ditch, all accompanying works on protection from sliding or atmospheric waters, pumping of atmospheric or underground waters, planning of excavation and filling, backfilling, compacting of land in layers of 20 to 30 cm, transport of the remaining soil (up to 100 m) with spreading in place approved by the Engineer, compacting and planning of the same, setting out of ditches and other.

- e) Measuring and payment of concrete shall be made up to the lines shown in drawings, in a way described in these specifications and subject to the approval of the Engineer.

In measuring for payment of concrete, all openings with cross section area greater than 400 cm^2 shall be rejected.

Payment of concrete shall be made per cubic meter in accordance with the unit rates given in the Bill of Quantities. These unit rates shall include costs of labour, all material, equipment, formworks and scaffolding and all other direct or indirect costs that must be made in order to finish work on proposed items, and all fully in accordance with the provisions of these technical specifications, regulations and standards.

Unit rates for reinforced concrete shall also include 5 cm thin layer of lean concrete, concrete class MB15, that shall be placed on surfaces that are not solid and plane enough and on which concreting is to be carried out by using reinforced concrete.

Measuring and payment for item: supply and construction of reinforcement, shall include only those quantities of reinforcement that are really incorporated into concrete, in accordance with reinforcement plans and as approved by the Engineer.

Payment for supply and construction of reinforcement shall be made per kilogram in accordance with the unit rates given in the Bill of Quantities. These unit rates shall include costs of supply and transport of reinforcement, bailing wire, bar supports and other necessary material, cleaning, cutting, bending, construction, welding and all other costs related to the supply and construction of reinforcement.

Unit rate per one ton or kilogram for reinforcement of $\text{O}12 \text{ mm}$ shall also include bars whose diameter is $\text{O}12 \text{ mm}$.

If works are executed with material that does not meet technical requirements from design or Engineer's approval, the Contractor shall repeat these works again, at his own expense, without right to ask for reimbursement.

Upon completion of works or, as instructed by the Engineer, during certain phases of work, the Contractor is obliged to bring structure into proper condition for use, as well as to backfill and plan all ditches and holes, clean all structures, installations, devices and parts.

All works are included in main items and shall not be paid separately.

The Contractor is obliged to maintain all executed and constructed structures, installations, devices and parts until they are taken over and to provide necessary protection. This shall be included in the unit rate.

4.4.6 TECHNICAL SPECIFICATIONS FOR PVC PIPES

Material for PVC pipes and joints is mixture of non-plasticized PVC and $\sigma = 10 \text{ MPa}$ with necessary additions.

Physical chemical properties

- o specific weight $1,38-1,45 \text{ g/cm}^3$
- o tensile strength $30-60 \text{ MPa}$
- o average density $1,40 \text{ g/cm}^3$
- o longitudinal extension coefficient in $1/\text{K}$ 80×10^{-6}
- o heat conductivity $0,16 \text{ W/Km}$
- o surface resistance $> 10^{12} \Omega$
- o water absorption 4 mg/cm^2

Quality of products and quality control conditions are defined by SRPS C6.502 and SRPS C3.511 standards.

Type of pipes used depends on place of installation, quality of soil and type of ground, loading and other conditions.

Placing of sewage pipes and joints is allowed without special static evidence under following conditions:

- Under traffic areas or areas that are only temporary exposed to the traffic of light vehicles minimal cover layer should be 0.8 m.

- Under non-traffic areas or areas that are only temporary exposed to the traffic of light vehicles minimal cover layer should be 0.8 m.
- On placing into the ground under buildings, cover layer over the socket should be at least 150 mm. If loadings due to built-in structure parts cannot be avoided, protective pipes should be placed.
- On placing into the channels of minimal width, cover layer should not exceed 6 m, while on placing under embankment into the very wide channels, that layer should not exceed 4 m.
- Soil for filling should have nearly following characteristics $8 \leq 20,5 \text{KN/m}^2$; $8 \leq 22,5 \text{KN/m}^2$.
- Placing in areas of underground waters is allowed only under condition that erosion of filling material is prevented. Erosion shall be prevented by placing pipes in filter layer of gravel or in concrete.
- If there is a departure from these norms, it is necessary to make calculation of bearing capacity for pipes where standard conditions for filling and compacting (DIN 4033) shall be provided, which means that in the area of pipeline from the bottom of channel to at least 30 cm above vertex of pipe, following compacting values shall be achieved:
 - 97% density of non-dig soil for non-cohesive soil
 - 97% density of non-dig soil for cohesive soil . All compaction values shall be proved during construction
- Filling in area of pipeline (from the bottom of channel to at least 30 cm above pipe) shall be done by using non-stone material that can be compacted. Filling material which is in direct contact with pipe may be taken from excavated channel but first it needs to be cleaned from coarse material. Compacting around pipes shall be carried out by using manual or hydraulic equipment. Each time material shall be filled only up to the vertex of pipe and compacting shall be carried out only at sides, and never in the pipe area. Material shall be compacted all until good side support for sewage line is obtained. Filling above pipe vertex shall be carried out in layers so that higher layers compact lower ones.

4.4.7 TECHNICAL SPECIFICATIONS FOR PEHD PIPES

By using technology of spiral rolling and polythen of high density (PEHD) the following can be produced:

- o profiled pipes [with sockets]
- o full wall pipes [without sockets]
- o arch rings
- o Prefabricated elements and manholes

Polythen of high density is thermoplastic mass on base of ethylene homopolymer and addings. In construction of pipes, PEHD designed for extrusion with addition of soot as UV stabilizer is used.

Physical chemical properties

- o density 0.945 g/cm^3
- o elasticity module 800 H/mm^2
- o coefficient of linear extension $1.3 - 2.0 \cdot 10^{-4} \text{ K}^{-1}$
- o heat conductivity coefficient (at 23°C) $0.35 - 0.40 \text{ W/mK}$

Quality of products and quality control conditions are defined by EN ISO 9969 standard. In accordance with the mentioned standard, depending on ring stiffness, pipes are classified in six classes according to the ascending loading. Ring stiffness is a measure that provides information on loading limit at permissible deformation of 3%.

Pipes produced by using spiral rolling technology provide full homogeneity of wall and absolute non-porosity. In order to achieve that entire pipeline keeps these properties, technology of connecting pipes by extrusion welding has been developed.

Resistance of PEHD pipes on aggressive medias is such that enables their successful use in:

- o pipelines for transport of industrial waste waters,
- o foul main sewers and sewers of general system,
- o vent pipelines,
- o outlets located at the bottom of the sea and
- o chimneys for waste gases.

PEHD pipes have following characteristics:

- o they are lightweight which allows significant savings in transport, manipulation and construction ,
- o great resistance on aggressive medias,
- o great corrosion resistance,
- o excellent physical properties which means longer service life (of pipes and joints) and low maintenance costs,
- o smooth inner surface which reduces flowing friction,
- o great abrasion resistance which means longer service period,
- o possibility of construction and servicing in all weather conditions from (-40 °C to +80 °C).

4.4.7.1 Chemical resistance of pipes

It is well known that plastic masses are corrosion proof and that their chemical resistance is good.

However, in contact of working material with pipe wall different processes may occur, such as liquid absorption (swelling), extraction of soluble parts of material (shrinking), hydrolysis, oxidation or other. Behavior of PEHD pipes is explained in DIN 8075 – addendum 1.

4.4.7.2 Transport and stockpiling

Due to great resistance on impacts and deformations and because of small weight, PEHD pipes do not require demanding procedures of transport and stockpiling. Even on low temperatures, below 0°C, they are elastic enough and resistant on impacts.

In spite of all, it must be taken care that pipes are stockpiled on even surface and that they are not in contact with sharp objects, in transport or at stockpiling place.

Pipes should be placed on surface at full length.

4.4.7.3 Installation method

Installation of pipes must be carried out by qualified workers under professional supervision.

In installation of pipeline it is necessary to obey general guidelines for placing of pipeline in ground, and which are defined by EN 1610 standard.

It is necessary to have a good preparation of subgrade (thickness is 15cm) from sand or other material that can be compacted and that does not contain grains larger than 20 mm. Compactness of material around pipeline must be 95% according to Proctor. Compacting shall be carried out in layers of 20 cm and up to the ¼ of outer pipe diameter. Testing has shown that compacting of material with adequate vibrating equipment is much better than manual compacting. If formwork for bracing of channel is being placed then compacting of gravel must be carried out after removal of formwork also.

In order to protect pipe from mechanical damages, it is necessary to cover it 30 cm above pipe vertex with material that does not contain coarse stone, groge or similar. That part of ditch may be filled with excavation material if does not contain material that possibly might damage the pipe.

4.4.7.4 Connecting pipes

For connecting pipes, method of extrusion welding is used. This method insures fully watertight connection.

Welding locations must be protected from strong solar radiation, wind, dust and temperature below +5°C.

During excavation of ditch, the Contractor must take care on traffic flow that might cause cave in of ditch and endanger safety of workers. The Contractor is obliged to undertake special measures for full protection and safety at work on all sections of excavated ditch.

If the ditch excavation is being carried out in the area of existing installations (electric lines, telecommunication lines, gas lines, heat lines, as well as water supply and sewerage system), and their routes are not marked on the terrain, before start of works on route position of these installations must be established by cross wise digging. Discovered installations shall be surveyed and data shall be submitted to the company responsible for maintenance of these installations, which means that reconciliation of the existing and designed installations shall be made. On checked sections excavation of ditch shall start in accordance with the accepted working method and subject to approval by the Engineer.

Notwithstanding requests according to which Contractor must have approval for each programme of works, arrangement of equipment and method of progress, only the Contractor is responsible for working method, high-quality of works, completion of work within agreed period and for safety and protection measures during execution of works.

These technical specifications define only major items that specify method and quality of work on excavation. For everything else that is not stated here, corresponding technical norms, standards, regulations and rulebooks are valid.

4.5 Relocation of water supply and sewerage systems

4.5.1 DESCRIPTION OF THE WORKS

Works on water supply and sewerage systems by which parts of pipeline or other elements of system are being relocated shall be fully executed in accordance with construction design that has previously passed technical control and approved by public service. Integral part of agreed Bill of Quantities is complete design with material specification, bill of quantities and all necessary details and drawings.

Works shall be executed according to the Engineer's instruction, without which no changes or major phases (such as backfilling of ditch, testing of pipes and installations or other) shall be carried out, and with approval of public service's representative. This Bill of Quantities and conditions for takeover and execution of works are integral part of construction contract.

Unit rates for these items of work in the Bill of Quantities are Contractor's selling prices and they include:

All necessary preparatory and final works that include high-quality and fully completed job.

All costs of execution of works: labour, material including distribution, equipment, formworks and scaffolding, prefabricated elements, assembly costs, transport, setting, as well as all other costs according to the valid regulations for price structure.

The Contractor is obliged to perform, at his own expense, testing of pipes, installations and sanitary facilities in accordance with the existing technical regulations: water supply shall be tested on pressure set and submitted for approval by the Engineer, and sewerage tested with gauge pressure not less than 1.5 m.

The Contractor is obliged to perform, at his own expense, disinfection of all pipeline installments, water supply, as well as test analysis of water upon completion of works, which shall be stated in construction diary with documentation on water analysis attached. Only after this, technical control and taking over shall be carried out.

It shall be necessary to create committee report on control of water supply and sewerage system in presence of the Engineer and the representative of the Employer and representative of public service responsible for these systems.

Excavation costs include excavation of ditches with parallel vertical cutting of side ends and bottom of ditch, all accompanying works on protection from sliding or atmospheric waters, pumping of atmospheric or underground waters, planning of excavation and filling, backfilling, compacting of land in layers of 20 to 30 cm, transport of the remaining soil (up to 100 m) with spreading in place approved by the Engineer, compacting and planning of the same, setting out of ditches and other.

4.5.2 MEASUREMENT AND PAYMENT

Works on water supply and sewerage shall be measured fully in accordance with the Design that has passed technical control and agreed Bill of Quantities and subject to the approval of the Engineer.

Unit rates for these items of work in Bill of Quantities are the Contractor's selling prices.

Section 5 Slope Protection

Contents

- 5.1. Boring, and Installation of Anchors
- 5.2. Reinforcement Mesh Q139,M.A. 500/560
- 5.3. Protection of Excavation Slopes with Sprayed Concrete - SHOTCRETE
- 5.4. Protection of Slopes with Mesh (Anchored and Hanging)
- 5.5. Fixing Individual Blocks
- 5.6. Protective Vegetation of Slopes, Cuts, Embankments, Shoulders and Green Areas
- 5.7. Lining of Slopes with Stone

5.1. Boring, and Installation of Anchors

In order to protect the face of excavation and excavated slopes, and their interaction with the surrounding hill mass, it is required to apply "SN" anchors (rock bolts). These anchors are partially pre-tensioned and embedded in cement mortar. The tensioning force is 20% of a minimum force in the anchor that is specified in the design.

- a) For the excavation front, SN anchors, R Φ 25, L= 4.0/ 6.0m, R Φ 19, L= 3.0m are foreseen.
A minimum force in anchors is foreseen to be 85kN.
- b) For excavation slopes, SN anchors R Φ 19, L= 3.0m/4.0m, R Φ 19, L= 2.50m are foreseen.
A minimum force in anchors is foreseen to be 55 kN, and 35 kN for 2.5 m long anchors.

The pre-tensioning force is 10-20 kN and is, most often, applied to the anchor with a torque wrench, and represents a control of an embedded anchor.

Foreseen anchors are made of ribbed steel R Φ 19 (25), with a thread L= 15 cm, and a pointed or bevelled tip for easier penetration into the borehole, through mortar.

The contact between the anchor and the primary lining or excavated slope shall be achieved over a (steel) plate, 160 x 160, d = 10 mm thick. The length of anchors is specified in the design.

The holes for anchors shall be bored in dry.

The borehole diameter:

Min d = 41 mm

Max d = 51 mm

After finished boring, the borehole shall be cleaned with compressed air in order to remove dust and fractions of rock mass, and then wetted before the injection of mortar, i.e. insertion of anchor. If an anchor is not to be inserted immediately into the borehole, it shall be closed with a proper plug.

An SN anchor is formed by driving a steel rod into a borehole of a larger diameter filled with 1:2 cement mortar with the addition of an accelerator.

Anchors are installed mechanically, applying a special equipment for mechanical installation of anchors, or using a creasing hammer.

Thick cement mortar – pudding consistency - (water-cement mortar 0.3-0.35) shall be injected into the borehole by inserting a rubber hose to the end of borehole, keeping it lightly in place until the grout from the borehole forces it out completely.

A plastic plug shall be used to close the borehole, to prevent the grout from leaking out.

Before the mortar hardens, an anchor plate shall be placed on prepared bedding, which is then pressed to adhere to the rock (primary lining) by tightening the nut to achieve the required pre-tensioned force.

The anchor shall be protected against corrosion in its full length (it shall be embedded in cement mortar or in shotcrete).

Pull-out tests are obligatory for anchors and shall be carried out in compliance with the Swiss standard SIA 191.

The anchor body shall be absolutely clean, rust- and grease-free. Control tests ordered by the Engineer are obligatory, namely:

Steel shall be in compliance with the Rules on technical norms for plain and reinforced concrete (PBAB/87), the instructions for use, and related standards:

SRPS C.K6.020 Hot-rolled steel. Reinforcing steel. Technical Specifications. 1987

SRPS C.K6.120 Hot-rolled steel. Reinforcing steel. Shape and dimensions. 1986

SRPS EN 10002-1; 1996 ICS 77.040.10

The quality of materials shall also be proved as directed by the Engineer.

Measurement

The contracted unit price shall include all material and equipment, work, labour, tools, kits, and all trial work and work related to the quality control of embedded anchors (pull-out tests).

Measurement for payment shall be based on the number of completed anchors as approved by the Engineer.

Payment

The Contractor shall be paid at the contracted unit price per 1 embedded anchor of specified diameter and length.

5.2. Reinforcement Mesh Q139, M.A. 500/560

The protection of front and side excavation slopes with a mesh Q139, M.A. 500/560. The mesh shall be in shotcrete, below anchors. Mesh ends shall overlap by three apertures and be tied with a wire. Overlapped surface area is included in the unit price. The mesh shall have the Manufacturer's compliance certificate which shall be submitted for the approval of the Engineer. Transport and storage shall be organized in such a way to avoid damaging and deformation. Before placement, the mesh shall be cleaned from any

dirt and grease, corrosion, and other possible damages. The bearing capacity of a welded reinforcement mesh shall be tested before its placement. The quality of samples shall be in compliance with SRPS U. M1.091 and subject to approval by the Engineer.

Before concreting, the Contractor shall request that the Engineer shall inspect and approve the placed reinforcement mesh.

Reinforcing steel shall be in compliance with the Rules on technical norms for plain and reinforced concrete (PBAB/87), the instructions for use, and related standards:

SRPS C. K6.020 Hot-rolled steel. Reinforcing steel. Technical Specifications. 1987
 SRPS C. K6.120 Hot-rolled steel. Reinforcing steel. Shape and dimensions. 1986
 SRPS U. M1.091 Structural, welded reinforcement mesh. 1986

The quality of materials shall also be proved as directed by the Engineer.

Measurement

The quantity to be paid to the Contractor at the contracted unit price is the number of kilograms of embedded reinforcement, as indicated on drawings and in specifications, i.e. reinforcement plans, and as determined and approved by the Engineer.

The unit price for reinforcement quoted by the Contractor in his tender shall also include waste from cutting and forming reinforcement, overlaps, "S" bars.

SRPS C. K6.120 is applicable for the calculation of weight of reinforcing steel.

Payment

For quantities determined in this way, the Contractor shall be paid at the contracted unit price (for 1 kg) that makes his full compensation for the scope and contents of works covered in this item.

5.3. Protection of Excavation Slopes with Sprayed Concrete - SHOTCRETE

Protection of slopes with Mt 30 sprayed concrete

This is a technology where cement mortar (with additives) is projected pneumatically (under high pressure and at high velocity) from a hopper to a surface. The force of that jet hitting the surface compacts the material to such a degree that it stays in place, without leaking, not only on vertical surfaces, but also on tunnel intrados. This concrete is applied in two or more layers. The layer thickness ranges from 2 to 10 cm. The shotcrete mixing and spraying technology shall be particularly defined within a design by the Contractor, in line with standards SRPS U.E3.011, and SRPS U.M2.008 / 1994 and subject to approval by the Engineer.

The shotcrete mixing and spraying programme shall be subject to approval by the Engineer. Shotcrete may be sprayed applying a dry or wet procedure.

Requirements for the quality of components in sprayed concrete

Use cement Pc 35, 45, 50, SRPS B.C1.011 and SRPS B.C1.014

Any aggregate used to prepare the shotcrete shall meet the requirements for concrete (SRPS B. B2.010) and special requirements for sprayed concrete.

Special requirements for shotcrete (sprayed concrete)

The granulometric composition of aggregate shall be in the following range:

Grain size A - 0.15 - 9.50 mm
 Grain size B - 0.15 - 12.50 mm
 Grain size C - 0.20 - 5.00 mm – for finishing

φ 0 – 0.2 mm = 15%
 φ 0.2 – 1.0 mm = 25%
 φ 1.0 – 3.0 mm = 35%
 φ 3.0 – 5.0 mm = 25%

The above-stated grain size ranges may be revised by the Contractor if proved justified experimentally, through the concrete plans and subject to approval by the Engineer.

Additives for shotcrete (sprayed concrete)

Additives shall meet the requirements from SRPS U. M1.036, the Rules for plain and reinforced concrete, and special requirements from these Rules. The usage of accelerators is envisaged, and plasticizers may also be used subject to approval by the Engineer. Accelerators should meet two requirements: bonding time, and strength rank. The sprayed mix that contains an accelerator shall start setting immediately (within 1 minute at latest), and finish bonding in 10 minutes at most, after leaving the mixer.

The compressive strength of sprayed concrete (unless otherwise specified in the design) that contains an accelerator, shall be at least 5.0 MPa, after 10 hours.

Plasticizers for a dry mix procedure have the task to reduce the surface pressure of water and accelerate the wetting of a dry mix in the nozzle. Plasticizers enhance the cohesion of a mix (its plasticity and adhesiveness), thus producing less rebound. All additives

shall be checked during test spraying, and may be applied only if the test spraying gave positive results. If additives are in liquid state, they shall be batched through water injected into the nozzle. If additives are powders, they shall be batched into a dry mix. Additives are added and selected so that their action does not start before they leave the nozzle.

The type of shotcrete lining and required class of concrete shall be specified in the design. A mean thickness of the lining shall not be less than specified in the design. The thickness of layers shall be checked during work by occasional testing and placement of signs – reference marks. (Minimum control implies one control per 10m²).

Seepage water in a tunnel, after making a shotcrete lining, shall be drained. The stone surface shall be completely clean and wet before the commencement of spraying.

If shotcrete with an accelerator is used, homogeneity is required with the coefficient of variation below 18%. If accelerators are not used, homogeneity is required with the coefficient of variation below 15%.

Preliminary tests and proofs

A programme of preliminary tests according to requirements from the design shall be submitted to the Engineer for approval by the Contractor. During preliminary tests, all components of concrete and equipment shall be included in the tests, and all properties of finished concrete specified in the design shall be proved. These tests shall form a basis to prepare a mix for sprayed concrete. Test spraying shall be performed in all directions. Concreted test surfaces shall be used to check workers and equipment. Hardened concrete shall later be subjected to core testing as and where directed by the Engineer.

If accelerators are used, it is necessary to prove the strength of concrete at 6, 12, 24 hours, and then 3, 7, and 28 days. If accelerators are not used, the strength of concrete shall be proved at 7 and 28 days. The class of concrete shall be defined by a 20 cm cube. The final approval of a planned mix is given after completed testing of all properties specified in the design. The Engineer and Designer shall give the approval in writing, through the Building Journal.

The control testing procedure shall include the properties of sprayed concrete in a fresh, hardening state and in a hardened condition, as specified in the Design. The testing of sprayed concrete in a fresh state shall be performed at least once at every 100 - 200 m³ of sprayed concrete. The testing of sprayed concrete in a hardened condition shall be carried out on cylinders, D=5cm in diameter, on a series of three cylinders taken at every 50 m³ of placed sprayed concrete. The mean strength of three successively tested samples shall be higher or equal to the specified class of concrete. Each particular result shall not be less than 90% of the specified class of sprayed concrete. Compressive strength shall be tested according to SIH NORM 162/66. Tensile strength shall be tested on the same samples as for compressive strength, applying the so-called Brazilian method.

The preparation of a dry mix shall be even and uniform, in order to obtain a homogeneous mix. Gravity mixers shall not be used. The duration of mixing shall be at least 20 revolutions of the mixer drum. The moisture of a dry mix shall be 3-5% of the weight of dry fractions, and its age – 1 hour at most.

If, due to a thicker lining, sprayed concrete is to be applied in several layers, it is necessary to take care that a new layer is applied immediately after the bottom layer has set, not on an already hardened layer. If aggressive water appears, the Contractor shall propose a concrete protection method, by drainage or use of appropriate materials for approval by the Engineer.

Measurement

The basis for calculation for a lining made of shotcrete (sprayed concrete) is the scope specified in the design.

The thickness of lining shall be defined in the design depending on rock properties.

The Contractor shall include a higher consumption of concrete for filling up overexcavations in unit prices.

Depending on rock properties, the Contractor shall foresee appropriately larger dimensions of excavations, in order to ensure, due to related rock deformations, the necessary space around the excavation for a shotcrete lining within the limits specified in the design.

All expenses of additional excavation and protection of a needed profile shall be borne by the Contractor and be included in the unit prices.

The controlled mean thickness of a measured section is relevant for the calculation. If a lining is identified to be constructed in a smaller thickness, the calculation shall be performed by interpolating the contracted prices for set thicknesses.

All calculations and measurement shall be submitted for the approval of the Engineer.

Payment

The Contractor shall be paid at the contract price per m³ of placed shotcrete, in specified thickness.

5.4. Protection of Slopes with Mesh (Anchored and Hanging)

5.4.1 Contents of Works

The work shall include the protection, with mesh, of the rock slopes that are, by themselves, stable at a certain gradient, but are prone to surface erosion.

5.4.2. Material

5.4.2.1. Mesh

Mesh shall be made of a galvanized steel wire, 3mm in diameter, with rectangular or hexagonal openings, 5-10 cm large. The mesh shall be double galvanized, with a zinc layer of at least 0.07 mm.

5.4.2.2. Anchors

Mesh shall be fixed to slopes with anchors as per details given in the steel design, in compliance with SRPS C.B3.021, with a double-galvanized anti-corrosive coating, 0.07 - 0.08 mm thick.

5.4.2.3. Wires and Pipes

For fixing mesh on slopes, aside from anchors, as per details in the design, it is necessary to use double-galvanized pipes according to SRPS C.B5.311, with a diameter of 48 mm, wall thickness of 3.5 mm, and thickness of double-galvanized coating of at least 0.07 mm.

5.4.2.4. Weights for hanging mesh

Concrete weights shall be used, as per details given in the design. The concrete for weights shall be of class MB-20, and meet the requirements from Sub-Section 5 of these Technical Specifications.

5.4.3. Execution of Works

The places and type of protection with mesh shall be specified by the Engineer, in conformity with requirements from the design and these Technical Specifications. Before placing mesh, a slope shall be prepared according to requirements from the design and these Technical Specifications. Everything that could prevent a normal rest of mesh on the ground shall be removed. For safety against rockfall, on steeper gradients (3:1 to 2:1), hanging mesh shall be used, burdened with concrete weights at the bottom end, and with anchors and pipes on the top of slope, so that any rock broken off slides controllably to the bottom of cut.

For milder slopes, anchored mesh shall be envisaged. The spacing between anchors shall be selected according to the geomechanical properties of rock – the spacing of about 1.0m should be taken into account. When it is impossible to drive an anchor directly into a rock, holes shall be drilled to serve the purpose. Meshes shall be joined together by interweaving with a double-galvanized wire of the same diameter as those in the meshes.

5.4.4. Quality control

The Contractor shall submit for approval to the Engineer a compliance certificate from the mesh producer. The quality control of used material and workmanship shall be performed by the Contractor, in accordance with the requirements from these Technical Specifications and subject to the approval of the Engineer.

5.4.5. Measurement

The surface protected with mesh shall be determined based on the measurement of surface covered with mesh in m², measured as per slope gradient, and as approved by the Engineer.

5.4.6. Payment

The protection of slopes with mesh shall be calculated at the unit price for m² of spread and fixed mesh. The price shall include all works, all materials, and all transports for the protection with mesh as per the design, and the Contractor shall have no right to claim any additional payment.

5.5. Fixing Individual Blocks

5.5.1. Contents of Works

Individual blocks shall be fixed with anchors in places specified by the Designer and the Engineer, depending on geological conditions.

5.5.2. Material

Anchors shall meet requirements from Sub-Sections 5 and 8.2. of these Technical Specifications.

Cement mortar 1:1 for grouting shall be in compliance with Sub-Section 5 of these Technical Specifications.

5.5.3. Execution of Works

Stone blocks that need to be fixed to the slope shall be fixed in the way described under Sub-Section 8.2. of these Technical Specifications and according to the description given in the design.

5.5.4. Quality Control

It shall be performed according to Sub-Sections 8.2. and 5 of these Technical Specifications and subject to the approval of the Engineer.

5.5.5. Measurement

The work shall be measured in m¹ of embedded anchors as approved by the Engineer.

5.5.6. Payment

Payment shall be made at the contract unit price per m¹ of embedded anchors, separately by each type.

This price includes the procurement of necessary material, hole boring, anchoring, erection of scaffolds, costs of injecting cement mortar, pre-tensioning, costs of protection of anchor heads, all transport and other costs needed to complete the work on fixing individual blocks, thus the Contractor shall have no right to claim any other additional payment.

5.6. Protective Vegetation of Slopes, Cuts, Embankments, Shoulders and Green Areas

5.6.1 General conditions

The protection of slopes and other surfaces is carried out in accordance with the design solution in several ways, and is applied in the construction of cuts, cuts-and-fills, embankments, green areas, etc. The works must be performed in accordance with the design, regulations, quality control and assurance programme (QCAP), construction works organisation plan (CWOP), requirements of the Engineer, and these Technical Specifications.

Before the beginning of these protection works, for the purposes of slope stability, it is necessary that the basic requirements are met to the full satisfaction of the Engineer:

- slopes are to be executed with a gradient that ensures the terrain stability and prevent subsequent sinking (deformation)
- unstable slopes, created by the operation of water, are to be repaired by appropriate intervention,
- surface and ground waters of the catchment watercourses shall be monitored and channelled into the recipient channels or appropriate depressions by applying grassy semicircular groves or drainage conduits,
- the embankment toes and tops of cutting slopes shall be rounded off, if not provided for in the design,
- surfaces of embankment slopes or cuttings shall be roughly levelled for greater roughness and better grip of grass, and smooth surfaces should be horizontally furrowed by appropriate tools (rake, etc.)

After the construction of embankment, cuts or road structures and implemented basic stability requirements, the slope surfaces need to be immediately protected in an appropriate manner and as directed by the Engineer.

5.6.1.1. Protection of slopes with topsoil material and grass vegetation

Work description

The work involves the protection of embankment slopes, cuts and green areas that are exposed to small quantities of water by applying topsoil material and grass on the surfaces specified in the design or as directed [requested] by the Engineer.

The application of this type of protection also depends on the pedological properties of the soil. The actual executed thickness of the topsoil layer shall be determined by the Engineer.

Procedure

Prior to the beginning of works on this protection, the contractor shall ensure that the basic slope surface stability requirements are met in accordance with these Technical Specifications and to the full satisfaction of the Engineer.

Active topsoil material shall be used for this type of protection, without any twigs, roots, stone or other material that are unsuitable for the development of vegetation.

The topsoil material shall be applied from the bottom to the top of the slope. The thickness of topsoil layer is usually determined in the design. If this is not the case, the thickness for slope layer shall be 0.15 to 0.25m, and for the green area up to 0.45m.

The topsoil shall be levelled and compacted by light compaction hammers. Grass shall be sown on the finely prepared topsoil layer. Sowing shall be done broadcast and then the surface rolled over so that the seed is set firmly in the soil. The type and mix of grass shall be selected in accordance with environmental conditions of the area to provide for the secure vegetation growth. The grass mix shall be proposed by an expert. The amount of seed shall be about 30-50g/m², and of fertilizer about 80g/m².

After the completion of the topsoil and grass layer, the surfaces must be tended until final growth. The contractor shall water the sown surfaces until the grass fully grows, and, if necessary, cut the grass once or twice.

Quality control

The contractor must [show] submit for the approval of the Engineer the results of analyses regarding the proper selection of grass and fertilizer types, as well as the quality control results for seeds.

The seed producer's compliance certificates must be [presented] submitted for approval to the Engineer.

The surfaces protected by topsoil material and grass shall be taken over on the basis of quantity of surface under grass of uniform density, fresh colour and healthy appearance, subject to the approval of the Engineer.

Measurement

Slope protection using topsoil material and grass shall be calculated in square meters as part of earthworks, for works, actually performed and as approved by the Engineer, and paid at agreed unit prices.

The unit price shall include all material needed for such type of protection and the works described in this sub-section.

5.6.1.2 Slope protection by turfing

This type of protection shall be applied where large quantities of rainwater flow over the slope. The covering is carried out by placing individual pieces of turf or grass mat rolls.

5.6.1.2.1. Protection of slopes by laying individual pieces of turf

Work description

The works involve the protection of slopes by laying individual pieces of turf, on the surfaces specified in the design, or [requested] as directed by the Engineer.

This type of slope protection shall particularly be performed for the stabilisation of the embankment bottom against wearing away as well as on sensitive spots on the top of slope, where the topsoil base is easily washed away.

Material

Individual pieces of turf, fertile soil, appropriate mix of grass and stakes shall be used for this type of protection. Individual pieces of turf shall be rectangular, 0.25 x 0.25 m or 0.30 x 0.30m and 0.07m thick. It is usually obtained from natural fields by machine cutting. Cut pieces of turf shall be stored until application, for a maximum of 7 days. The turf placed in storage must be protected from deterioration and must be tended. Fertile soil and grass mix should fit the pedological properties of the soil and environmental conditions of the surrounding area. The willow and other stakes shall be about 30 cm long, 2-4 cm thick.

Procedure

Prior to the commencement of works on this protection the contractor shall ensure that the basic slope surface stability requirements are met, in accordance with these Technical Specifications and to the full satisfaction of the Engineer.

The protection shall be established by placing individual pieces of turf on prepared and levelled slope surfaces, or on previously laid unweaved textile carpets. The pieces of turf shall be placed in the form of a chess-board with very little space in between. These spaces shall then be filled with fertile soil and sown with grass. On the slope surfaces that are exposed to erosive action of water, the pieces of turf shall be placed in such a manner that the edges between individual pieces of turf are at an angle of 45° to the direction of water flow.

The turf placed on the slope surface shall be fixed by willow or other stakes. Slope protection made of individual pieces of turf shall be tended during and after the work is completed until it attaches to the substratum and grows into it. Depending on weather, watering shall serve as protection.

Measurement

Slope protection by placement of individual pieces of turf shall be calculated in square metres, for actually completed works as approved by the Engineer, and paid at agreed unit prices.

The unit price shall include all material needed for such type of protection: procurement, transport and tending of turf, transport to the storage site, work on laying the turf, filling spaces in between with fertile soil and plating of grass, procurement and making of stakes, fixing the turf with stakes, tending of established surfaces and all the necessary work described in this sub-section.

5.6.1.2.2 Slope protection with rolled turf (carpet lawn)

Description

The work involves the protection of slopes using a finished compact rolled turf on surfaces specified in the design or [requested] as directed by the Engineer.

Material

This type of protection is manufactured by covering large surfaces of appropriate unweaved textile with topsoil and sowing the appropriate seeds. On the upper side, unweaved textile has 50mm curls ensuring the capture of the deposited soil and grass. On the other hand, unweaved textile serves as a protective layer against washing off of soil particles from the slope surface. Until the grass grows stronger, watering should be intensive. Turfs are cut by a machine in the shape of rolls of 0.30 x 2.00 metres. Immediately after cutting, the rolls shall be transported to the construction site and fixed on the prepared slope surfaces.

Rolls may also be taken from natural pastures in the vicinity of works if the Engineer establishes that their quality meets the [ToR] specified requirements and quality standards.

Procedure

Prior to the execution of this protection, the slope surfaces shall be cleared of rough waste and levelled. Rolls shall be placed on prepared surfaces and fixed on the top and bottom of the slopes with 10mm stakes. The spaces between adjacent rolls should be small, and filled with fertile soil and seeded.

Protection executed in this manner requires tending during and after the completion of works until uniform vegetation is achieved.

Measurement

Slope protection with rolled turf shall be calculated in square metres, for actual works performed and as approved by the Engineer, and paid at agreed unit prices.

The unit price shall include all materials and work needed for such type of protection: making of rolls, procurement, transport to the site of execution, fitting, filling of spaces between rolls, necessary tending and everything described in this sub-section.

5.6.1.3 SLOPE PROTECTION WITH GRASS COVER _ HYDROSEEDING**Work description**

The work involves the construction of a grass cover by hydroseeding, which achieves stabilisation and vegetation protection of cut, embankment, shoulder slopes as well as steep and inaccessible terrain.

Such protection may be specified in the design or [requested] directed by the Engineer with the designer's consent.

Materials

This type of protection uses appropriate grass mixes that are mixed with high molecular weight polymer emulsion and water with the addition of appropriate fertilizers and cellulose. Hydroseeding shall use only grass varieties of completely new properties: low growth of vegetation mass, poor reproductive capacity, high resistance to environmental deviations, very strong and well developed root system taking over the function of erosion protection.

Procedure

This type of protection is most often carried out without prior preparation of topsoil material or any other preparation on all types of soil, regardless of their pedological composition. These can be soils without the topsoil, sterile and devastated soils (blue sandstone, alluvial deposit, quarries, embankment material, industrial waste disposal sites, coal, gravel, waste rock, etc.). The absence of humus substances and physiologically active substances in the soil of the above types of soil shall be compensated by organic-humus-peat ingredients in an alkali suspension. Work on this protection shall be phased.

Prior to the commencement of work, the terrain shall be tested by the Contractor for data on general environmental and vegetation properties of the environment. On that occasion, basic soil properties shall be established as well as the objective to be achieved by hydroseeding defined. On the basis of the above, the formula and work technology shall be elaborated and submitted for approval by the Engineer.

The hydroseeding itself shall be carried out by a special machine of a wide operating radius, which projects jets of the mix comprising different ingredients directly to the treated surface. This application is economical when treating large surfaces. After the treatment of the soil by hydroseeding, it should be protected until the grass cover forms. In the parts where the grassing is unsuccessful, the contractor shall repeat the procedure as directed by the Engineer.

Measurement

Slope protection with a grass cover by hydroseeding shall be calculated in square metres of treated area as approved by the Engineer, and paid at agreed unit prices.

Unit price shall include the procurement, necessary equipment and all the necessary work and material described in this sub-section and appropriate tending until hand-over time.

5.6.2 Slope protection with unwoven textile cover with embedded grass seeds**Work description**

This work includes the protection of slopes using the unwoven textile cover with embedded grass seeds on surfaces specified in the design or [requested] directed by the Engineer with the consent of the designer.

Material

A material also known as grass carpet is used for this type of protection. It is unwoven textile of polyester origin, to which an appropriate mix of grass seed is added in the course of industrial production. The grass seed mix is selectively produced with respective shares of species depending on environmental and terrain conditions. The technology used for producing the unwoven textile gives it appropriate physical-mechanical and hydraulic properties, and the specific structure enables good seed protection and optimal conditions for its normal development.

Appropriate grass mixes are used for the protection of slopes and other surfaces prone to erosion such as *Festuca ovina*, *Festuca rubra Jalax*, *Festuca rubra gemina*, *Poa annua*, *Poa pratensis Merion*, *Cynodon dactylon*, *Trifolium repens*, etc., in the amount of 0.2-2.5kg/m².

Procedure

Prior to the commencement of work on protection, slopes usually need to be aerated at the depth of 50mm and cleared of rough waste. Then appropriate fertilizers shall be applied. The type and amount of fertilizer shall be determined on the basis of soil analysis.

After the processing and fertilising the upper layer of soil, the surface is levelled and rolled over, and then the grass carpet is placed over. The ends of the carpet shall be fixed with wooden wedges or covered with earth. On soils with low moisture content water spraying is mandatory in the amount of 10 to 15 l/m² daily. Further tending comprises of water spraying in the amount of 4-5 l/m² daily.

The contractor shall tend the grass surfaces until the vegetation finally grows and attaches properly.

Quality control

The Contractor shall present to the Engineer for approval the results of previous analyses for the purposes of proper selection of

grass and fertilizer type, as well as the certificate of compliance for the seeds.

The surfaces protected by the grass carpet shall be taken over on the basis of the surface covered at the appropriate ratio according to current standards and as approved by the Engineer.

Measurement

Slope surfaces protected by covers made of unwoven textile with embedded grass seeds shall be calculated in square metres of formed grass carpet as approved by the Engineer, and paid at the agreed unit prices.

The unit price shall include: procurement and fitting, all work and materials necessary for this type of protection, described in this sub-section. After the sprouting (growth) ends, the contractor shall repeat the procedure on the surfaces where seeding failed as directed by the Engineer.

5.6.3 Slope protection by planting shrubs and grassy vegetation

Description

The work involves the protection of slopes by planting low shrubs sparsely and grass vegetation at specific exposed surfaces. The protection shall be carried out on surfaces specified in the design or [requested] directed by the Engineer.

Material

This type of protection uses the seedlings of low and sparsely planted shrubs and grass vegetation, selected on the basis of pedological properties of the terrain. Selected vegetation must be resistant to wind and snowdrifts and other unfavourable impacts.

The selection of the seedlings, fertilizer as well as the manner of planting and tending shall be in accordance with the Responsible designer recommendations and as directed by the Engineer. Local or adapted types of shrubbery should be used.

The protection of steep slopes with trees or thick shrubbery is not recommended, because after heavy rains great load on the layers of soil is created due to leaves retaining water, which may jeopardize the stability of slopes.

Procedure

This protection shall be used on slopes where the basic stability requirements under these Technical Specifications are ensured. It shall be carried out by planting low shrub seedlings at a specified distance (one every 2.0m² if not otherwise specified in the design).

Afterwards, semicircular groves shall be created on the slopes and the entire surface shall be seeded with grassy vegetation.

Grassy groves regulate and slow down the flow of water caused by heavy rains, showers and rapid melting of snow, so that it is diverted in a controlled manner to recipient channels or depressions.

Measurement

The protection of slopes by planting low shrubs and grass vegetation shall be calculated in square metres, for works actually performed and approved by the Engineer, and paid at the agreed unit prices.

The unit price shall include the procurement, planting and placement as well as all necessary material and work described in this sub-section. The excavation and construction of groves shall be paid as a separate item, and calculated per meter of length.

5.6.4 Protection of slopes with interwoven willow twigs (withies)

Description

The work involves the construction of protection by interwoven withies for the cut and embankment slopes with materials of unstable structure (crumbled dolomites, marl, flysch, loos water permeable material and the like) non-resistant to atmospheric and hydrological impacts.

The surfaces on which this type of protection is to be applied shall be given in the design or as [requested] directed by the Engineer.

Material

Willow or other stakes of Ø 20-50mm and 0.70-0.80m long shall be used for the support of the interwoven withies. For the weaving between the stakes, the fresh willow twigs of Ø 5-30mm shall be used. Turf or topsoil may be used as filler between the withies.

Humified fields shall be grassed in the manner described in Technical Specifications. The selection of the vegetation and fertilizer type depends on the pedological properties of the soil and environmental conditions.

Procedure

Protection of slopes using interwoven withies with humification and grassing shall be carried out on prepared slopes mostly of cuts where the basic stability requirements are provided for in accordance to these Technical Specifications. Protection shall be carried out using interwoven withies directly on the slope without topsoil according to design solutions. If the design does not provide the solutions for protection, it should be carried out by fixing the stakes at a distance of 0.50m and intertwining with in between. The surfaces should be covered in withies up to 3m of slope length. Interwoven withies are placed with their upper edge at the same height as the top of the slope. When protecting river bank slopes, interwoven withies shall be placed diagonally to the water flow. Grass shall be seeded on the carpet of straw or hay (in the amount of 0.60 kg/m²) which shall be sprayed with bitumen emulsion (approximately 0.8 kg/m²) or directly on topsoil surface with the addition of fertilizer (80 g/m²), and which can be protected with a thin unwoven textile. After the construction, protection shall be cared for until it finally grows. The protection using interwoven withies shall be carried out on surfaces on which other forms cannot produce proper results.

Measurement

Slope protection with intertwined withies shall be calculated in square metres for works actually performed and approved by the

Engineer and paid at paid at the agreed unit prices.

The unit price shall include procurement, transport and fitting as well as all the necessary work and material described in this sub-section, as well as the proper care.

5.6.5 Protection of slopes with gabions

Work description

The work involves the protection of slopes using gabions on slopes specified in the design or [requested] directed by the Engineer with the consent of the designer.

Materials

This type of protection uses gabion elements that are made of cages (meshes) and fillers (construction material). The cage shall be made of wire or polymer mesh.

Wire meshes are made of steel wire (Č.0146 and Č.0147) with hexagonal apertures and double threads at the joint. The mesh shall have the shape of a rectangular prism. The steel mesh shall be galvanized for durability and greater resistance to corrosion. The size of aperture and the diameter of the wire depend on the filler material, which may be large gravel or crushed stone material, broken stone. Gabion dimensions differ and depend on the producer's programme. As a rule, the gabions are made in the following sizes: 1.0 x 1.0 x 1.0; 1.0 x 1.0 x 2.0; or 1.0 x 1.0 x 3.0, or as per design.

Polymer mesh shall be made of HDPE, polyvinyl-chloride, polyethylene, or polypropylene. The meshes normally have rectangular apertures (openings). The manner of assembling, joining and executing gabion elements is the same as with wire meshes. Local stones that have the necessary and proper quality for this type of works may be used as fillers.

Quality control

The netting and the joining material for gabions shall comply with the quality requirements under these Technical Specifications. The quality of material for the filling (large gravel, crushed stone material or broken stone) should meet the requirements of these Technical Specifications for such materials. Prior to the commencement of work the contractor shall obtain proof of usability of all materials from the competent body and present the original documentation on quality to the Engineer for review and approval.

Execution

For this type of protection, the gabion elements shall be filled at the site of wall construction. According to the design or [request] instructions of the Engineer, first the excavations for the foundation shall be carried out. In the executed excavation, the gabions that are filled with stone material shall be placed. The smallest parts of stone filling must be larger than the mesh holes. The material shall be distributed manually or with hand tools, to fill the cavities as best as possible. After the gabions are filled, they shall be closed with lids, tied with vertical and angular ties, and edges shall be extended along the entire length of the section; gabions shall then be successively placed in the same layer or subsequent layers.

All adjoining gabions in the same layer or subsequent layers shall be tied with a steel wire for joint action of elements and greater strength. Between the gabions and natural soil appropriate filter material shall be fitted to prevent the infiltration of particles into the filler. It is also important to allow for the draining of water from the deepest part of the foundation through drainage conduits.

If the wall is specified to be higher than one gabion (over 1m) the design shall calculate and ensure its stability and set the needed dimensions which shall be confirmed by the Designer and the Engineer.

Measurement

Protection of slopes using gabions shall be calculated in cubic metres for actual works performed and approved by the Engineer and paid at the agreed unit prices.

The unit price shall include procurement, transport and fitting as well as all the work and materials described in this sub-section

The excavation for the foundation and filter materials shall be calculated in cubic metres, and paid at agreed unit prices, for actual works performed and approved by the Engineer as a separate item.

5.6.6 Protection of slopes by stone lining

Description

The work involves the protection of stone embankment slopes by lining with selected stone on surfaces specified by the design or [requested] instructed by the Engineer.

Material

This type of protection applies stone material used for the construction of embankment. The material shall be of appropriate mineralogical and petrographic composition, sound and of the right size (the largest edge of 0.40m)

Execution

This type of protection is most commonly applied in higher stone embankments for the purposes of constructing steeper slopes and preventing erosion.

Stone lining shall be executed by making a dry wall from selected stone during the construction of the embankment. The longer edge of the stone should be vertical to the surface of the slope to have the stone well wedged into the embankment and stable.

The stone shall be shaped and finished with a hammer if necessary. When making the stone lining, it is particularly important that the foot foundation is built into the firm and sound substratum. The finishing of the lining at the top of the slope should be executed in such a manner that it becomes a whole with the shoulder.

The shape and gradient of the lining shall comply with the design requirements, and the deviation may be within the tolerance range. After the lining is completed, the slope and the surrounding area shall be cleared of stone rubble.

Measurement

The protection of slopes by stone lining shall be calculated in square metres for actual works performed and approved by the Engineer and paid at agreed unit prices.

The unit price shall include excavation for the lining foundation, selection, procurement and finishing of stone, transport and laying of the stone in the lining, and all the materials and work described in this sub-section.

5.6.7 Protection of slopes with mesh

Work description

The work involves the securing and protecting the slopes in rock terrain with meshes in parts where there is a possibility of collapse of unstable parts. The surfaces to be protected shall be specified in the design or determined by the Engineer.

Material

This type of protection uses steel or polymer wire mesh. The steel wire mesh shall have hexagonal apertures with triple wire thread. The steel wire shall be galvanized for greater durability and resistance to corrosion. The wire diameter shall be 1.2-3.1mm, and the apertures shall be 50-100mm. Wire ends shall have a larger diameter (Ø 1.4 to 4.0mm). The width of the net shall depend on the manner of application and range between 1.0 and 3.0 m and is delivered in 25.0m rolls.

Steel anchors of Ø 10-12mm shall be used for the fixing of mesh to the slope. The distance between the anchors shall be about 2.0-3.0m. The anchors shall be fixed to the slope rock at about 0.50 m of depth. The top end of the protective mesh may be fixed to the concrete beams embedded in the slope, and the bottom end fixed with anchors or concrete weights. The Contractor shall obtain the compliance documents for all the materials from the competent body and present it to the Engineer for inspection and [consent] approval.

Execution

Prior to placing this protection, the slope shall be cleared of loose and unstable parts and major rough parts removed. Then the safety mesh shall be placed.

The mesh shall be fixed with anchors.

Concrete weights at the bottom end allow for the removal of collapsed and collected materials. Meshes shall be joined together with galvanized or plasticized wire.

Measurement

The protection of slopes with mesh shall be calculated in square metres, for actual work performed and approved by the Engineer, and paid at agreed unit prices.

The unit price shall include the procurement, transport, fitting and all the work and materials described in this sub-section.

5.6.8 Protection of slopes with sprayed concrete

Description

The work involves the protection of slopes made of rock material prone to surface erosion due to climate or mechanical impact, or in places where the rocks are prone to greater decomposition and where there are clay interbeds or clay nests.

This type of protection shall be applied on surfaces specified in the design or [requested] instructed by the Engineer.

Materials

This type of protection requires anchors, meshes, injection mortar and concrete. Anchors shall be made of steel wires Ø 5.0mm and of required strength. Injection mortar shall be prepared according to special formula. Meshes shall be from steel wire of Ø 2mm, with apertures of square or hexagonal shape of about 400mm in size. Meshes are usually galvanized, however, non galvanized ones may be used but only if they are not corroded. Sprayed concrete shall be mixed according to the formula set by the authorized body. Mortars of class PC25 or PC35 meeting the requirements of HRN B.C.1.011 norm. The sand and aggregates should have the appropriate granule composition, clean and with no harmful admixtures. The water must be chemically pure, suitable for concrete works. Sprayed concrete must have a proper consistency. A layer of sprayed concrete shall be applied with a special machine.

Prior to the commencement of protection work, the Contractor shall obtain required quality documentation for all construction materials as well as the working formula for the mixes in accordance with requirements referred to this Technical Specifications and present them to the Engineer in the original for review and [consent] approval.

Execution

Prior to the commencement of protection, the rocky slopes shall be regulated according to design or [request] instructions of the Engineer, by removing all unstable, major rough parts and dust.

The mesh shall be fixed to the slope with anchor wire built into sound rock by bored holes of Ø 32mm and about 0.20m of depth. Anchor wires shall be placed in such holes so that both ends stick out, and the wire shall be fixed with cement mortar based on quick-setting cement. Sprayed concrete of the proper thickness as per design but of no less than 30mm shall be applied with a machine to the prepared substratum with fixed wire meshes.

The executed protection shall be cured for 7 days, by watering or coating with verified chemicals that prevent evaporation from the layer, and the quality control shall be carried out in accordance with these Technical Specifications.

The application of such chemicals shall be approved by the Engineer on the basis of documents on quality obtained from the competent body.

On slopes where rocks have only surface cracks, this protection shall be carried out without the wire mesh, and the thickness of the sprayed concrete shall be about 30mm.

Quality control

Quality control of basic materials, injection mortar, sprayed concrete and built in layer of sprayed concrete shall be performed fully in accordance with these Technical Specifications.

Measurement

The protection of slope with sprayed concrete shall be calculated in square metres of a specified thickness, for actual work performed and approved by the Engineer, and paid at agreed unit prices.

The unit price shall include the procurement and fitting, as well as all work and material described in this sub-section, depending on the layer thickness, work technology, needed transport and carriage, scaffolding, curing and possibly difficult working conditions.

5.6.9 Protection of slopes by fixing individual blocks

Description

The work involves protection of slopes made of rock by fixing individual unstable blocks with anchors, on surfaces with unfavourable geological, hydrological and geo-mechanical properties, specified in the project or as per Engineer's [request] instructions.

Material

This type of protection requires anchors and injection cement mortar. Material quality and formulation of cement mortar shall be proven with appropriate documentation of the competent body that the Contractor shall present to the Engineer in the original for inspection and [consent] approval.

Anchors shall comply with the HRN requirements for steel, and be made of ribbed steel Ø 16, 19, 22, and 25mm or use patented anchor (Perfo, Dibel rock anchors, Williams's hollow, BBRV, Polensky and Zollner, IMS etc.)

Anchors shall be placed in the previously bored holes and fixed with cement mortar. Cement mortar also serves as an anti-corrosion protection. To increase viscosity of the mix, cement mortar shall be prepared with expansive cement and with inhibitors.

Execution

This protection shall be carried out according to the description and conditions set forth in the design. The work involves placing appropriate anchors into previously bored holes to secure individual unstable blocks. The fitted anchors shall be tested for tensioning by a competent body according to appropriate norms for such materials and purpose, and according to the quality criteria from the design and these Technical Specifications.

Measurement

The slope protection by fixing individual blocks shall be calculated in meters of length of embedded anchors of specific profiles as approved by the Engineer, and paid at agreed unit prices.

Unit price shall include procurement, boring and fitting anchors and all materials and works needed for such type of protection, described in this sub-section.

5.6.10 Protection of slopes with geomeshes

Description

The work involves protection of slopes, cuts and embankments with geomeshes as the reinforcement of topsoil, which reduces the thickness of topsoil (topsoil thickness is 5 cm) and increases friction on the contact plane and erosion protection and grassing of steep and high slopes of embankments and cuts, as indicated in the Design or as directed by the Engineer.

Materials

Types of materials with technical properties of geomeshes are given in table .

Execution

The substratum on which the meshes are to be laid shall be executed without rough spots. The mesh shall be fixed to the slopes of embankment or cuts with U/V shaped anchors (wedges).

The distance between anchors shall be determined on the basis of the following parameters: height and gradient of the slope, type of material of the slope, load, etc.

The usual number of anchors (wedges) is 4pcs./m² , and they are made of reinforced steel of 6-8mm in diameter, 50cm length, pointed at the end for easier fixing to the sub-stratum. Canals shall be excavated on the top and bottom of the embankment or cut. Laid geomesh shall be fixed in the canal with wedges and unrolled down the slope and fixed with wedges at every 2-3m for better contact between the soil and the geomesh.

The geomesh shall be cut to a desired length (with scissors or cutter) prior to anchoring in the bottom canal.

Laid meshes must overlap by at least 10cm along their length (vertical) and 5 cm along their width, and the wedges shall be hammered in at approximately 1.5m distance.

The anchoring canals may be filled with excavated material, and it is possible to fill them with concrete or stone.

After that, the geomesh shall be covered and completely filled with topsoil material, there should be about 10mm of topsoil left on top of the geomesh.

The grass shall be dispersed over the surface in the amount of 50g/m² or hydroseeding shall be performed.

Quality control

Quality control shall be performed in accordance with these Technical Specifications.

Measurement

The surface covered with geomesh shall be paid at unit price for a square metre [set forth in the contract documentation] completed in accordance with the Design, these Technical Specifications and as approved by the Engineer.

The unit price shall include the procurement and fitting and all the work described in this sub-section as well as the necessary materials and transport.

5.6.11. Trees and shrubs planting

Description

Trees and shrubs planting shall be carried out within the landscaping in accordance with the Design proposal during afforestation of road areas: cuts, side cuts, embankments, green areas and around the objects next to the road area.

This project encompasses digging of holes, rubble disposal, transport of fertile soil, planting trees, anchoring tree-trunks, watering seedlings on the areas defined by the design.

Materials

Tree and shrub seedlings shall be well-developed, with properly developed root systems and over-ground parts, without phyto-pathological diseases or entomological damages, aged between 10 and 12 years (for trees), and between 4 and 6 years (for shrubs). The selection of planting material must be adjusted to existing microclimate and pedological habitat conditions. Preference should be given to domestic autochthonous species and variances, as well as allochthonous species resistant to negative biotic and abiotic factors.

Planting material transported from a nursery should be kept in adequate manner from the moment of planting.

For thermal insulation, seedlings with baled turf should be put into a pit, and container seedlings should be covered with straw or jute bags. To prevent the drying of turfs, seedlings should be occasionally watered.

Planting seedlings with turf must be done during the rest period of vegetation. Container seedlings should be planted during the whole year.

Work procedure

Planting holes shall be dug in the geo-mechanically stable substrates.

Dimensions of the pits for planting, according to the greenery categories, dimensions of planting holes shall be:

- for deciduous and coniferous trees 0,80x0,80x0,80
- for shrubs and flattened conifers 0,40x0,40x0,40

Planting holes, having been dug, are filled with a mixture of humus and organic fertilizer, or a humus mixture with chemical (starting) fertilizer added. Organic fertilizer shall be added in the ratio of 1:4 (one part of organic fertilizer to four parts of humus). Chemical fertilizer NPK (15:17:24) in the ratio defined in the Manufacturer's instruction.

While planting trees, right before putting a seedling into a hole, it shall be required to trim back the damaged roots and corona proportionally.

After the planting, fully-grown tree-trunks shall be anchored, and then watered by mild spout, so that the water can get to every part of a root system. Minimum water quantity used for watering replanted trees shall be 45-60 litres per seedling, and for shrubs – 30 litres per seedling.

Planting density according to the green categories:

- lower deciduous shrubs – 1 to 2 seedlings per m²
- higher deciduous shrubs – one seedling per 2m²
- coniferous shrubs – one seedling per 1,5 to 2,5 m²
- low deciduous trees – one seedling per 2-3 m²
- medium deciduous trees – one seedling per 3-5 m²
- high deciduous trees – one seedling per 5-7 m²
- low conifers – one seedling per 3-5 m²
- high conifers – one seedling per 5-7 m²

A proposal for planting density shall be made by the Designer in accordance with biological characteristics of the suggested plant species and ground properties.

If a planting material is smaller and younger, and having all characteristics required in these technical conditions, Engineer may take a decision to increase a planting density, in order to achieve the purpose of the Design task.

Quality control

Complete planting material must have a health certificate.

Green areas, made by planting trees and shrubs, should be maintained regularly: by watering, earthing up if necessary, pruning and fertilizing. Dried or damaged plants should be replaced with healthy and regular ones.

Engineer shall be required to control the health of plants, the seedlings preservation until the moment of planting, the regularity of planting process and plant nursing measures.

Measurement

Planting of trees and shrubs shall be measured according to the operation that is actually carried out and approved by Engineer and shall be paid by Contract Unit Prices. The Contract Unit Price shall include: purchase of plants, transport, storage of plants, digging of planting holes, removal of rubble, filling the holes with humus mixture, planting, anchoring, watering plants and all required labour as described in this paragraph.

5.7. Lining of Slopes with Stone

5.7.1. Scope and Contents of Works

This work include the lining of slopes, rock embankments, and hill sides, in a 30 cm thick layer, with selected stone, as a substitute for humification of slopes on rock embankments and hill sides. This work may be undertaken using other methods and materials, as proposed by the Contractor subject to approval by the Engineer

The lining of slopes of earth embankments with stone or concrete is covered under Sub-Section 8.3.3.6. of these Specifications.

5.7.2. Material

Undressed stone from excavation on the road route may be used for lining, if such stone meets requirements. The size of blocks shall be 20-30 cm.

5.7.3. Execution of Works

Lining shall be performed at the same time with the construction of embankment, with stones laid accurately in the cross-section of embankment, as defined in the design and marked on the site with the construction cross-section. Each stone shall have a secure bearing and be fixed, so that the slope cannot possible collapse due to instability of some stone blocks, or for any other reasons whatsoever. The foot of a lined slope or hill side shall be firmly built into a sound substratum, and constructed in such a way that the lining cannot collapse under atmospheric influences or any other harmful actions.

The end of lining on the top of slope shall be constructed in a good quality, so that any damages to shoulders and similar are impossible to occur.

The work includes all transport, selection, laying, and fixing of stones.

5.7.4. Quality

Quality requirements are such that the surface shall meet requirements from the design with respect to the gradient of shaped slopes, and subject to the approval of the Engineer.

Any variation from foreseen surfaces in the design may be allowed within the limits of a visual accuracy between particular construction cross-sections that must be set according to Sub-Section 2.2. of these Technical Specifications and subject to the approval of the Engineer.

5.7.5. Slope Protection for Embankments made of Stone Material

These Technical Specifications and the Design allow for the slopes of embankments made of stone material to be lined with stone or concrete. Since this procedure may be difficult at some locations, this Sub-Section provides for the Contractor to propose variant solutions as follows, subject to the approval of the Engineer, but all expenses resulting from such solutions shall be borne by the Contractor.

To humify and grass slopes of low embankments, with this being obligatory in places where climatic conditions allow effective humification and grassing.

To shape and secure slopes of high embankments so that they allow the runoff and prevent the erosive action of surface water. The basic objective is to make slopes stable and to fix all unstable rocks in an adequate way (by garreting, etc.). Besides, on very high embankments, on the downstream side, a raised monolithic concrete kerb shall be constructed according to details from the design, or a raised kerb with a half-gutter.

In that case, shoulders shall be constructed at the level of the upper edge of raised kerb and from rock material mixed with earth, compacted at 40 MPa.

To ensure the road drainage, channel pipes shall be set along the embankment slope (in the form of segment or similar) on the downstream side.

The Contractor's proposal regarding the method of protection shall be subject to approval by the Engineer.

5.7.6. Measurement



This work shall not be measured.

5.7.7. Payment

This work shall not be paid extra, as it is already included in the unit price for construction of embankment.



Section 6 Sub-base layers

Contents

- 6.1. Sandy-gravelly materials – construction of subgrade
- 6.2. Construction of Sub-base Layer from Crushed Stone 0/31 mm and 0/63 mm, Mechanically Stabilized
- 6.3. Sub-base Layer Made of Crushed Stone 0/31.5 mm, Cement Stabilized

6.1. Sandy-gravelly materials – construction of subgrade

6.1.1. Description and Objective

The subgrade layer is the top layer of roadbed, made of selected material and constructed in a cut or over an embankment. Depending on material in the cut, the subgrade can be made of local soil, or local soil of inadequate properties shall be excavated and replaced with appropriate material, with prior treatment of subsoil in the cut.

Over the subgrade layer goes the sub-base of pavement structure.

This item includes the procurement of material of adequate quality, haulage to the site, levelling, and compaction according to levels and gradients specified in the final design. Depending on physical properties of material, the item includes any wetting or drying of hauled and spread material before its compaction. The item also includes any replacement of subgrade in the cut, if local soil has inadequate physical and mechanical properties.

6.1.2. Execution of Works

The works on construction of this layer may start only when a lower layer, by height level, has been prepared and approved by the Engineer. The works shall not be executed over a frozen underlying layer.

* Subgrade on Embankment

The layer is constructed by dumping material over the end, so that trucks that haul the material to the site do not run over the underlying layer. For the compaction of subgrade layer made of cohesive soil, it is necessary to use sheepfoot rollers, and the surface of layer shall be closed with light smooth steel rollers. It is necessary to achieve the compaction degree $S \geq 100\%$ for the Standard Proctor Test.

For the compaction of a subgrade layer made of sand or gravelly material or rock debris, it is necessary to apply the equipment for compaction of non-cohesive material (vibro roller, vibro plates, static rollers). It is necessary to achieve the compaction degree $S \geq 95\%$ for the Modified Proctor Test.

The compaction of subgrade layer shall start from the higher edge toward the lower edge by their height level on the cross section, with the compaction equipment going longitudinally with overlapping.

* Subgrade on Soil

Local Soil of Favourable Properties

On the part of road route where the subgrade is on existing ground made up of cohesive soil that meets the quality criteria for subgrade, the subgrade shall be made of local soil (levelling and compaction).

The technology for preparation of subgrade is directly related to the natural moisture in the period of works and the type of soil. Preliminary soil investigations identified a high natural moisture content in soil comparing to an optimum moisture for the compaction of silts and clays. Climatic features of the season during which the works will be executed may result in soil moisture considerably lower than the one identified during soil investigations, i.e. the moisture close to the optimum one. Therefore it is preferable to execute this item of works in a summer and dry period.

In the light of everything mentioned above, with the aim of selecting a work technology, it is necessary that the field soil mechanics laboratory identifies, immediately upon the commencement of earth works, the natural moisture of soil at the subgrade level, and to confirm, or amend, statements on the type of silty-clayey soil and its physical and mechanical properties specified in the pavement structure design. Based on these indicators, the Contractor shall apply an adequate work technology, i.e. the technology recommended in these Technical Specifications, or technology proposed by the Engineer and the soil mechanics laboratory, or technology proposed by the Contractor and approved by the Engineer.

If silty-clayey soil has a higher moisture content comparing to an optimum for the compaction of soil, and as assessed by the soil mechanics laboratory the soil can be dried under favourable climatic conditions (summer, dry period), it is necessary to apply the following work technology in a hot and dry period:

- a) Construction of temporary canals to receive and drain any rainwater;
- b) Soil ripping with a bulldozer equipped with a special plough blade as an implement or with a tractor-drawn plough, to the depth of at least 30 cm;
- c) Loosening of ripped – ploughed soil with disc and spading machines;
- d) Due to a risk of rain, at the end of work day, the surface shall be lightly levelled and rolled with a crossfall toward temporary canals;
- e) On the next work day, the steps b, c, and d shall be repeated;
- f) Final levelling (levels and gradients as per the design) and compaction with sheepfoot rollers shall start, and after achieving the required compaction the surface shall be closed with light static rollers, temporary ditches shall be backfilled and the soil compacted immediately before the construction of pavement structure layers.

The compaction of subgrade layer shall start from the higher edge toward the lower edge by their height level on the cross section, with the compaction equipment going longitudinally with overlapping.

Local Soil of Favourable Properties, but with High Natural Moisture Content

If the silty-clayey soil has a higher moisture content comparing to an optimum for soil compaction, and as assessed by the soil mechanics laboratory the soil cannot be dried under favourable climatic conditions (summer, dry period), it is necessary to compact the soil with the natural moisture content and achieve a maximum compaction with the standard compaction energy (defined with the Proctor test curve). It is necessary to achieve the compaction degree $S \geq 97\%$ for the Standard Proctor Test. The surface of subgrade layer compacted in this way shall

be covered with "filter plastics – geotextile", type ≥ 250 g, according to the Manufacturer's instructions. Locations with subsoil prepared in this way shall be precisely defined and noted down in the construction records on the execution of works.

The compaction of subgrade layer shall start from the higher edge toward the lower edge by their height level on the cross section, with the compaction equipment going longitudinally with overlapping.

Local Soil of Unfavourable Properties

On the part of road route where the subgrade is on existing ground with identified, by the field soil mechanics laboratory, places or stretches with clayey silt of uniform granulometric composition ($U < 9$) and low bearing capacity ($CBR_{lab} \leq 3\%$), it is necessary to excavate and replace the soil in thickness as per the design. The bottom of excavation in such type of soil shall be levelled in order to form a gradient as design for the subgrade and just lightly rolled to make a relatively flat surface. Such surface shall then be covered with "filter plastics - geotextile", type ≥ 250 g, according to the Manufacturer's instructions. The geotextile shall be spread with a substitute material for subgrade dumped over the end.

For the compaction of substitute material made up of sand or gravelly material, or rock debris, it is necessary to apply compaction devices for non-cohesive material (vibro roller, vibro plates, static rollers). It is necessary to achieve the compaction degree $S_z \geq 95\%$ for the Modified Proctor Test.

The compaction of subgrade layer shall start from the higher edge toward the lower edge by their height level on the cross section, with the compaction equipment going longitudinally with overlapping.

6.1.3. Material for Construction of Subgrade

Only previously tested material that meets the quality criteria may be applied for the construction of subgrade layer on embankments or in cuts (on existing ground), or substitute layer for subgrade in cuts (on existing ground).

Testing Standards

The testing of physical and mechanical properties of materials for subgrade shall be performed in compliance with the following standards:

- SRPS U.B1.010 - Sampling
- SRPS U.B1.012 - Determination of soil moisture content
- SRPS U.B1.014 - Determination of specific gravity
- SRPS U.B1.016 - Determination of bulk density of soil
- SRPS U.B1.018 - Determination of granulometric composition
- SRPS U.B1.020 - of limits of liquidity and flattening
- SRPS U.B1.024 - Determination of content of combustible matter in soil
- SRPS U.B1.038 - Determination of optimum water content
- SRPS U.B1.042 - Determination of California Bearing Ratio

Tests shall be performed for every change in material and/or at least once at every 1000 m^2 of subgrade.

6.1.4. Quality Assessment Criteria for Subgrade Material

Local soil or material from borrow pits to be used to construct the subgrade shall have the following physical and mechanical properties:

- Maximum bulk density according to the Standard Proctor Test $\geq 1.60 \text{ t/m}^3$;
- Moisture content in material shall be close to an optimum moisture and ($W_{opt} \pm 2\%$), i.e. the required compaction degree should be achievable during compaction;
- Liquid limit $W_L < 55\%$
- Plasticity index $I_p < 20\%$
- Degree of non-uniform grain size distribution $U > 9$
- Content of organic matter $< 6\%$, uniformly distributed
- Laboratory California Bearing Ratio value $CBR \geq 8\%$ at the compaction degree $S_z = 100\%$ for the Standard Proctor Test, and swelling $< 3\%$.

A substituted subgrade layer shall be constructed using sand or coarse-grained non-cohesive material (rock debris or sandy gravel) that meets the following criteria:

* Criteria for Sand

- Non-plastic sand;
- Degree of non-uniformity of grain size distribution $U \geq 9$;
- According to AASHTO classification of soil, material shall belong to Class A3;
- Laboratory California Bearing Ratio value shall be $CBR \geq 15\%$ at the compaction of 100% for the Standard Proctor Test.

* Criteria for Gravel and Rock Debris

- Index of plasticity for silty fractions $I_p \leq 6\%$;
- Degree of non-uniformity of grain size distribution $U = 15-100$ for sandy gravel, and/or $U = 15-50$ for rock debris;
- The largest grain shall not be larger than 100 mm;
- According to AASHTO classification of soil, material shall belong to Class A1-a or A1-b;
- Laboratory California Bearing Ratio value shall be $CBR \geq 20\%$ at the compaction of 95% for the Modified Proctor Test.

6.1.5. Control of Constructed Subgrade

Control of Material

The control of material hauled and spread on the roadway shall be conducted at least once at 1000 m^2 according to the following standards:

- Natural moisture SRPS U.B1.012
- Specific gravity SRPS U.B1.014
- Granulometric composition SRPS U.B1.018
- Consistency limit SRPS U.B1.020

Material shall meet quality criteria and results of prior tests specified in the previous Sub-Section.

6.1.6. Compaction Control

The control of compaction shall be performed by testing the dry bulk density of a compacted layer and comparing it with a maximum dry bulk density defined by the Proctor Test. Tests shall not be performed on a frozen layer. This test shall be performed at least once at every 30 m² according to the following standards:

- Sampling SRPS U.B1.010
- Determination of soil moisture content SRPS U.B1.012
- Determination of bulk density SRPS U.B1.016
- Determination of modulus of compressibility by round plate bearing test SRPS U.B1.046

It is necessary to reach the compaction degree $S_z \geq 100\%$ for the Standard Proctor Test in case of fine-grained cohesive material, and $S_z \geq 95\%$ for the Modified Proctor Test in case of coarse-grained non-cohesive material.

The criteria for a required modulus of compressibility shall be defined on a test section, while determining relations between a required degree of compaction and the modulus of compressibility, for actual conditions regarding moisture content and interaction of layers. The criteria for every typical stretch shall be created by a commission composed of the Engineer, the Contractor, and the representatives of control laboratory, based on tests performed on test sections.

The test results from test sections, and modifications in compaction evaluation criteria shall be recorded by the Engineer in the Building Journal.

Any repeated tests due to unsatisfactory results shall be at the Contractor's expense

Control of Evenness and Level of Surface of Constructed Layer

The control of evenness shall be performed in any place selected by the Engineer, but the least frequency of test points shall be at every designed cross sections. When measuring with a 4m long levelling staff in any direction, a maximum variation below the staff may be 2 cm.

The control of levels of subgrade surface shall be performed at every designed cross sections, but, besides, it is possible to carry out control at any other place as selected by the Engineer. The allowable variation of constructed levels from the designed ones is -2 cm and/or +1 cm, provided that the designed cross fall has been provided.

6.1.7. Calculation of Works

Measurement:

Executed work, previously checked and accepted by the Engineer, shall be measured in m².

Payment:

Previously accepted and calculated executed work, shall be paid at unit prices from the contract per square metre (m²) of constructed subgrade layer.

6.2. Construction of Sub-base Layer from Crushed Stone 0/31 mm and 0/63 mm, Mechanically Stabilized

6.2.1. Description

This item includes the procurement, haulage, placement, rough and fine spreading, watering if needed, and compaction of a sub-base layer made of crushed stone material, as per dimensions given in the design.

6.2.2. Work Execution

The work shall be executed in one or two layers depending on machines. Material shall be spread longitudinally at the same gradient as the formation level. When speaking of cross section, the layer shall have the crossfall of the present formation level, i.e. as needed for rainwater drainage.

The layer shall be compacted in full width (i.e. carriageway width) with appropriate compaction equipment. Compaction shall be performed from a lower edge to a higher edge.

Sub-base material shall neither be embedded over a frozen surface, nor over a layer of snow and ice.

6.2.3. Quality Control of Material for Sub-base Layer Made of Crushed Stone

Crushed rock aggregate shall be used to construct a lower sub-base layer. Quality control at preliminary tests shall be performed according to the following regulations:

- SRPS B.B0.001 – Natural aggregate and stone, sampling
- SRPS B.B8.012 – Natural stone, compressive strength tests
- SRPS B.B8.010 – Determination of water absorbed by natural stone
- SRPS B.B8.002 – Testing of stone for frost resistance
- SRPS B.B8.045 – Testing of stone and rock aggregate for resistance to wear according to the Los Angeles method.
- SRPS B.B8.037 – Determination of friable grains in coarse-grained aggregate
- SRPS B.B8.047 – Definition of shape and surface appearance of grains in rock aggregate
- SRPS B.B8.048 – Testing of shape of grains in rock aggregate
- SRPS U.B1.018 – Determination of granulometric composition as per Section 5 Determination of particles of 0.02mm in size by hygrometry (or according to YUS B.B8.036)
- SRPS B.B8.036 – Determination of the particles in aggregate that pass through a screen with 0.02 mm mesh (the applicable procedure is the one from this SRPS)

- SRPS B.B8.038 - 1.5.52 Content of clay and muddy components
 SRPS B.B8.031 - Absorption of water by aggregate
 SRPS B.B8.030 - Bulk density of aggregate with pores and voids (in compacted and loose condition)
 SRPS B.B8.032 - Bulk density of rock (with and without pores and voids), rock porosity and density
 SRPS U.B1.012 - Determination of moisture content
 SRPS U.B1.016 - Determination of bulk density of soil
 SRPS U.B1.038 - Determination of optimum water content
 SRPS U.B1.042 - Determination of California Bearing Ratio

Tests shall be performed for any change in material.

6.2.4. Criteria for Quality Assessment of Sub-Base Material

Crushed stone aggregate composed of grains of crusher-run stone, chippings, sand, and fill material shall meet certain requirements regarding:

- Physical, mechanical, mineralogical and petrographic properties of stone itself and rock aggregate;
- Granulometric composition of entire material ;
- Load-bearing capacity;
- Content of organic matter and light particles.

Crushed material for mechanically stabilized lower sub-base layers shall be composed of grains that meet the following requirements:

6.2.4.1. Physical and Mechanical Properties of Stone

Mean compressive strength(MPa)

- in dry condition min 120

Water absorption (% by mass) 1.0

Frost resistance (after 25 cycles of freezing)

(Stone is resistant to frost if the drop of mean compressive strength after freezing is up to 20% comparing to mean compressive strengths in dry condition).

Mineralogical / Petrographic Composition

Stone may be of eruptive, sedimentary, or metamorphic origin.

6.2.4.2. Physical and Mechanical Properties of Crushed Rock Aggregate

- Grain shape, proportion of grains of unfavourable shape (3:1)..... max 40%
- Water absorption (SRPS B.B8.031)..... max 1.6%
- Friable grains..... max 7%
- Resistance to wear, Los Angeles method max 40%
- Content of muddy-clayey and organic particles..... max 5%

Note: For unscreened rock material, the specified limit values for: the proportion of grains of favourable shape; the proportion of friable/poor quality grains; water absorption; and the loss at Na_2SO_4 , are calculated as the percentages of mass on separated laboratory fractions, i.e. as the proportion of grains larger than 4 mm.

For screened rock material, the specified limit values are expressed as the percentages of mass on the tested – nominal fraction.

The granulometric composition of crushed rock aggregate for the sub-base layer, 0/31mm fraction, shall be within the following limit curve values

Square sieve size (mm)	% of weight in relation to total weight of material 0/31 mm
0,1	2-9
0,2	5-14
0,5	8-20
1	11-30
2	15-40
5	25-55
10	30-65
20	60-80
31,5	100
50	



The granulometric composition of crushed rock aggregate for the sub-base layer, 0/63mm fraction, shall fall within the following limit curve values:

Square sieve size (mm)	% of weight in relation to total weight of material 0/63 mm
0,125	2-15
0,25	5-20
0,5	7-26
0,75	9-30
1	11-34
2	18-44
4	26-56
8	36-69
16	50-85
22,4	59-93
31,5	71-100
45	85-100
63	100

Aside from the above-mentioned criteria, the material shall also meet the following requirements:

- The content of grains smaller than 0.02 mm shall not exceed 3%
- The degree of non-uniformity in granulometric composition $U = 15-50$.

From the aspect of load-bearing capacity, the aggregate shall have the laboratory California Bearing Ratio CBR $\geq 80\%$ at the compaction degree $S_z = 95\%$ for the Modified Proctor Test, and an optimum moisture $W_{opt} = 7-9\%$.

The content of organic matter and light particles shall not exceed 3% by weight.

6.2.5. Control of Prepared and Compacted Sub-Base Layer

The control of a prepared and compacted sub-base layer shall be performed by determining its degree of compaction or modulus of compressibility at every 500 m². If the determination of the compaction degree and the modulus of compressibility are performed in parallel, tests shall be run at every 50 m.

The tests shall be performed in compliance with the following regulations:

- SRPS U.B1.010 - Sampling
- SRPS U.B1.012 - Determination of moisture
- SRPS U.B1.016 - Determination of bulk density

The sub-base surface shall be checked in relation to designed levels, and also for evenness.

6.2.5.1. Work Quality Evaluation Criteria

Depending on the pavement structure design solution, the following criteria shall be met:

Thickness of sub-base made of crushed stone (cm)	Required degree of compaction S_z for the Modified Proctor Test, S_z (%)
30	98%

When placing this material over a hard substrate, it is necessary to adjust compaction equipment, i.e. vibrations, to such conditions so that aggregate would be compacted to a required degree.

Any repeated tests due to unsatisfactory results, shall be at the Contractor's expense. The sub-base surface levels on randomly chosen places may vary by ± 10 mm.

The evenness of surface shall be measured with a rope or crosses at randomly chosen places, and variations from the measure plane may be 10 mm at most in any direction.

6.2.6. Measurement and Payment

Payment shall be made per m² of an actually prepared, compacted sub-base layer, as approved by the Engineer.

6.3. Sub-base Layer Made of Crushed Stone 0/31.5 mm, Cement Stabilized

6.3.1. Description and Objective

This item includes the procurement of material, mixing, haulage, spreading, compaction, and curing of a layer of designed thickness, according to requirements of these Specifications and the design. The sub-base layer made of cement-stabilized material shall be placed using finishers in its full width and thickness, thereby achieving a proper height of the layer and its preliminary compaction. The material to be placed shall be produced in central plants with automatically controlled batching of all basic materials.

6.3.2. Basic Materials

The basic materials are:

- Crushed rock aggregate
- Portland cement, grade as defined in SRPS B.C1.011 and/or SRPS B.C1.012
- Construction-grade water
- Protection of a constructed layer with a semi-stable bituminous emulsion (PE) defined as per SRPS U.M3.020.

An approximate percentage of materials to be added for the construction of sub-base is:

- Portland cement PC 25 3-6%
- Water 5-7%

Granulometric Composition

The granulometric composition of mineral mix is specified in the design and shall be within the following limit range for the types A and B:

Sieve size, mm	Percentage passing through, %	
	Type A	Type B
0.1	3-25	0-12
0.2	7-32	2-18
0.5	12-45	5-27
1	17-57	8-36
2	24-70	14-47
4	32-84	21-60
8	44-100	33-73
16	60	49-90
31.5	100	75-100
50		100

Physical and Mechanical Properties of Stone

- Grain shape, proportion of unfavourably shaped grain (3:1) max 40%
- Water absorption (SRPS B.B8.031) max 1.6%
- Friable grain max 7%
- Resistance to wear, Los Angeles method max 40%
- Frost resistance, Na₂SO₄ Mass loss after 5 cycles max 12%
- Content of muddy-clayey and organic particles max 2%

Optimum Moisture and Maximum Dry Bulk Density with Added Binder

A sample of crushed stone aggregate with the addition of an approximately expected amount of binder shall be compacted with energy for the Modified Proctor Test (2.66 MNm/m³). The test result is optimum moisture, and/or the amount of water in the sample that enables a maximum compaction of the stabilized mix for the given energy. The stabilized mix of crushed stone aggregate shall be embedded into the sub-base layer at optimum moisture increased by 1%. A maximum dry bulk density obtained according to the Modified Proctor Test is used as a parameter when determining the degree of compaction of embedded material.

6.3.3. Quality Requirements for Used Materials

6.3.3.1. Quality Requirements for Cement

Pure Portland cement is used as binder, with the addition of pozzolan or slag class 25, 35, and 45. Used cements shall be in compliance with SRP Standards, as follows:

- SRPS B C1 011 – Portland cement, Portland cement with additives, metallurgical cement, pozzolanic cement, composite cement
- SRPS B C1 012 – Cements. Method of packaging, delivery, storage, and sampling.

All binder samples are tested for the following properties:

- Standard consistency
- Time of setting
- Soundness
- Sieve residue
- Compressive strength (for cement classes 25 and 35 after 7 and 28 days, and for cement class 45 after 3 and 28 days)

6.3.3.2. Quality Requirements for Water

Water that meets the following requirements shall be used:

- pH higher than 6
- The content of sulphates (SO₄) lower than 2700 mg per l l of water
- The content of chlorides (Cl) lower than 300 mg per l l of water
- The indicator of organic matter expressed as consumption of potassium permanganate (KMnO₄) using the method of oxidation is lower than 200 mg per l l of water
- Total salt content, expressed as dry residue, is lower than 5000 mg per l l of water. Drinking water or water from the mains can be used without testing.

6.3.3.3. Quality Requirements for Cement-Stabilized Mix

Cement-stabilized mix is tested for the following properties:

- Determination of uniaxial - compressive strength according to SRPS U.B1.030
- Testing of cement-stabilized soil for frost resistance according to SRPS U.B1.050

The mix shall meet the following requirements:

Layer	Compressive strength of stabilized mix (MN/m ²)	
	after 7 days	after 28 days
Pavement structure sub-base for motorways and very heavy traffic load	2.0 - 5.5	3.0 - 6.0
Pavement structure sub-base for heavy and medium traffic load	1.5 - 5.5	2.5 - 6.0

These requirements apply to cement classes 25, 35, and 45 (SRPS B.C1.011).

A cement-stabilized mix, aside from the above-mentioned compressive strength, shall also be frost resistant. The compressive strength reduction index according to SRPS U.B1.050 may be at least 80%.

6.3.4. Documents for Preparation of Preliminary Mix Design

In accordance with Sub-Section 5.3, and/or conducted quality control of rock aggregate, cement, water, and mix of these materials, a preliminary mix design is issued for the construction of sub-base from cement-stabilized rock aggregate. The preliminary mix design serves as laboratory proof that, with approved materials and designed mix composition, it is possible to achieve the quality of mix as set in these Technical Specifications.

The preparation of mix according to the preliminary mix design shall be such that any minor variations in the quality and proportion of component materials during production do not have a considerable effect on physical and mechanical properties of the mix.

The preliminary mix design determines:

- The granulometric composition of basic, non-bound, rock aggregate,
- The proportion of basic, non-bound, rock aggregate,
- The proportion of a binder (cement),
- The proportion of water,
- An optimum moisture content and a maximum dry bulk density of the mix,
- The compressive strength of mix after 7 and 28 days, and
- The resistance of mix to frost and thaw.

All tests necessary for the preparation of a preliminary mix design shall be conducted according to SRPS U.E9.024, and the test results shall be shown in a report (preliminary design for the preparation of a cement stabilization mix). In case of any crucial change in the properties of any of component materials, the location of a borrow pit for basic, non-bound, rock aggregate, or the producer of a binder, a new preliminary mix design shall be prepared.

Before starting to construct this layer, the Contractor shall provide from the authorized laboratory all compliance certificates for designed component materials and the mix design for the approval of the Engineer.

6.3.5. Production and Placement

The stabilization technology shall be prepared in the central plant. Necessary production phases are:

- Mixing of the basic material with a binder and water in a stationary plant
- Transport of the determined mix to a prepared substrate, and its spreading
- Compaction of the spread mix
- Finish treatment of the stabilized layer
- Protection and curing of the completed structure.

For mixing in a central place, bunker or continuous concrete mixers are required. Related installations and equipment for handling the basic material and for precise batching of cement and water shall be provided within the stationary plant. The quantities of materials, binder and water shall be batched by their weight proportions. A minimum mixing time is about 30 seconds after feeding all component materials into the mixer. Mixed material is spread with appropriate spreaders or modern finishers. Dumping mixed material on piles and subsequent spreading are not allowed. A fresh mix shall be spread in full width at once, with one or more spreaders.

6.3.6. Compaction of Stabilized Layers

Immediately after obtaining a satisfactory mix with optimum moisture, it should also be compacted to a required degree that corresponds to 98% of a maximum laboratory compaction for the modified procedure. The stabilizing mass is compacted with vibro rollers and rollers with rubber wheels, separately or combined. The layer shall be compacted uniformly and carefully over its entire surface.

The compaction work shall be organized in such a way to avoid any longitudinal trails. During compaction, the mass shall have suitable moisture content. The range of moisture content is:

$$W = W_{opt} \pm 2\%$$

where:

W – working moisture during compaction

W_{opt} – optimum moisture according to working mix design.

The time from mixing the stabilization mass to its final compaction shall be 2 hours at most.

6.3.7. Finishing

Several methods for finishing a completed stabilization surface are allowed, depending on the type of employed machines, site conditions, and characteristics of basic material. Regardless of methods used to assure the quality of surface, the requirements that shall be met are to achieve required compaction, and to eliminate any trails from compacting machines on the stabilized surface. The surface shall be flat, compacted, and free from any projections and cracks.

6.3.8. Execution of Construction Joints

After completed daily stabilization work, a transverse, vertical, construction joint shall be executed by cutting into the previously stabilized layer at its end. This shall be done as the last operation at the end of work day, or as the first operation at the beginning of the next day.

Protection and Curing of Constructed Sub-Base Layer

Immediately after completing the stabilization work, it is necessary to protect the structure, and prevent the evaporation or sudden drying of the mix.

Special care is required in hot weather. In any case the layer shall be kept wet for at least 7 days.

The layer may also be protected by watering its surface, and then spraying it with bituminous agents (bituminous emulsion, diluted bitumen) in the amount needed to form an impermeable film, usually $0.5 - 1.0 \text{ kg/m}^2$, which shall be done for three days. After the layer has been constructed, it shall not be open to any traffic for 7 days, nor shall any new stabilization layers and pavement structure be constructed on it. In case of a freezing hazard in winter, the stabilized sub-base shall be covered with other layers of pavement structure.

6.3.9. Weather Conditions

Rain

In case of rain while spreading the binder during stabilization, the spreading shall be immediately stopped on the site, the spread binder embedded into the mass as fast as possible, and the final mixing and completion of the stabilization process resumed when rain stops.

Performed and completed cement stabilization is later not affected by rain. In case of preparing stabilization in the central plant, and spreading it with the finisher, it is necessary to envisage protection of the spread layer with plastic foils or other suitable means.

Cold Weather

Stabilization shall not be carried out at temperatures below 5°C . It is necessary to protect a stabilized layer against freezing for a 7-day period. The protection shall be carried out by covering the surface with a suitable cover.

Stabilization shall not be carried out if the layer below it is frozen, and stabilizing mixes shall not be produced from frozen basic materials.

6.3.10. Control Tests

Control tests during the stabilization of the basic material with cement or other similar hydraulic binders include:

- Prior tests
- Control tests

Prior tests imply

- Performing all prior tests of component materials and preparing a preliminary work mix in laboratory conditions;
- Transferring the preliminary work mix to stabilization machines and determining the required work mix composition in working conditions;
- Determining and adopting a stabilization technology on a test section.
- Submitting all test results and technology proposals to the Engineer for approval

Transferring Results of Preliminary Work Mix to Machines on Site.

When transferring results of a preliminary work mix to machines on the site, accurate weight ratios for batching individual component materials shall be determined. In this process, the current moisture of basic material used for work shall be taken by adding only the difference in the amount of water needed for the mix to fall within specified moisture content limits.

Fresh mix samples are taken from trial production and tested in order to confirm their required stabilization properties. At least three mix samples shall be tested, by controlling their:

- Granulometric composition
- Uniaxial - compressive strength with tubes previously cured for 7 days in a wet chamber.

If these tests give the results that match with the laboratory findings, stabilization may be performed subject to the approval of the Engineer.

If this compliance is not achieved, necessary adjustments shall be performed before starting the work.

The contractor engaged for stabilization work shall constantly maintain the adopted work mix throughout his work on the site.

Determination of Work Technology on Test Section

A test section should have an area of at least 600 m^2 . Compaction achieved shall be determined on a freshly embedded layer, before setting, on at least four places for each particular work stage.

The granulometric composition shall be checked on these places. On at least two places testing is performed on samples prepared from a fresh mass and of uniaxial strength, after specified curing for 7 days in a wet space.

If tests show that the achieved quality matches the one obtained in laboratory conditions, the work may be resumed, otherwise, the work shall be stopped.

Control Tests

These tests imply the following minimum testing performed during the work executed by the Contractor as a part of his quality assurance programme:

- The degree of compaction (for the Modified Proctor Procedure) of a freshly embedded layer, at every 500 m²;
- The granulometric composition of mineral mix at every 300 m²;
- Basic parameters that define the quality of binder, for every 100 t of binder;
- Compressive strength on tubes made of a fresh mix, at every 1000 m² of a completed layer;
- Constant control of evenness, profile accuracy, and thickness of the completed layer at every cross-section.

Requirements To Be Met for Stabilization Layer

An embedded layer of stabilizing mix shall meet the following requirements:

- The achieved degree of compaction shall be at least 98%;
- Evenness measured with a 4 m long levelling staff, or another suitable apparatus, shall fall within the range of ±15 mm;
- Any variation in the thickness of placed layer shall not exceed ±15 mm;
- Completed stabilization shall show necessary homogeneity in achieved compaction.

The sub-base made of stabilized soil – material can be considered homogeneous, if the coefficient of variation KV in one series of compactions measurements conducted on the stabilized layer is:

$$KV < 3\%$$

The coefficient of variation shall be calculated applying the formulae:

$$KV = \frac{\sigma}{\bar{x}}, \quad \sigma = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2}$$

where:

x_i – the results of compaction measurements on site

\bar{x} – the arithmetic mean of all compaction measurements on the tested stabilized section

n – the number of compaction measurements on the tested stabilized section

σ – standard deviation

6.3.11 Calculation of Works

Measurement:

Measurement in cubic metres (m³) of the layer completed, measured, and approved on the site and after testing by the Engineer.

Payment:

The quantity of works, as specified in the above-described way, shall be paid at the contracted unit price, and this payment shall make full compensation for all works, equipment, tools, and everything else needed for the execution of works as previously described in this Section.

Section 7 Superstructure

Contents

- 7.1. Edge strips, kerbs, and prefabricated elements
- 7.2. Open channels
- 7.3. Shoulders



7.1. Edge strips, kerbs, and prefabricated elements

7.1.1. Edge strips and kerbs

7.1.1.1. Description

This section includes the construction, i.e. procurement and placement of:

- Concrete or asphalt edge strips adjacent to asphalt or concrete pavement, dimensions as per the design;
- Raised concrete or asphalt kerbs at rest and parking areas, dimensions as per the design;
- Raised concrete or asphalt kerbs at high embankments, dimensions as per the design, sloped, including necessary hand excavation, haulage of surplus material, and concrete bedding, all according to details from the design.

7.1.1.2. Work Technology

Before constructing edge strips, the sub-base shall be compacted well, and previously tested and accepted by the Engineer.

Edge strips and kerbs shall be constructed before asphalt layers. For concrete pavements, concrete edge strips shall be constructed in the following way:

- Transverse joints, 8 mm wide, shall be performed as contraction joints at 3.00 m¹ spacing.
- The lower part of each joint shall be filled with sand, grain size 0-3 mm, and its upper part with a joint sealing compound. Joints shall be sealed only when concrete sets, and joints are dry, with their sides cleaned. If the compound sinks, joints shall be re-sealed immediately.

Concrete edge strips for asphalt pavements, and concrete kerbs for concrete and asphalt pavements, shall be constructed as monolithic with contraction joints, while placing tar paper at every 3.0 m. If these works are executed by segments with compaction joints, then for edge strips, tar paper is placed between two segments, and for kerbs, concrete for one segment shall lean freely on concrete for another segment.

Edge strips shall be constructed in two layers, and/or in a single layer, in full accordance with the design and the Engineer's instructions.

Asphalt kerbs shall be constructed with a special machine, and using a special mix.

Concrete shall be placed with special finishers for this type of work. Edge strips less than 0.50 m wide may also be constructed without a special finisher, by mechanical compaction, with the Engineer's special approval. Classes of concrete are 15 or 20 kN/m², depending on design solutions. Asphalt edge strips and kerbs shall be constructed using a special machine. This pertains to the construction of kerbs and edge strips at concrete pavement, whereas for asphalt pavement, asphalt edge strips shall be laid down together with asphalt for the pavement structure. In principle, it is allowed to use pre-fabricated concrete elements for concrete kerbs subject to approval by the Engineer. All details, such as excavations, concrete bedding, laying kerbs, sealing joints, and so on, shall be performed exactly as per detailed design drawings. Their levels and position shall be constructed in line with the design.

When laying elements, all measures for proper execution of works shall be taken, i.e. excavations shall be properly shaped, subsoil for concrete bedding shall be prepared in a professional manner, non-wetted prefabricated elements shall be placed, and joints shall be constructed professionally to ensure good adhesion between concrete and kerbs. Only elements with no or minor damages, invisible after placement, may be laid. After laying kerbs, protective measures shall be taken against the action of wind, sun, and frost.

After laying kerbs, and finishing all pertaining works, all kerbs shall be cleaned completely, and any damages on them, incurred during execution of other works, shall be fixed by the Contractor in a way agreed with the Engineer, or the damaged elements shall be replaced with new ones where directed by the Engineer.

7.1.1.3. Quality Control

Regular controls shall be performed in full accordance with Sub-Section 4.5. for asphalt, and Sub-Section 5. for concrete from these Technical Specifications.

The quality of materials for asphalt kerbs shall be controlled fully as indicated in Sub-Section 4.5. of these Technical Specifications. Along with regular controls, the final work quality control shall be ensured in plants for pre-fabricated elements. The quality of concrete prefabricated kerbs shall be assessed based on the quality of concrete and finished products, and their frost resistance, in compliance with requirements set out in Sub-Section 5 of these Technical Specifications.

7.1.1.4. Applicable Regulations

SRPS U.E3.020 – Technical specifications for construction of concrete pavement (Section on concrete concrete lanes and kerbs);
SRPS U.M3.095 – Sealing compound for joints on pavements.

7.1.1.5. Measurement and Payment

The amount of executed works shall be measured according to the amount of actually executed works in metres of length, within the scope of design and as approved by the Engineer.

All works from this Section shall be calculated at an agreed unit price that makes a full compensation for the procurement of all materials and elements, transport, preparation and placement, and for concrete bedding for asphalt kerbs, strips, and everything else needed to complete this work, and the Contractor shall have no right to claim any other fee for completed work.

7.1.2. Typical Prefabricated Concrete Elements on Service Passageways

7.1.2.1. Description

This item includes the procurement and placement of typical prefabricated concrete elements at the ends of service passageways.

7.1.2.2. Work Execution

The work includes the procurement, transport, and placement of finished elements made of concrete, class MB-45, over MB-15 concrete bedding, in full accordance with details from the design. Placed elements shall have levels and longitudinal gradients as designed.

The entire work shall be executed according to the design based on these Technical Specifications, requirements set in Sub-Section 4.7, and applicable standards for this type of works.

7.1.2.3. Measurement and Payment

Calculation per metre length of actually placed element as approved by the Engineer.

7.2. Open channels

7.2.1. Description

Open channels shall be constructed to drain water from the carriageway, in full accordance with the design.

7.2.2. Material

Concrete for open channels shall be at least of class MB 30, depending on solutions from the design, and its grade shall be in compliance with Sub-Section 5 of these Specifications.

All materials used to construct open channels shall be tested for compliance and meet PBAB and other applicable Yugoslav standards and the requirements of these Technical Specifications.

7.2.3. Work Execution

The construction of open concrete channels shall precede the placement of layers of asphalt pavement. Open concrete channels may be constructed as monolithic, prefabricated, or semi-prefabricated (where kerbs are semi-prefabricated). If kerbs are prefabricated, then they shall be placed into fresh concrete bedding that ensures the stability of kerbs from the bottom and sideways – toward the slope.

For such construction of kerbs of open channels, immediately after the bedding and kerbs have set, berms shall be constructed as per the design.

Open channels shall be constructed in 3-4m long segments, with joints, which depends on the geological composition of soil. Open channels shall be constructed as monolithic, with tar paper placed in construction joints.

If works are executed by segments, compaction joints shall be constructed in two layers and with tar paper. These joints shall be normal to the centreline and with sharp edges. Whether the kerbs of open channels are constructed as monolithic or by segments, tar paper is not needed at places of compactions (construction) joints, and two adjacent segments of concrete shall be in direct contact.

When constructing open channels in situ, it is forbidden to shape the upper surface with a trowel, but this should be done with a screed or corn broom, vertically to the road surface.

Open channels are laid on a previously compacted and accepted blanket course, if the thickness of asphalt layers is equal to the thickness of open channels. If asphalt pavement layers are thicker, the difference in thickness shall be made up with sand that needs to be compacted and tested, otherwise the blanket course shall be excavated to a required level and re-compacted.

Formwork for open channels shall be properly fixed and firm, so as not to warp. Proper vibrators or machines for open channels shall be used for construction.

Open channels shall be precisely shaped in terms of geometry, without any variation from the design, and in vertical terms, open channels shall be constructed exactly as per designed levels and appropriate gradients, in general and by segments, with the accuracy of ± 5 mm. Evenness shall be measured with a levelling rule. For semi-prefabricated and prefabricated open channels, no damaged elements shall be used.

Protection, safekeeping, and curing of open concrete channels shall be performed in accordance with relevant provisions of Sub-Section 5 of these Specifications.

Open channel width shall be specified in the design, and is, usually, 0.50 or 0.75 m.

7.2.4. Quality Control

The Contractor shall submit to the Engineer all prior tests for materials and concrete that will be used to construct open channels, in order to obtain his approval for use, and it shall meet the following quality requirements:

- Tensile bending strength f_{ct} = 5 MPa
- Water-permeability of concrete $V = 6$
- Frost resistance MB - 30
- Resistance to frost and salts - damage 0%
- Bohme wear resistance in dry $18 \text{ cm}^3 / 50 \text{ cm}^2$ and water-saturated $35 \text{ cm}^3 / 50 \text{ cm}^2$
- Water absorption: max. 1%
- Control of concrete shall be performed both at the place of mixing, and that of concreting.

Both at the place of mixing, and that of concreting it is necessary to determine batches of concrete and assess them according to one of criteria from Art. 46 of PBAB.

7.2.5. Measurement

This work shall be measured per metre length of constructed open channels for each relevant width and type of open channel separately, and as approved by the Engineer.

- 7.2.6. **Payment**
Payment shall be made at the contracted unit price for metre length of open channels, according to measurements from Sub-Section 4.10.5. The unit price shall include all necessary works on the construction of open channels, and any extra excavation or filling, all materials for construction, formwork, and equipment, all transports and haulages, curing, protection, and all other expenses, and the Contractor shall have no right to claim any extra payment on top of the contract price.
- 7.3. **Shoulders**
- 7.3.1. **Scope and Contents of Works**
This Section includes the construction of shoulders, namely:
- Shoulders covered with a 5 cm layer of sand, gravel, rock chippings, the width as per the design;
 - Shoulders topsoiled in a layer 15-25 cm thick, sown with grass, the width as per the design.
- 7.3.2. **Material**
To fill the part of shoulders above the blanket course surface, it is possible to use material that meets requirements for materials intended for the finish layers of embankments according to Sub-Section 3.4.1.2. of these Technical Specifications, and the finishing part of shoulder shall be executed according to Sub-Section 3.13.1.1. or 3.13.1.2.
- On both sides of carriageway, up to the surface of blanket course, the shoulders shall be constructed using the same material and in the same thickness as the sub-base.
- For sanding and gritting it is possible to use sand made of sound rock material, grain size 0/8 mm, the grade of which is in compliance with SRPS U.E9.020, and gravel and rock chippings of grain size 0/30 mm
- Top soil shall meet requirements set in Sub-Section 3.1. of these Technical Specifications.
- 7.3.3. **Execution and Quality of Works**
All works shall be executed according to detailed drawings from the design documents, unless otherwise set out in these Technical Specifications.
- Spread material shall be compacted. In principle, characteristics defined in Sub-Section 3.4.1. of these Technical Specifications shall be observed.
- The surface of a spread layer shall be constructed with crossfall and gradient according to the design, taking into account the reduced level of surface by the thickness of a compacted layer of sand, gravel, or chippings.
- Shoulders shall be covered with planned materials in the thickness of 5 cm exactly as per the designed cross-section, with a special superelevation for the sake of compaction. Compaction shall be performed with a 3 ton roller.
- The horizontal edges of shoulders shall be constructed as per the design. Variations from designed lines are allowed only to avoid any visual intrusion.
- The levels of finished shoulder surface are allowed within the range of 1 cm below the designed surface.
- Deviations in the thickness of a constructed layer in compacted condition are allowed within the range of ± 1 cm of designed values.
- Humification shall be performed in thickness as specified in the design, with grass seeding, according to requirements set out in Sub-Section 3.11. of these Technical Specifications.
- In general, all requirements as given in Sub-Section 3.13.3.1. hereof shall apply for evenness, compaction, and thickness.
- 7.3.4. **Acceptance and Measurement**
The works shall be subject to approval by the Engineer based on the quality requirements of these Technical Specifications.
- The quantities for calculations shall be determined in square metres of completed shoulder surfaces, covered with sand, gravel, etc. based on actually executed works within the scope of design and as approved by the Engineer. The construction of shoulder cores above the blanket course surface shall be calculated within the volume of embankment, and the shoulder cores on both sides of carriageway up to the blanket course surface level shall be calculated within the volume of blanket course.
- 7.3.5. **Payment**
The amount of works determined according to Sub-Section 3.13.5. and accepted according to Sub-Section 3.12.4. hereof, shall be paid at the agreed unit price for 1 m². The agreed price shall include all works pertaining to the procurement of material, transport, placement, and everything else needed to complete the works entirely, and the Contractor shall have no right to any extra compensation.
- The construction of shoulder cores, humification, and grassing shall be paid within the construction of embankment under Sub-Section 3.4.1. of these Specifications.



Section 8 Concrete

Contents

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8.1. Summary and General Provisions

8.1.1. General

These technical measures and specifications apply to all types of concrete, all plain and reinforced concrete elements and constructions on roads, cement mortars and grouts for grouting cables.

This is the purpose of the requirements for quality and quality control of basic materials for concrete: the technological requirements for construction and maintenance of the structure and its elements, the requirements for regular control of production, transport and placement of concrete, design, and pre-testing of concrete, quality control of fresh and hardened concrete; and the instructions for calculation and taking over of works depending on their quality.

8.1.2. Quality Assessment

As generally defined in these Technical Specifications, to verify the value of key indicators of particular production operations, or properties of particular materials or products, the criteria of probability and statistics are obligatory, and all works and materials shall be subject to the approval of the Engineer.

8.1.2.1. Categories of Concrete

Regarding the determination of concrete mix composition, according to the Rules for Plain and Reinforced Concrete - PBAB/87, concrete may be classified into one of two categories: B-I and B-II. Category I concrete (B-I) may be mixed without pre-testing up to MB 25. A minimum amount of cement of class 35, for category I concrete (B-I) (of plastic consistency), in a fresh concrete mix with the largest fraction 16-32 mm, shall not be less than specified in the table below:

Minimum amount of cement	
MB (kg/m ³)	Class 35
10	220
15	260
20	300
25	350

For Class 45 cement, the above-stated amount of cement may be reduced by 10%, and for Class 25 cement these should be increased by 10%.

The above-given amounts of cement shall be increased by:

- 10% - for 8-16 mm fraction in the mix
- 20% - for 4-8 mm fraction in the mix
- 10% - when placing concrete of liquid (thin) consistency

Category I concrete (B-I) may be: MB-10, 15, 20, and 25, and may be placed only on the site where it is mixed, and shall not be delivered to any other contractor without pre-testing of fresh and hardened concrete. Composition of Category II concrete (B-II) shall be defined based on pre-testing of fresh and hardened concrete with envisaged materials, for foreseen construction conditions, and planned use of the structure. As for plain and reinforced concrete of Category II (B-II), the following classes of concrete shall be used for the construction of elements and structures:

MB-10, 15, 20, 30, 35, 40, 45, 50, 55, and 60.

For reinforced concrete it is not allowed to use any class lower than MB-15. The granulometric composition of aggregates for the production of Category I concrete (B-I) without pre-tests and with the range of granulometric composition aggregate for the production of Category I concrete (B-I), with obligatory pre-testing, and of Category II concrete (B-II) is defined by SRPS U.MI.05 7/84

8.1.2.2. Concrete Quality Control

The concrete quality control comprises the control of production and the control of compliance with the structural design and concrete design. Overall responsibility for the quality control of all concrete materials and all concrete works shall remain with the Contractor and subject to the approval of the Engineer. The concrete production control and compliance control shall be performed by:

- The producer of concrete until the handover of concrete to the contractor in charge of concrete works,
- The contractor in charge of concrete works from the taking over of concrete to the completed curing of placed concrete.

The producer of concrete shall control each class of Category II concrete – B-II that is produced in the concrete plant and shall meet SRPS U.MI.050, SRPS U.MI.051, and SRPS U.MI.052;

- The production and compliance control are complementary procedures of overall performance quality assurance activities. Most often, the production control refers to the control of particular phases in the production of materials and execution of works, and the compliance control to the control of final properties. The first control (production control) is usually performed by producers of materials themselves (cement, screening, additive production plants, etc) and contractors (concrete plants, concrete production points), and the latter control (compliance control) by competent external authorities (investor's engineer, representatives of authorized institutions for such activities, laboratories of authorized institutions, inspection services) determined by the Investor. Inevitably, both controls overlap partly. An optimum solution is to programme and organize them as complementary, and the compliance control shall use the results from the production control. For cement, aggregate, and concrete additives, these obligations are defined in the ordinances on mandatory quality compliance testing, which, for concrete production, has still not been done;
- For Category I concrete – B-I, the compliance control is mandatory, with requirements for the site of placement, and the control of the least quantity of cement depending on required class of concrete (visual control of cement batching and accuracy of batching equipment);
- For Category II concrete – B-II, the concrete production control is mandatory and the compliance control, with requirements for the site of placement;
- According to new Rules, both controls shall be defined with the structural design and concrete design.

The class of concrete is considered to be concrete of the same grade and with the same special properties, as specified in the structural design and concrete design.

The producer of concrete shall test the ingredients of concrete (aggregate, cement, additives), as shown in Art. 39 of the new Rules on Plain and Reinforced Concrete PBAB/87. The producer of concrete, when producing B-II concrete, shall test its compressive strength on a sample taken for each class of concrete, namely:

- Every day when concrete is placed: at every 50 m³ of produced concrete, i.e. at every 75 mixes, taking into account a larger number of tests (samples). In exceptional cases, if the quantities of produced concrete in the period of compressive strength tests are large (greater than 2000 m³), samples for testing shall be taken at every 100 m³ and 150 m³ of mixes, respectively. The total number of tests for every class of concrete, produced in large quantities (greater than 1000m³) during the assessment period, shall not be below 30. For lesser quantities of concrete (lesser than 1000 m³), in the period of assessment it is necessary to perform at least 10 tests for each type of concrete;
- The Technical Specifications for production, testing, and assessment of quality of B-II concrete produced in the concrete plant are defined in SRPS U.MI.051.

8.1.2.3. Sampling

Testing for water-impermeability, resistant to frost, wear, and other harmful influences from the environment, shall be done according to parts specified in the concrete design, and in compliance with relevant Yugoslav standards. For the production control, concrete samples shall be taken by the producer of concrete at the concrete plant. From that mix, only one sample of fresh concrete shall be taken to form all test bodies needed for testing strength and other properties of concrete. The quality of each type of concrete shall be assessed separately, taking into account all test results. If assessing concrete grade (MB), concrete is taken by batches in conformity with the control programme as specified in Art. 46 of the new Rules on Plain and Reinforced Concrete PBAB/87.

8.1.2.4 Types of Materials and Production

Particular types of materials and products shall mean certain materials and products from the same source and same production, i.e. of same nominal characteristics:

- For mineral aggregate, every fraction by itself (separately) shall be defined as a particular material, and also the fractions having the same name, if differ by their material composition, place of production (deposits), or production method;
- For cement, cements having the same name, produced in the one and same cement plant, under the same material and technological/processing criteria and conditions, shall be taken as a particular type;
- For concrete additives and other industrially-produced materials, the same applies as for cement;
- For B-I and B-II concrete, particular types are defined primarily according to key technical characteristics. Types of concrete are classified by grade (MB), provided that they meet design requirements and these specifications. Concretes composed of different basic materials are treated separately, all the same as concretes from different production sources.

8.1.3. Concrete Production Control

B-I and B-II concretes shall be produced from previously tested and visually inspected basic materials in concrete production plants that are designed to be functionally adequate, are previously tested, and are controlled during operation. The concrete production control covers:

- Testing of concrete for production capabilities according to SRPS U.MI.050,
- Testing of components of concrete,
- Testing of fresh concrete, and
- Control of placement and curing of concrete.

The control is conducted by the producer of concrete, under control of the Contractor and subject to the approval of the Engineer.

Concrete production plants are considered to be completely equipped plants that include: reception, storage, and handling of basic materials, mixing, handling, and placement of fresh concrete, and curing of placed concrete. Outside the concrete production plant (concrete plant), plants for the production of mineral aggregate (screening plant) are separated as independent plants.

The control of quality of B-II concrete (fresh and hardened) shall be performed at the place of production (concrete plant) and on the site of placement (compliance control), and the control of quality of B-I concrete - on the site of placement (compliance control), and the control of the least amount of cement, which is performed by the Contractor in the presence of the Engineer who shall also accept batches of concrete.

As a rule, concrete plants shall receive only those basic materials that meet required quality criteria. The producer of concrete shall necessarily organize the storage and handling in the concrete plant in such a way to make it possible to precisely remove from use any defective batch of basic materials.

Control tests of basic materials for concrete also includes a visual inspection of properties of fresh concrete before and after placement.

Pre-testing of basic materials shall be performed by the Producer in conformity with these Technical Specifications, and their use shall be subject to the approval by the Engineer.

8.1.4. Final Concrete Quality Assessment

For B-II concrete it is necessary to give a final quality assessment that includes:

- Documents on taking over of concrete by batch;
- An opinion on the quality of placed concrete given based on a visual inspection of the construction, perusal of documents on construction, and verification of results from the records on regular production control with results of the control of compliance with quality requirements. The final assessment of the quality of concrete in the construction is used to prove the safety and durability of the construction or to request an additional proof of the quality of concrete by special tests

The constructions or structures for which trial load tests are specified or envisaged in the design, or required by the Investor, shall be taken over after a trial load test based on measured deformations and strains in the construction, and based on other necessary data on the quality of material. The constructions or structures for which trial load tests are not required, shall be taken over also according to other suitable and applicable methods.

8.1.5. Concrete Mix Design

B-II concrete mixes shall be designed in accordance with the applicable Rules on technical measures and requirements for plain and reinforced concrete (Art. 28-30).

- 8.1.6. Concrete Plant Manager
For every concrete plant or group of concrete plants, the producer of concrete shall appoint a responsible manager qualified for concrete technology. The job of this manager shall be related only to technological problems of concrete plants.
- 8.2. Basic Components of Concrete
- 8.2.1. Quality of Rock Aggregate for Concrete
- 8.2.1.1. Definitions
- 8.2.1.1.1. Rock Aggregate
A general name for a non-screened, or from several screened fractions composed mix of granular rock material that may be natural aggregate, a product of stone crushing, or a product of recrushed natural aggregate.
- 8.2.1.1.2. Natural Aggregate
A loose stone made by mechanical accumulation of coarse- and fine-grained material moved (transported) by water energy. Its main characteristic is the roundness of granular fragments.
- 8.2.1.1.3. Non-Screened Natural Aggregate (Natural Mix of Aggregates)
Natural aggregate from which grains have not been separated by fraction size. This is a natural mix, as obtained by exploitation of deposits. Another synonym used for it is "a natural mix of sand and gravel".
- 8.2.1.1.4. Rock
A smaller or larger piece of solid stone taken from its natural environment in a natural or artificial way.
- 8.2.1.1.5. Screened Rock Aggregate
Aggregate divided into fractions in the screening plant may be:
 - Screened natural aggregate
 - Screened crushed aggregate
 - Screened mixed aggregate
- 8.2.1.1.6. Screened natural aggregate
Natural aggregate divided into fractions in the screening plant.
- 8.2.1.1.7. Screened crushed rock aggregate
Crushed stone produced by crushing and divided into fractions in the screening plant.
- 8.2.1.1.8. Screened Mixed Rock Aggregate
Fractions of rock aggregate with mixed screened crushed rock aggregate and screened natural aggregate.
- 8.2.1.1.9. Rock Aggregate Fraction
A mix of rock aggregate grains limited by the lower nominal size (d) and the upper nominal size (D) of grain.
- 8.2.1.1.10. Total Aggregate Mix for Concrete
A mix of several aggregate fractions.
- 8.2.1.1.11. Largest Grain
The size of opening in a standard screen through which all rock aggregate grains pass.
- 8.2.1.1.12. Oversized Grain
Rock aggregate fraction grains that stay on screen mesh the upper nominal size (D).
- 8.2.1.1.13. Undersized Grain
Rock aggregate fraction grains that pass through screen mesh of the lower nominal size (d).
- 8.2.1.1.14. Sand (Fine Rock Aggregate)
Fine rock aggregate i.e. rock aggregate fractions with grains that pass through a standard laboratory screen with 4mm mesh. The following three categories of sand are distinguished from the coarsest grain to the finest grain:
 - Coarse grain, with a nominal size of fraction 4/0;
 - Medium grain, with a nominal size of fraction 2/0
 - Fine grain, with a nominal size of fraction 1/0 mm
Depending on whether it is obtained by screening natural aggregate or crushed stone, it may be called natural sand or crushed sand.
- 8.2.1.1.15. Coarse-grained aggregate
Natural aggregate fractions with grains that pass through a standard laboratory screen with a 63 mm mesh, but stay on a standard laboratory screen, with a 4 mm mesh. It may contain recrushed grains of natural aggregate, but only to the degree that more than 50% of the surface area of every grain remains round in shape.
- 8.2.1.1.16. Natural aggregate (natural mix)
Natural aggregate that serves as basic component for the production of screened natural aggregate shall be composed of firm – mechanically resistant, fresh and weather-resistant pebbles (cobbles). The surface of pebbles shall be clean, without any scum that could prevent a good (intimate) bond with a cement binder.
Their shape shall be as spherical as possible. Their petrographic and mineral composition shall be favourable, and any substances potentially harmful for the physical and mechanical properties, as well as durability, of concrete or its components (reinforcing bars) shall be defined in quality and quantity.

The usability of a natural mix for the production of natural aggregate fractions shall be proven through tests of particular properties, with quality requirements as defined in Table 1.

Table 1, Quality requirements for natural aggregate for the production of aggregate for concrete

No.	Property and relevant standard	Quality requirement
1	Petrographic and mineral composition (B.B8.004)	Favourable *
2	Components that prevent hydration of cement	Not allowed
3	Bulk density of grain (B.B8.031)	2000-3000 kg/m ³
4	Resistance to crushing (U.M8.030)	max 30% (m/m)
5	Water absorption (B.B8.031)	max 1,5 (m/m)
6	Resistance to frost (B.B8.044)	
	- Plain and reinforced concrete	max 12% (m/m)
	- Wearing course of pavement structure	max 3% (m/m)
	- Lower part of pavement slab	max 5% (m/m)
7	Total sulphur content, expressed as SO ₃ (B.B8.042)	max 1% (m/m)
8	Chloride content, expressed as Cl (B.B8.042)	
	- Reinforced concrete	max 0.10% (m/m)
	- Pre-stressed concrete	max 0.02% (m/m)
9	Content of organic matter (B.B8.039; B.B8.040)	colour of liquid lighter than standard
10	Grain shape (volumetric coefficient, (B.B8.049)	min 0.18%
11	Resistance to crushing and wear (B.B8.045)	max 35% (m/m)
12	Content of fine particles, clay balls, friable grains, light particles, coating of grains... (B.B8.030)	***
*	If a petrographic analysis shows the presence of components that may be reactive, it is necessary to perform tests according to SRPS B.B8.056 or B.B8.057.	
**	In the cement-stabilized load-bearing courses of pavement structure, it may amount up to 3% if the required resistance to frost is met.	
***	Requirements for natural aggregate shall not be defined, but the test results shall be given in the test report.	

8.2.1.1.17. Small Particles

Particles that pass through a standard screen, mesh 0.09 mm and 0.063 mm, respectively

8.2.1.1.18. Silty Particles

Particles from 0.005 mm to 0.09 mm, and from 0.005 to 0.063 mm in size, respectively.

8.2.1.1.19. Clayey particles

Particles smaller than 0.005 mm in size.

8.2.1.1.20. Basic Feedstock

Rock that serves as an initial component (feedstock) for the production of screened crushed rock aggregate shall be of a favourable mineral composition, fresh, and of good mechanical strength. It shall be resistant to atmospheric influences. According to its structural characteristics (structure and texture), it shall be such as to enable the provision of solid fragments (grains) of favourable shape. Petrographic analyses shall define all components that are potentially harmful for the durability of concrete and its components (reinforcing bars). The usability of stone for the production of screened crushed rock aggregate shall be proven through tests of particular properties, with quality requirements as defined in Table 2.

Table 2 Quality requirements for stone for the production of screened crushed rock aggregate for concrete

No	Property and relevant standard	Quality requirement
1.	Petrographic analysis (B.B8.003)	Favourable *
2.	Abrasive wear resistance (B.B8.015)	
	• Plain and reinforced concrete	
	• Concrete exposed to wear and erosion	max 35 cm ³ /50 cm ²
	Very heavy and heavy traffic	max 10 cm ³ /50 cm ²
	Medium, light, and very light traffic	max 18 cm ³ /50 cm ²
3.	Bulk density (B.B8.032)	2000-3000 kg/m ³
4.	Water absorption (B.B8.010)	max 1% (m/m)
5.	Compressive strength (B.B8.012)	
	• In dry condition	
	Plain and reinforced concrete	min. 80 MPa
	Concrete exposed to wear and erosion	min. 160 MPa
	• In water-saturated condition	
	Plain and reinforced concrete	min. 64 MPa
6.	Resistance to crushing and wear (B.B8.045)	
	• Plain and reinforced concrete	max 30% (m/m)
	• Wearing course of pavement structure	
	Very heavy traffic	max 16% (m/m)
	Heavy traffic	max 18% (m/m)
	Medium, light and very light traffic	max 22% (m/m)
7.	Resistance to frost (B.B8.002)	
	• Plain and reinforced concrete	max 5% (m/m)
	• Wearing course of pavement structure	max 3% (m/m)
8.	Total sulphur content, as SO ₃ (B.B8.042)	max 1% (m/m)
	Chloride content, as Cl (B.B8.042)	
	• Plain and reinforced concrete	max 0.1% (m/m)
	• Pre-stressed concrete	max 0.02% (m/m)
*	If a petrographic analysis shows the presence of components that may be reactive, it is necessary to perform tests according to SRPS B.B8.056 or B.B8.057	

8.2.1.1.2) Fractions of rock aggregate

Fractions of rock aggregate, whether they are produced by screening natural aggregate, or from crushed stone, shall be produced in technologically appropriate procedures (washing, crushing, sieving), in order to obtain rock aggregate of required quality. The usability of screened aggregate by fraction (whether from natural or crushed aggregate) shall be proven through tests of particular properties, with quality requirements as defined in Table 3.

Table 3. Quality requirements for screened rock aggregate

No	Property and relevant standard	Quality requirement
1.	Petrographic and mineral composition (B.B8.004)	Favourable
2.	Components that prevent hydration of cement	Favourable
3.	Bulk density (aggregate grains) B.B8.031.	2000-3000 kg/m ³
4.	Water absorption (B.B8.031)	
5.	Resistance to crushing (U.M8.030)	max 30% (m/m)
6.	Resistance of aggregate to frost B.B8.044	max 12% (m/m)
	• for wearing course of cement-concrete pavement	max 3% (m/m)
	• for the lower part of cement-concrete pavement	max 5% (m/m)
7.	Total sulphur content (as SO ₃) B.B8.042	max 1% (m/m)
8.	Total chloride content (as Cl) B.B8.042	
	• for plain and reinforced concrete	max 0.1% (m/m)
	• for pre-stressed concrete	max 0.02% (m/m)
9.	Content of organic matter B.B8.039 and B.B8.040	Lighter than standard
10.	Grain shape (volumetric coefficient) B.B8.049	
	• natural aggregate	min. 0,18
	• crushed aggregate	min. 0,15
11.	Content of small particles, frak. 0-4 mm B.B8.036.	
	• natural and mixed aggregate	max 5% (m/m)
	• aggregate of rock origin	max 10% (m/m)
12.	Content of small particles in fractions larger than 4 mm	max 1% (m/m)
13.	Ball clay content (B.B8.038)	
	• in fine aggregate	max 0.5% (m/m)
	• in coarse aggregate	max 0.25% (m/m)

No.	Property and relevant standard	Quality requirement
14.	Weak grain content (B.B8.037)	
	• for frost-resistant concretes	max. 3% (m/m)
	• for other concretes	max. 4% (m/m)
15.	Content of light particles (B.B8.034)	
	• Appearance of concrete not important	max. 1% (m/m)
	• Appearance of concrete important	max. 0,5% (m/m)
16.	Clay-coated grains (B.B8.004)	Not allowed
17.	Resistance to crushing and wear (Los Angeles) B.B8.045	
	• Plain and reinforced concrete (resistant to erosion and abrasion)	max 30% (m/m)
	• Wearing course of cement-concrete pavement, "B" grading	
	Very heavy traffic	max 16% (m/m)
	Heavy traffic	max 18% (m/m)
	Other traffic load	max 22% (m/m)
	• Lower part of cement-concrete pavement	max 30% (m/m)
18	Bulk density in loose and compacted conditions B.B8.030.	To be tested and logged
*	If a petrographic analysis shows the presence of components that may be active, it is necessary to perform tests according to SRPS B.B8.056 or B.B8.037.	

8.2.1.2. Granulometric Composition

The grains of aggregate shall be as much cubical or spherical as possible.

Aggregate fractions to be used for the preparation of concrete shall be washed or dedusted; fine-grained from 0 to 4 mm, and coarse-grained from 4 to 125 mm.

As a rule, for structural concrete, it is mandatory to use fractions: 0-4, 4-8, 8-16, 16-32, 32-63, and 63-125, and mid-fractions: 0-1, 0-2, 1-4, 2-4, 8-11, 11-16, 16-22, 22-32, 32-45, and 45-63 mm, in conformity with SRPS B.B3.100 and B.B2.010.

When determining the grain composition for mineral aggregate, the values for diameters shall refer to screening through square mesh.

The granulometric composition of fine aggregate (0-4 mm) shall be within the following ranges (according to SRPS B.B2.010)

Sieve	(mm)	0.125	0.25	0.50	1.0	2.0	4.0	8.0
Passing through sieve	(% mass)	2-13	8-30	20-50	40-80	65-100	90-100	100

Depending on need and importance of available materials, it is possible to separate aggregate into two fractions (e.g. 0-1 mm and 1-4 mm, or 0-2 mm and 2-4 mm), so that the mix of the two fractions in a certain ratio meets specified limits. Such separation may be undertaken when it is impossible to produce sand fractions with a satisfactory grain size distribution, which is determined by tests, particularly from the aspect of achieving the required degree of grain size distribution in fresh concrete and its castability and workability with used machines (W/C ratio, cement portion, consistency). Fine aggregate shall have 45% residue at most between any two successive sieves. The grading modulus of fine aggregate shall be within the range from 2.3 to 3.60. The grading modulus is a sum of the residues on standards laboratory screens with mesh: 0.125, 0.25, 0.5, 1, 2, 4 and 8 divided by 100.

The diameter of a maximum aggregate grain for structural concrete shall neither be larger than 1/3 of the smallest size of elements to be concreted, nor larger than the smallest free gap between reinforcing bars in a horizontal row, and 1/4 - 1/3 of the distance between the nearest sides of the form. When determining a maximum diameter of grain, the effect of forms and reinforcement is taken into consideration according to Faury's method.

The total granulometric composition of aggregate for B-I and B-II concrete shall take, i.e. treat, as general guidelines with determined maximum diameters of grain, the values of limit curves according to SRPS U.M1.057/84. In principle, it is necessary to determine the total granulometric composition of aggregate based on experimental tests of concrete (pre-tests), in terms of getting as close as possible to an optimum conformity between technical and economic solutions, considering the requirements of production, handling, and placement of fresh concrete, and the highest possible utilisation of available materials, in order to meet quality criteria for hardened concrete.

The grading composition implies an absolute volumetric proportion of particular groups of grains. Experimentally adjusted and adopted curves of the total grading composition shall not be corrected subsequently, i.e. changed without particular proof tests.

8.2.1.3. Handling requirements

(Stockpiling and handling of aggregate in phases after the exit from the screening plant until the mixing of fresh concrete.)

Every aggregate fraction shall be treated as a separate element for stockpiling and handling. When working on the same site with two or more fractions with the same name considering their grading, but from different sources, the criterion that it is not allowed to mix together such materials non-systematically, i.e. uncontrollably without necessary tests shall be strictly observed.

Particular fractions shall be handled and stockpiled in accordance with the following requirements:

- Segregation of fractions: each particular fraction shall pass through all phases of stockpiling and handling to the phase of direct batching in a concrete mix, and all appropriate measures shall be taken (gravity transport by group of materials, proper gradients of belt conveyers, pile spreading in order to prevent the formation of a cone, etc.);
- Changes in grading due to grain crushing: particularly for coarser fractions it is necessary to take care that grains do not crush due to fall under the impact of gravity;
- Moisture of materials: regardless of weather conditions, an even distribution and sufficiently low moisture level shall be properly and safely assured in particular fractions in the phase of their batching into a concrete mix, which primarily applies to fractions up to 4 mm in size, if the plant is not equipped with instruments for measuring moist percentage for each fraction. The use of frozen aggregate, or aggregate mixed with ice and snow is not allowed for the production of concrete;

- Tempering of aggregate: considering the entire complex of works in the concrete plant, the possibility of tempering fractions (beside water) in a technically appropriate way shall also be assured in cold weather, before and during their processing into concrete, as well as the possibility of warming the water.

8.2.1.4. Pre-testing of Mineral Aggregate

Only previously tested mineral aggregate shall be used for the production of concrete. Pre-tests shall be conducted according to provisions Sub-Section 8.2.1. of these Technical Specifications and subject to the approval of the Engineer.

The number of samples and sampling method shall reproduce, in a reliable way, the quality of aggregate and degree of quality homogeneity according to SRPS B.B0.001/84. Pre-tests shall be performed for each type of mineral aggregate separately. The type of mineral aggregate shall imply different geological sources, and different locations and preparation methods. The validity of compliance tests for pre-testing of rock and aggregate shall be in conformity with the applicable legislation.

8.2.1.5. Control Testing of Mineral Aggregate

For each particular type of mineral aggregate, throughout its production, i.e. use for the project, control tests shall be performed at least as much as for all items specified in Sub-Section 5.2.1., if there are changes in the mineralogical composition.

8.2.1.6. Control Testing of Mineral Aggregate within Concrete Plant

The control tests of mineral aggregate within the concrete plant in the phases of production, stockpiling, handling, and transport, until its processing into concrete. The testing of mineral aggregate within quality control shall be, in principle, distinguished by samples that are taken:

- Immediately under the screening unit,
- From stockpiles in the screening plant, or from local stockpiles in the concrete plant,
- From the discharge points of the batching units in concrete plants.

The control tests of mineral aggregate for the production of B-I, B-II, and transport concrete shall be performed in concrete plants in compliance with the Rules for Plain and Reinforced Concrete - PBAB/87, and SRPS U.M1.051/87, as follows:

- Granulometric composition of aggregate according to SRPS B.B8.029, at least weekly
- Proportion of particles smaller than 0.09 mm in fractions or mid-fractions according to the procedure defined in SRPS B.B8.036, at least weekly
- Proportion of particles up to 0.063 mm in size in aggregate fractions according to the procedure defined in SRPS B.B8.036/82, or the hygrometry procedure defined in SRPS U.B1.018, at least weekly
- Moisture of aggregate fractions according to SRPS B.B8.035/84, at least once in 8 working hour
- Organic impurities in fractions smaller than 4 mm in size shall be tested only when there is a possibility of their presence and in specific time intervals, according to SRPS B.B8.039 or SRPS B.B8.040, when needed.

The one-time group testing of samples is the one-time taking of at least three individual samples from three places on the stockpile that are most typical regarding the possibility of indicating the heterogeneity of grading and moisture, and are therefore, tested separately as well. Aggregates shall be sampled and tests in equal time intervals considering the amount of materials. Samples are taken with respect to the quantitative replenishment of stockpiles, and quantitative use of aggregate for the production of concrete according to SRPS B.B0.001/84. For concrete works, it is necessary to perform tests according to special programmes for each particular concrete plant, or for each particular group of functionally interconnected plants, all in conformity with the applicable legislation. These programmes shall be prepared by the concrete plant (producer of concrete) and submitted for the approval of the Engineer.

Tests mentioned in Sub-Section 8.2.1.6. shall be performed by the concrete plant under the supervision by the Engineer in full compliance with all requirements of the Technical Specifications. An overview of the applicable standards for testing of mineral aggregate is given at the end of this Sub-Section in A. Legislation and A/I. Standards. All concrete plants shall meet the requirements of SRPS U.M1.050.

8.2.1.7. Material Balance of Mineral Aggregate

With a special study, the producer of concrete shall prove the possibility of a reliable supply of concrete plants with mineral aggregate. The control of aggregate and production in the concrete plant also includes the current mineral balance, which deals with the balancing between consumption and production of aggregates. This balancing shall be separated, in terms of achieving optimum technological solutions.

8.2.2. Cement

Types of cement, quality requirements, handling requirements, prior and control tests.

8.2.2.1. Types of Cement according to SRPS

The concrete works envisage the use of Portland cements, quality grades: 25, 35S, 35B, 45S, 45B, and 55, Portland cements with the addition of pozzolane up to 20%, and 15% for pre-stressed concrete, Portland cements with the addition of slag or mixed additives up to 30%, class 35 and 45, according to type and use of the structure. For constructions and elements made of pre-stressed concrete it is possible to use cement based on Portland cement clinker, with not more than 15 % of smelting slag. These cements should meet the requirements given in Sub-Section 8.2.2.3.1. of these Technical Specifications.

Pozzolanic and metallurgical cement may be used for the stabilization of earth works and shall meet the quality requirements from Sub-Section 8.2.2.3.2. of these Technical Specifications.

Imported cement may be used to mix concrete only if such cement is provided with a compliance certificate (quality certificate) from a Yugoslav company registered for the activity that encompasses the testing of cement and issue of such compliance certificates.

8.2.2.2. Types of Cement out of SRPS and Special Cement

For special concrete works it is envisaged to use Portland cement of appropriate composition, with or without additives, and some other types of cement as well. Which of these cements will be used depends on the type and use of structure, conditions to which the structure is exposed in operation, and thus the selection of cement shall be performed on a case-by-case basis for every major or crucial structure, which is to be determined based on pre-testing of cement and concrete. These pre-tests shall be preceded by soil and groundwater tests, which is of influence for the selection of cement.

8.2.2.2.1. Special Cement for Pavement and Other Structures

Special cement for pavement and other structures is Portland cement of previously defined mineralogical composition, or this cement with the addition of a selected type and amount of blast furnace slag or pozzolane. These cements shall meet the requirements specified in Sub-Section 8.2.2.3.3. of these Technical Specifications.

8.2.2.2.2. Cement of High Early Strength—Quick Hardening Portland Cement

Quick hardening Portland cement shall be used for structures that require high early strength. This cement may be obtained from the clinker of a specific mineralogical composition, i.e. clinker with a high content of C₃S and finely ground, and shall meet requirements set out in Sub-Section 8.2.2.3.5. and 8.2.2.3.4. of these Technical Specifications.

8.2.2.2.3. Sulphate-resisting Cement

Sulphate-resisting cement and sulphate-resisting Portland cement with the addition of slag or pozzolane shall be used for structures that will be exposed to the action of aggressive sulphate ions during their operation. These cements shall be obtained from clinker of a specific mineralogical composition with a low content of carbon sulphate C₃S.

8.2.2.2.4. Cement for Wearing Course on Edge Strips of Pavement and Concrete Kerbs

White cement, the grade of which meets requirements set in Sub-Section 8.2.2.3.6. of these Technical Specifications.

8.2.2.2.5. Cement for Grouting

Cement for grouting is Portland cement designated as PCK or Portland cement with the addition of granulated blast furnace slag, pozzolane, or both in the amount of not more than 15%, designated as: PC 15z k, PC 15p k, PC 15d (z or p) k. Cement used for the preparation of grout need not be the same as cement used for the basic construction, or element of the construction. The cement shall meet the quality requirements set out in SRPS B.CI.011/82 and special requirements for the chloride ion content (Cl⁻), not more than 0.025%.

8.2.2.3. Quality Requirements for Cement

Cement shall be tested according to methodologies given in Table 7.

8.2.2.3.1. Additional Quality Requirements

According to SRPS, cement shall meet requirements set out in SRPS B.CI.011/82. Aside from these requirements, these cements shall also meet the following additional quality requirements:

- For Portland cement:

autoclave expansion	max 0.8%
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- For Portland cement with the addition of slag (not more than 30%) or pozzolane (not more than 20%):

Autoclave expansion	max 0.5%
The content of additives shall not vary from the declared content	max = 2%

8.2.2.3.2. Cement for Stabilisation

Pure Portland cement with the addition of pozzolane or slag, or metallurgical cement, class 25, shall be used for stabilisation. In terms of quality, used cements shall meet the quality requirements set out in SRPS B.CI.011/82.

8.2.2.3.3. Special Cement for Pavement Structure

- Portland cement,
- Portland cement with the addition of a selected type and amount of blast furnace slag or pozzolane.

Mineralogical composition of clinker

This composition may vary depending on the type of structure and conditions of operation, which is to be determined with pre-tests:

- Content C₃A
 - Content C₃S
 - Shape and size of crystals
- | | | | |
|--------|--------|--|-----------------|
| max 8% | 55-65% | C ₃ S and C ₃ S, determined by the microscopic analysis of clinker | Must be regular |
|--------|--------|--|-----------------|

Chemical composition of cement

- Loss on ignition
 - Content of SO₃
 - Content of MgO
 - Insoluble residue:

a) For Portland cement with the addition of slag	max 2.0%
b) For Portland cement with the addition of pozzolane	max 10.0%
 - Control of the content of added slag or pozzolane, with allowed variations from the declared value,
- | |
|----------|
| max = 2% |
|----------|

Physical properties of cement

- Fineness (Blaine's specific surface area)

a) For Portland cement and Portland cement with the addition of slag,	2400-3700 cm ² /g
For class 35 cement	min 3250 cm ² /g
For class 45 cement	max 15%
(pozzolane max 5% mm)	
b) For Portland cement with the addition of pozzolane	max 3900 cm ² /g

- Standard consistency max 29 %
- Setting:
 - Start of setting at 20°C after 2.0 hours
 - at 30°C after 1.0 hour
 - End of setting not after 10 hours
- Volumetric soundness (Le Chatelier's rings) increased spacing between needle tips after boiling max 5 mm
- Autoclave expansion max 0.5%
- Deformations:
 - Shrinking (measured per mortar according to the method specified in Table 7), after 28 days max 0.6 mm/m
- Cement strength:
 - Compressive strength of cement min 6 MPa after 28-day aging, and
 - Flexural strength of cement shall meet the quality requirements of Yugoslav standard B.C1.011/82

8.2.2.3.4. Quick-Hardening Cement (Portland)

Mineralogical composition of cement

- Content of C3A max 15%
- Shape and size of crystals of C3S and C2S, determined by the microscopic analysis of clinker Must be regular

Chemical composition of cement

- Loss on ignition max 3.0%
- Content of SO₃ max 3.5%
- Content of MgO max 5.0%
- Insoluble residue max 2.0%

Physical properties of cement

- Fineness: Blaine's specific surface area min. 3000 cm²/g,
- Volumetric soundness on pats and Le Chatelier's rings shall meet the requirements set out in C.C1 011/82
- Autoclave expansion max 0.8%
- Setting
 - Start of setting not less than 60 minutes
 - End of setting not after 10 hours
- Strength (tested according to SRPS B.C8.022 or the Rilem-Cembureau procedure) after 3 days
 - Compressive strength min 23.5 MPa,
 - Flexural strength 4.0 MPa.

8.2.2.3.5. Sulphate-Resisting Portland Cement, Sulphate-Resisting Portland Cement with Added Slag, Sulphate-Resisting Cement with Added Pozzolane

Mineralogical content:

- Content 3CaO Al₂O₃ (C3A)..... max 3.5%
or if 2 C3A + C4AF ≤ 20%
the content of C3A is allowed.....max 5.0%
- Shape and size of C3S and C2S crystals, determined by a microscopic analysis, shall be regular

The percentage and type of added material shall be selected depending on the type of structure and aggressive environment to which the structure will be exposed during operation.

Chemical composition of cement

- Loss on ignition max 5.0%
- Content of SO₃ max 3.5%
- Content of MgO max 5.0%

Insoluble residue:

- a) For sulphate-resisting Portland cement and sulphate-resisting Portland cement with the addition of slagnot more than 3%
- b) For sulphate-resisting Portland cement with the addition of pozzolanenot more than 1.5%

Physical properties of cement

- Fineness:
 - residue on 0.09 mm sievenot more than 10%
 - Blaine's specific surface area..... min 2400 cm²/g
- Standard consistencymax 29%
- Bulk density, without pores and voidsmin 3.0 g/cm³
- Time of setting:
 - Startnot in less than 60 min

- End not more than 10 hours
- Volumetric soundness
 - a) on small pats, cement shall be of sound volume, after 3 hours of boiling;
 - b) Le Chatelier's rings:
 - increase in spacing of arms max. 10 mm
- Autoclave expansion max 0.5%
- Shrinking (measured on mortar according to the method given in Table 7) max 0.6 mm/m

Strength of cement

Determined as specified in SRPS B.C.8.022, and shall meet the quality requirements set out in SRPS B.C.1.014/82, Classes 25, 35, or 45

Resistance to corrosion

Shall meet the requirements for sulphate corrosion tested according to V.V. Kind's method

8.2.2.3.6. White Portland Cement

White Portland cements, grade class 25, 35, 45, and 55, and whiteness groups A, B, and C, that meet the quality requirements set out in SRPS B.C.1.009/82 shall be used.

Chemical composition of cement

- Content of SO₃
 - For cements with specific surface area up to 4000 cm²/g, max 3.5%
 - For cements with specific surface area above 4000 cm²/g, max 4.5%
- Loss on ignition for classes 35, 45, and 55 max 5.0%
- Insoluble residue max 2.0%
- Content of MgO max 5.0%

Physical properties of cement

- Fineness on 0.09 mm sieve not more than 10%
- Whiteness
 - Group A at least 80%
 - Group B at least 75%
 - Group C at least 70%
- Specific surface area at least 2400 cm²/g
- Bulk density without pores and voids at least 2.9 g/cm³
- Time of setting
 - Start of setting not less than 45 min.
 - End of setting not more than 10 hours
- Volumetric soundness, SRPS B.C.8.023
 - On small pats: cement shall be of sound volume after 3 hours of boiling
 - According to Le Chatelier's method:
 - increased spacing between needle tips after boiling max. 10 mm
- Autoclave deformations for cement with the content of MgO > 5% max. 0.8%
- Strength of cement
- Compressive strength and flexural strength shall meet the requirements set out in SRPS B.C.1.009/82.

8.2.2.3.7. Cement for Grouting

Cement for grouting shall meet the requirements set out in these Technical Specifications for the relevant type of cement. The cement for grouting cables in pre-stressed concrete shall meet the quality requirements set out in the Rules on technical norms for grouts for pre-stressing cables, and/or quality requirements set out in the 1963 International recommendations for suspensions for pre-stressed concrete, and German provisional guidelines for injection of cement mortar into ducts. This cement may contain chloride ions not more than 0.025%, and not more than 0.013% of chloride ions in water, i.e. the mix of cement-aggregate and water shall not be more than 100 mg/l of used water. Before being used for grouting, cement shall be particularly tested for the content of calcium-chloride.

8.2.2.3.8. Supersulphate cement

Cement components

- Granulated blast furnace slag 70-90%
- Portland cement clinker, not more than 5%
- Anhydrite 10-25%

Chemical composition of cement:

The chemical composition of cement shall meet the following requirements:

- Content of SO₃ max 15%

Physical properties of cement:

- Fineness:
- Residue on 0.090 mm sieve max 10%
- Soundness:

- On small pats: Cement shall be of sound volume after 3 hours of boiling and after resting for 28 days in water at the temperature of $20 \pm 1^\circ\text{C}$
- According to Le Chatelier's method:
Increased spacing between needle tips after boiling not more than 10 mm
- Setting:
Start of setting not less than 45 min.
End of setting not more than 10 hours
- Strength of cement:
Compressive strength and flexural strength shall meet the requirements set out in SRPS B.C1.011/82.

8.2.2.3.9. Low-Heat Cements

For massive concrete, and only for structures for which this is required in the design, the cements with a low heat of hydration shall be used, grade class 25 and 35, that shall meet the quality requirements set out in SRPS B.C1.013/80 for the given type and class of cement.

- Components of cement shall meet the requirements set out in SRPS B.C1.011.

Chemical composition of cement

- Loss on ignition (moist-free at 105°C) not more than 5%
- Insoluble residue for pozzolane-free cements not more than 2%
- Content of SO_3 for cements designated as:
NPC, NPC mp, NP mp max 3.5%
NPC nz, NPC nz mp, NP mp nz max 4.0%
- Content of MgO for cements designated as:
NPC, NPC mp, NP mp, NP mp nz max 5.0%
NPC nz, NPC nz mp, NM nz, NM nz mp (If MgO is not in the form of periclase, and the soundness of volume is confirmed with an autoclave test) max 7.0%

Physical properties of cement

- Fineness:
Residue on 0.09 mm sieve max 15%
Blaine's specific surface area at least 2400 cm^2/g
- Bulk density at least 3.0 g/cm^3
- Quantity of water for standard consistency, for cements:
NPC, NPC nz, NPC mp, NM nz,
NM nz mp not more than 30%
NP mp, NP mp nz not more than 32%
- Time of setting:
Start not less than 2 hours
End not more than 10 hours
- Volumetric soundness:
Le Chatelier's method not more than 10 mm
The big pat method no cracks allowed
- Hydration heat:
the dissolution method:
after 7 days not more than 250 J/g
after 28 days not more than 295 J/g
the method with a vacuum flask:
after 3 days not more than 230 J/g
after 7 days not more than 275 J/g

Strength of cement

Determined as specified in SRPS B.C8.022, and shall meet the quality requirements set out in SRPS B.C1.013/80. The strength of cement after 90 days shall also be tested, with the results stated in the test report which shall be submitted for the approval of the Engineer.

8.2.2.4. Handling Requirements

Transport and storage of cement, and handling of cement in phases – from the supplier to the entry into the process of preparation of a fresh concrete mix.

8.2.2.4.1. Transport of Cement

Every type of cement shall be supplied in bulk with silo trucks and silo wagons, and in bags with trucks and wagons. White Portland cement and supersulphate cement shall be supplied to concrete plants in bags only.

Silo trucks and silo wagons for bulk cement transport shall be hermetically closed, and when taking over cement, they shall be tamperproofed until the cement has been repumped into the silo. Such transport vehicles shall not be used for transport of any other materials. Cement may be filled into transport silos only if they are completely dry. Silo trucks and silo wagons shall be equipped with a unit for repumping cement into silos on the site.

Bagged cement shall be transported in covered trucks only, or in closed wagons. The bottom of a truck, or wagon, shall be completely dry. Bags shall be loaded and reloaded only in covered places, to exclude any possibility of dampness. All cement damaged with damp or in any other way shall be removed from the site immediately.

Every cement delivery shall be documented with an accompanying Manufacturer's specification list indicating:

- Type and class of cement
- Origin - Manufacturer of cement,
- Production date
- Shipment date,
- Quantity of cement.

Besides, a certificate with test data, as specified in Sub-Section 8.2.2.6.2, shall also be enclosed.

8.2.2.4.2. Storage of Cement

To store cement, the concrete plant shall be equipped with silos in a qualitative and quantitative way that ensures the reception of delivered bulk cement, and with a storage area for bagged cement.

In the concrete plant, cement shall be stored by types and used for preparing concrete according to the order of reception on the site. Silos in the concrete plant shall be protected against weather conditions, equipped with a platform and sampling kit, with the possibility of sampling over the full height of silo, and with a kit for measuring the quantity of cement in the silo. Silos shall be equipped with units for discharging any inadequate cement deliveries. From the outside, silos shall be painted in light colours. Cement silos in the concrete plant shall be of a capacity needed for a 3-day production of concrete, and at least 3 units. From one of such units cement is pumped for the production of concrete, another one is refilled, and the third one is for control. Any fourth unit, or subsequent unit, shall be used as a back-up for any case of untimely procurement, and inadequate quality of cement.

One and the same silo shall store cements of a single type and class, from the same factory. Cements of the same type and class from different manufacturers may be stored in the same silo only if previously proven that they are compatible, and that mixing them has no adverse impacts on the properties and uniformity of produced concrete, which shall be proven with a comparative test. Cement storages shall be built to ensure a dry storage of bagged cement, regardless of weather conditions.

A safe way of keeping different types of cements in the storage shall be ensured. Cements, in principle, may be stored for 3 month at most, with a one-time monthly restacking, except for special cements that require a faster application, namely:

- Quick hardening cement not longer than 1 month
- Supersulphate cement not longer than 14 days

8.2.2.5 Pre-Testing of Cement

Only previously tested cements shall be used for the production of concrete. Pre-tests shall be performed by an authorized institution.

Pre-tests shall be performed for each type of cement separately. A type of cement is considered to be a different mark, i.e. name of cement, and a different origin. Pre-tests shall be performed according to specifications provided for each type of cement separately, as given in Table 6.

8.2.2.5.1 Time for Cement Pre-Tests

According to PBAB/87 (Official Journal of SFRY, No. 11/87), it is obligatory to ensure a compliance certificate on performed pre-testing of cement, for each type, as follows: 1 compliance certificate for the monthly consumption of up to 2000 tons, 2 certificates for the monthly consumption of 2000-5000 tons, and 3 certificates for the monthly consumption in excess of 5000 tons. If the producer of concrete requires the use of cements of Yugoslav manufacturers without pre-test compliance certificates, the Engineer shall allow their use only when assured that they meet the basic properties of cement: a standard consistency, time of setting, volumetric soundness, and fineness. The Engineer shall make an entry on his approval into the Building Journal, and set a time limit within which the producer of concrete shall provide a pre-test compliance certificate. The longest time may be 35 days.

The application of the first paragraph above shall be obligatory for the use of cement for concrete pavements, and concrete for bridges. For other concretes, the Engineer may require a lower frequency in the provision of compliance certificates, with each shipment of cement tested before its use against the properties from the second paragraph above, and if the results are met, the Engineer shall approve the cement for use. This paragraph shall not apply to imported cements, for which the application of the first paragraph of this Sub-Section is mandatory.

During sampling, a protocol shall be prepared and enclosed with the compliance certificate. Sampling shall be in compliance with SRPS B.C1.012/79.

8.2.2.6 Regular Tests of Cement

- Regular test within the concrete plant,
- Supplier's certificate on cement testing.

Table 6.
Specification of tests for particular indicators of cement properties for different cements within pretesting (x: to be tested, - not to be tested)

Cement code	type	Pavement and other structures	Quick hardening	For stabilisation	White	Sulphate-resisting	Grouting	Super-sulphate	Low-heat
1	2	3	4	5	6	7	8	9	10
8.2.2.5.1.		Chemical analysis							
		x	x	x	x	x	x	x	x
8.2.2.5.2.		Structural composition							
-	Bogue's method	x ¹⁾	x	-	x	x ²⁾	x	-	x ³⁾
-	X-raying	x	x	-	x	x	x	x	x
-	microscopic	x ⁴⁾	x	-	x	x	x	x	x
¹⁾ for Portland cement									
8.2.2.5.3.		Fineness							
-	residue on 0.090 mm sieve	x	x	x	x	x	x	x	x
8.2.2.5.4.		Blaine's specific surface area							
		x	x	x	x	x	x	x	x
8.2.2.5.5.		Bulk density w/o pores and voids							
		x	x	x	x	x	x	x	x
8.2.2.5.6.		Bulk density in loose and compacted condition							
		x	x	x	x	x	x	x	x
8.2.2.5.7.		Water required for standard consistency							
		x	x	x	x	x	x	x	x
8.2.2.5.8.		Time of setting							
-	at 20°C	x	x	x	x	x	x	x	x
-	at 5, 10, 30°C	x	x	x	x	x	x	x	x
8.2.2.5.9.		Volumetric soundness							
-	on small pats	x	x	x	x	x	x	x	x
	Chatelier-y method	x	x	x	x	x	x	x	x
-	autoclaving	x	x	x	x	x	x	x	x
8.2.2.5.10.		Water absorption posle 30 minuta							
		x	x	x	x	x	x	x	x
8.2.2.5.11.		Water retention							
		x	x	x	x	x	x	x	x
8.2.2.5.1.12.		Linear deformations on mortar prisms							
		x	x	x	x	x	x	x	x
8.2.2.5.13.		Mechanical flexural and compressive strengths after (1),3,7,28,(90) days							
		x	x	x	x	x	x	x	x
8.2.2.5.14.		Whiteness							
		x-	x-	x-	x	-	-	-	-
8.2.2.5.15.		Hydration heat							
		x ⁵⁾	x ⁶⁾	x ⁷⁾	x ⁸⁾	x ⁹⁾	x ¹⁰⁾	x ¹¹⁾	x
8.2.2.5.16.		Susceptibility to cracking according to L'Hermite's method or AFNORP 15-351 (the method applied in the Institute)							
		x	x	-	-	x	x	-	-
8.2.2.5.17.		Corrosion according to V.V. Kind's method in the solution that matches the composition of aggressive water in nature (according to the procedure adopted in the Institute)							
		x	-	x	-	x	x	x	x

8.2.2.6.1. Regular Control Tests within Concrete Plant

Regular control tests within the concrete plant shall be performed by the laboratory of the producer of concrete. The tests shall be performed on samples taken from transport vehicles or from silos, at every repumping of a one-time delivery of bulk cement. Samples of cements that are used in a small quantity (special cements) and delivered in bags to the concrete plant, shall be taken from every delivery.

All control tests shall be completed to the satisfaction of the Engineer

Samples from bulk and bagged deliveries shall be taken for one-time measurement and overall testing, individually or all at once, in the quantity needed for testing, which means that tests are not performed on samples to achieve a certain degree of average condition.

Regular control tests for all types of cements from Table 6. of these Technical Specifications are obligatory in the following scope:

- Cement used for concrete pavements and concrete for bridges shall be tested every day when concrete works are executed, which is in accordance with PBAB/87 (Off. Journal of SFRY, No. 11/87, Art. 11);
- For cement used for other concrete works, every delivery shall be tested.

Control tests in both cases shall determine as follows:

- Standard consistency SRPS B.C8.023
- Time of setting SRPS B.C8.023
- Volumetric soundness by 3-hour boiling of small pats SRPS B.C8.023
- Fineness - residue on a 0.09 mm sieve SRPS B.C8.023

8.2.2.6.2. Supplier's Cement Testing Certificate

The producer of concrete shall submit to the Engineer, for each delivery of cement, a cement quality test certificate. The certificate shall contain results of the tests performed according to SRPS standards, and of other tests as set out in these Technical Specifications. The certificate shall have the code and source of cement, the stamp and signature of the supplier, i.e. of his authorized representative.

8.2.2.7. Storage of Cement Samples

For every type and class of cement, the producer of concrete shall take and store samples according to the applicable Yugoslav standard for cement sampling. One cement sample taken in that way may refer to not more than 250 tons of received and/or used cement.

Cement samples shall be taken immediately, and within one week from the delivery at latest. Cement samples shall be stored in the laboratory of the producer of concrete until the time of handover/taking over of completed structures, while ensuring that the qualitative soundness of cement samples shall not be compromised.

Samples are taken in the presence of the Engineer or person in charge of that, and shall be sealed.

Table 7. Types of tests in the Institute that is authorized for certification, and test methodologies

Type of test	Test method
Sampling	SRPS B.C1.012/79
Chemical analysis of cement based on Portland clinker	SRPS B.C8.020/75
Potential mineralogical composition of Portland cement (to be tested if needed)	According to Bogue's calculations or according to Leo-Parker's correction of Bogue's formulae
Mineralogical composition of Portland cement, if needed	Microscopic or X-ray diffraction
Content (%) of slag or pozzolane	According to a procedure elaborated in the Institute
Physical properties of cement:	
- Fineness, on sieve	SRPS B.C8.023/82
- Blaine's specific surface area	
a) For Portland cement	SRPS B.C8.024/63
b) For cement with admixtures	SRPS B.C8.026/66
- Bulk density w/o pores and voids	SRPS B.C8.023/82
- Bulk density in compacted and loose conditions	SRPS B.C8.023/82
- Standard consistency	SRPS B.C8.023/82
- Time of setting	SRPS B.C8.023/82
- Volumetric soundness	
a) on small pats	SRPS B.C8.023/82
b) on Le Chatelier's rings	SRPS B.C8.023/82
Autoclave expansion of cement	SRPS B.C8.025/79
Linear deformations -shrinking	SRPS B.C8.029/79
Construction of bodies according to expansion. Curing: water=20±1°C	SRPS B.C8.029/79
Strength	SRPS B.C8.022/76
Whiteness of cement	SRPS B.C1.009/82
Cement hydration heat	
a) Vacuum flask method	SRPS B.C8.027/75
b) Dissolution method	SRPS B.C8.028/75
L'Hermite's method, or AFNORP 15-351	
Susceptibility to cracking	(According to a method applied by the Institute)
If the cement in question shall be resistant to aggressive sulphate environment	Resistance to sulphate aggressiveness and corrosion determined according to a procedure adopted by the Institute for Testing of Materials

8.2.3. Water for Production of Fresh Concrete

Water for the production of concrete shall not show an unfavourable impact on the setting and hardening of cement. Plain drinking water (tap water) may be considered suitable for mixing concrete; if water is chlorinated, it shall be subjected to a full test. Industrial waste water and marsh water that contain harmful ingredients that disrupt normal setting and hardening of concrete shall be considered unusable.

Water from rivers and lakes, and/or groundwater, shall be used only when a qualified company, registered for the activity that covers water quality testing, issues satisfactory compliance certificates.

8.2.3.1. Quality Requirements for Water

Water may be considered suitable for the production of concrete if it meets the following requirements:

Properties		Plain concrete	Reinforced concrete	Pre-stressed concrete
pH value		4.5 - 9.5	4.5 - 9.5	4.5 - 9.5
Chloride content (Cl ⁻), mg/l	max	-	300	100
Sulphate content (SO ₄ ²⁻), mg/l	max	2700	2700	1000
Sulphate content (S ²⁻), mg/l	max			100
Nitrate content (NO ₃ ⁻), mg/l	max	500	500	500
Phosphate content (P ₂ O ₅), mg/l	max	100	100	100
Bicarbonate (alkaline) content (NaHCO ₃), mg/l	max	1000	1000	1000
Consumption of potassium-permanganate (KMnO ₄), mg/l	max	200	200	200
Content of dissolved matter, as a residue from the evaporation of clear or filtered water, mg/l		5000	5000	2000
Content of undissolved matter, as a difference from the residue from evaporation of unfiltered and filtered water, mg/l		2000	2000	2000
Difference in time of setting between cement pastes prepared with tested water and with distilled water, in minutes		30	30	30

Water shall not contain oils, grease, oil products, and sugar. Their presence shall be determined visually, and the presence of sugar by a qualitative chemical analysis.

The quality of water shall be tested by an institute authorized for certification, according to test methods specified in the Yugoslav standard U.M.I. 058/85.

The pre-test compliance certificates shall be valid for one construction season.

Regular control tests by the concrete manufacturer's laboratory shall be performed when needed or as directed by the Engineer.

8.2.4. Concrete admixtures

"Concrete admixtures" mean chemical substances that are added to concrete in small quantities before or during mixing in order to obtain certain properties in fresh or hardened concrete, as defined in SRPS U.M.I. 034/81.

For concrete mixing it is allowed to use only admixtures confirmed, by a compliance certificate, to possess declared properties and whose use does not weaken the basic properties of concrete, and does not cause the corrosion of reinforcing bars. (Certification for compliance is obligatory according to "Off. Journal of SFRY" No. 34/85.)

Compliance certificates are issued by qualified companies registered for the activity that covers the testing of such admixtures for quality.

Before the use of concrete with admixtures, the concrete producer shall test its qualities and confirm this by a compliance certificate issued by a qualified company registered for the activity that covers the testing of such concrete.

The concrete producer shall require the manufacturer's instructions for use and follow them. The concrete producer shall furnish the Engineer with a quality certificate for every delivery of every type of admixtures.

The certificate shall contain the test results for properties specific for the intended use, non-harmfulness for concrete, the code and source of the admixture, production date, quantity, delivery date, stamp, and signature. The certificate shall be submitted by the producer, or by his authorized representative.

The producer of admixtures shall, for every admixture separately, define with what types of cement they may be used. The selection of type of admixture shall be confirmed by the Engineer on a case-by-case basis.

8.2.4.1. Classification of Concrete Admixtures

Concrete admixtures are classified into the following basic groups:

- Plasticizers,
- Air entrainers,
- Retarders,
- Accelerators,
- Hardeners,
- Sealants,
- Admixtures for concreting at low temperatures.

Concrete admixtures may have a combined effect on the properties of concrete. In that case, the title of the pertaining group shall first state its primary characteristic that has the greatest impact on the properties of concrete.

8.2.4.2. Quality Requirements for Concrete Admixtures

For the production of concrete it is allowed to use admixtures that meet quality requirements according to SRPS U.M.I. 035/82.

Testing of Chemical and Physical/Chemical Properties

The following physical and chemical properties shall be tested according to SRPS U.M.I. 039/82

- Bulk density in fluid state
- Bulk density in solid state
- Surface tension of plasticizers and air entrainers,
- Content of dry matter in fluid state,
- Solubility in fluid state in distilled water and lime-saturated water .
- Loss on ignition in solid state,
- pH value,
- Chlorine-ion content, qualitative, and quantitative only if the qualitative analysis turns up positive,
- IR spectroscopy,
- Determination of reduction matter,
- Stability of foam from air entrainers.

Physical/chemical properties of an admixture are not subject to requirements. Test results are entered into a protocol.

Testing impacts of admixtures on the properties of cement paste and mortar

- Testing impacts of admixtures on the properties of cement paste shall be performed according to SRPS U.M1.038,
- Standard consistency shall be tested according to SRPS B.C8.023,
- Time of setting for admixtures for concreting at low temperatures shall be determined at - 5°C and at a lower limit temperature declared by the manufacturer,
- Volumetric soundness shall be determined according to SRPS B.C1.023
- Testing impacts of admixtures on the properties of cement mortar shall be performed according to SRPS U.M1.038,
- Reduced amount of necessary water shall be determined according to SRPS U.M1.038,
- Flexural and compressive strength shall be determined according to SRPS B.C8.022,
- Linear deformation shall be tested according to SRPS B.C8.029,
- Air content shall be determined according to SRPS B.C8.050

The qualities to be met by cement paste and mortar with an admixture are given in Table 1 of SRPS U.M1.035/82. Tests not subject to requirements shall be performed and their results entered into a protocol.

Testing Impacts of Admixtures on Corrosion of Steel in Concrete.

Admixtures do not have any impact on the corrosion of steel in concrete, if a rod (test specimen) made of concrete, according to SRPS U.M1.044, with a maximum amount of admixture as declared by the manufacturer, at the voltage of 225 mV according to a calomel electrode and the procedure set out in SRPS U.M1.044, has the current density of less than 60 A/cm².

Testing Impacts of Admixtures on Properties of Concrete

Fresh concrete:

- Bulk density in compacted state
- Consistency shall be determined according to SRPS U.M8.054,
- Time of setting shall be determined according to SRPS U.M1.019,
- Air content shall be determined according to SRPS U.M1.031.

Hardened concrete:

- Bulk density,
- Compressive strength shall be tested according to SRPS U.M1.020.
- Resistance to frost shall be tested according to SRPS U.M1.016
- Water-impermeability shall be tested according to SRPS U.M1.015

The quality to be met by hardened concrete with admixtures is given in Table 2 of SRPS U.M1.035/82, and the impacts of admixtures on concrete properties shall be tested according to SRPS U.M1.036/81. For bulk density in compacted state, time of setting, as well as the content of air in fresh concrete, the quality shall not be determined, but the tests shall be performed and their results entered into a protocol.

8.2.4.3. Checking Primary Use

Before mixing concrete with the use of admixtures, it is necessary to check whether the admixture to be used in concreting is suitable for its primary use, as defined in SRPS U.M1.037/81 ("Pre-testing for the selection of concrete admixture with particular aggregate and cement").

8.2.4.4. Checking Admixtures in Concrete Plant Before Use

Before applying admixtures, the producer of concrete shall check every received batch of admixtures, or a part thereof, for the following properties:

- Standard consistency of cement paste,
- Time of setting of cement paste of standard consistency,
- Compressive strength of concrete samples.

8.2.5. Chemical agents for surface protection of placed concrete against drying out

For the surface protection of placed fresh concrete that has to harden it is allowed to use liquid chemical spraying agents. These agents shall be pre-tested by a qualified company registered for the activity that covers the testing of qualities of these agents, and shall be used according to the manufacturer's instructions. The contractor shall furnish the Engineer with a quality certificate for every delivery of every type of protective agent.

The certificate shall contain the test results for properties specific for the intended use, non-harmfulness for concrete, code and source of the agent for surface protection of concrete against drying out, production date, quantity and date of delivery, stamp, and signature. The certificate shall be submitted by the manufacturer or his authorised representative.

Before using a chemical agent for surface protection of places concrete against drying out, the Contractor shall have a report on testing of water retention effects, through the measurement of their ability to prevent the loss of moisture during the early setting period. The method ASTM C-156 shall be applied for the test.



8.3. Quality Requirements for Concrete

8.3.1. Quality Requirements

8.3.1.1. General

For all concrete works within the construction (except for any specifically set requirements) the applicable technology shall be the technology of plasticized, thick, compact, and technically water impermeable concrete that is, for certain uses, artificially micro-aerated or capillary-densified. Only concrete found to meet specified quality requirements, through pre-tests and special requirements, may be used for this procedure. Concrete shall be placed only mechanically. Concrete for concrete pavements shall meet the requirements set out in SRPS U.E3.020/87.

8.3.1.2. Composition of Class B-II Concrete

The composition of class B-II concrete, considering its properties in fresh and hardened conditions, shall be determined through calculations and experimentally.

8.3.1.3. Properties of Concrete

In designs, the required grades and other properties of concrete (MB) shall apply for concrete after 28-day aging, and shall refer to destructive strengths of moulded cubes, with 20-cm sides, and a maximum grain size of 63 mm, cured at 95% humidity, at least, and the temperature of $20 \pm 4^\circ\text{C}$, and tested according to SRPS U' M1.020.

The quality of concrete shall be defined in the design based on technical specifications for concrete works, and specifications for relevant constructions and elements in the course of operation. Regardless of its intended use, concrete shall also bear, aside from the designation of its grade (MB), its special properties in the design, if special purpose structures are constructed.

The design may envisage that concrete, aside from the designation from paragraph 2 above, also bears designations of other properties, such as: water impermeability, frost resistance, frost and salt resistance, resistance to chemical impacts, and wear resistance.

8.3.1.3.1. Provision of Proof for Concrete Grade

Every 3 months, in order to prove the grade of concrete, all results of compressive strength tests, grouped by batch for the past three months, shall be processed statistically for every type of concrete. The statistical processing of test results shall include the calculation of the typical strength of concrete: F_k . The typical compressive strength is the value below which not more than 10% of all strengths of tested concrete may be expected, with the number of samples $n \geq 30$, and meeting the following requirement:

$$F_k = F_{km} - 1.28 S \quad \text{where:}$$

F_k - Typical compressive strength in MPa

F_{km} - Mean compressive strength value for all test results in MPa

S - Standard squared deviation in MPa, defined according to Art. 46 of the new PBAB/87 (standard deviation)

When producing B-II concrete, the producer of concrete shall test its compressive strength according to SRPS U' M1.020 on a sample taken for every type of concrete, on every day of production, or at every 50 m³ of produced concrete, and/or at every 75 mixes, taking into account the already obtained number of tests. In exceptional cases, if the quantities of produced concrete in the assessment period are large (in excess of 2000 m³), then samples for testing shall be taken at every 100 m³, i.e. 150 mixes. The total number of tests for every class of concrete produced in larger quantities (in excess of 1000 m³) in the assessment period shall be not more than 30. For smaller quantities of concrete, at least 10 tests shall be performed for every type of concrete in the assessment period. The results of concrete compressive strength tests shall be assessed according to SRPS U' M1.051.

All tests shall be completed to the satisfaction of the Engineer and all results shall be submitted for the approval of the Engineer.

8.3.1.4. Concrete Grade Control Programme

Grade of concrete (MB) shall be assessed by batch, in line with the control programme against one of criteria, as specified in Art. 46 of the new Rules on technical norms for plain and reinforced concrete ("Off. Journal of SFRY", No. 11 dated 23 February 1987).

8.3.1.4.1. Other Requirements

Having in mind various requirements for the basic load (dead load) and the useful load of a construction and/or structure, concrete shall be mixed and placed according to criteria for achieving other relevant technical properties conditioned by the values of W/C factor of fresh concrete that shall not exceed specific limit values, by achieving the required degree of castability and water impermeability of hardened concrete, as set out in SRPS U' M1.015.

8.3.1.5. W/C Factor for Concrete without Special Requirements

For concretes for which there are no special requirements in the design or technical specifications, water shall be used only as much as necessary to compact concrete well, considering the placement conditions, but the applicable criterion is that they shall not be mixed and placed with a W/C factor in excess of 0.60.

8.3.1.6. W/C Factor for Frost-Resistant and Water impermeable Concretes

The criterion that a maximum W/C ratio shall not exceed 0.50 shall apply to concretes for which specifications or technical specifications require, or for which a need arises, subsequently, considering field conditions, to ensure the freeze-thaw resistance or impermeability. If a need arises for a higher W/C factor, because of the placement needs, it is necessary to use special technological procedures, such as the addition of plasticizers, micro-aeration, capillary densification, or other appropriate procedures. Such concrete shall be impermeable, according to the Rules on technical norms for concrete pavement (SRPS U' E3.020/87).

8.3.1.7. W/C factor for concrete on pavement and concrete exposed to frost and salt

For concrete pavements and other concretes particularly exposed to the action of frost and salts, micro-aeration shall necessarily be applied. Based on prior documented tests, instead of the micro-aeration of these concretes, it is allowed to apply their capillary densification. For these concretes, in general, the criterion of a maximum W/C factor value of 0.60, and the criterion of impermeability are becoming stricter. For concrete on pavement, an additional requirement is that the value of a maximum W/C factor shall not exceed 0.50. For concrete in pre-stressed structures that shall not be aerated, the applicable criterion is the one set out in the Rules on technical measures and requirements for pre-stressed concrete.

8.3.1.8. Testing Concrete for Frost Resistance

The frost resistance of concrete shall be tested according to SRPS U.M1.016/77. The grades for frost resistance of concrete are M-50, M-100, M-150, and M-200, where the number indicates the highest number of alternate freezing at a stable temperature of -20°C for 4h, and thawing in water of temperature $+20^{\circ}\text{C}$ for 4h. The objects to be tested shall be in the shape of a cube, with 150 or 200 mm long sides, or cylindrical specimens taken from a completed structure, 150/150 mm in size. The number of samples, cycles, and the test procedure shall be in line with the requirements set out in the above-mentioned SRPS, depending on the required grade of concrete (MB). When pretesting for the frost resistance of concrete, it is necessary to test aggregate, water, cement, and any admixtures of concrete according to requirements set out in relevant SRPS, Rules on technical norms for plain and reinforced concrete, and Rules on technical measures and requirements for pre-stressed concrete.

In the previous procedure, it is necessary to get a mix design for concrete that should be resistant to frost from a relevant institution registered for that type of activities. In the designs it is necessary to specifically state those elements of construction that also require frost resisting concrete. The pertaining appendices to the design shall state the compressive strengths of concrete – concrete grades, the types of steel and reinforcing bars, and the relevant grades of frost resistance, or frost and salt resistance of concrete.

When testing concrete for frost resistance, the compressive strength of frozen concrete test bodies shall be at least 75% of strength of non-frozen test bodies of respective age (standard).

Four days before starting the test, all test bodies shall be put into water of temperature $20^{\circ}\text{C} \pm 2$, that should be at least 2 cm above the top surface of test body.

Mandatory pre-tests for the frost resistance of concrete shall be conducted for concrete pavements, bridge span structures and gutters, and for other concrete structures, if for concrete works, i.e. mixing of concrete, non-standard mineral aggregates are used (all gravels with the presence of hornstone, all volcanic rocks with the content of glass, dolomites, etc.), with the presence of small particles of 0.02 mm in size.

The mentioned pre-tests shall be conducted for concrete in constructions and elements on such road sections where the freeze-thaw process is present in the range from 0 to 20°C , and if the number of freeze-thaw cycles per year is over 10, particularly in environments where water and aggressive substances are present (in the air, water, soil, and during winter road maintenance), where the Designer shall take these conditions into consideration when designing the structure.

Mandatory control tests for the frost resistance of test concrete bodies (kerns) shall also be performed for concrete pavements. If mineral aggregate for concrete works (this does not apply to concrete pavement and lanes, bridge span structures, gutters, and tunnel arches) has a smaller presence of particles finer than 0.02 - 2.5 mm in size, the testing for frost resistance is not necessary, but if their share is over 2.5% but not more than 4%, to approve the mineral aggregate for use in the above-mentioned concrete works, the frost resistance of such concrete constructions and elements shall be proven according to the procedure already described above.

8.3.1.8.1. Testing Concrete for Frost and Salt Resistance

The frost and salt resistance of concrete shall be tested according to SRPS U.M1.055. A minimum requirement is that it shall be resistant.

8.3.1.9. Concrete Exposed to Aggressive Action of Water or Soil

Concrete placed in the environment exposed to the aggressive action of water or soil shall fully meet the quality requirements set out in the Rules on technical measures and requirements for the design and construction of concrete and reinforced-concrete constructions in environments exposed to the aggressive action of water and soil (SRPS U.M1.014 and PBAB/87).

8.3.1.10. Degree of Aggressiveness of Water and Soil to Concrete

The degree of aggressiveness of water and soil to concrete shall be determined by chemical analyses of water and soil performed by a qualified company registered for that activity. The action of water on a structure may be under pressure of 15 atm, and with a unilateral hydrostatic pressure, a pressure with a gradient in excess of 5 which is a criterion whether the structure is under water pressure or not.

8.3.1.11. Water sampling

Water samples to be sent for testing shall be taken at water temperature of 0°C to $+25^{\circ}\text{C}$. If the temperature of water during sampling is not within the stated range, this should be stressed in particular.

8.3.1.12. Indicators of aggressive actions of water and soil

The indicators of aggressive actions of water and soil, as set out in the Rules specified under 8.3.1.9., relate to concrete mixed with Portland cement, with the addition of pozzolane or slag, or with special Portland cement that has a required water impermeability after 28-day setting under normal conditions.

8.3.1.13. Basic forms of aggressive action of water on concrete are:

1. General acidic aggressiveness determined over the concentration of acids, i.e. pH value;
2. Carbon-acidic aggressiveness, determined over the concentration of free carbonic acid, taking into account the content of calcium, chlorides, and sulphates, as well as carbonate hardness;
3. Leaching, determined by the value of hydro carbonate alkalinity;
4. Sulphate aggressiveness, determined by the concentration of sulphates, taking into account the chloride content;
5. Magnesium aggressiveness, determined by the concentration of magnesium ions depending on the content of sulphate ions;
6. Ammonium aggressiveness, determined by the content of ammonium ions;
7. Alkaline aggressiveness determined by the concentration of alkalis.

8.3.1.14. Concrete exposed to aggressive action of water and soil

Concrete exposed to aggressive action of water and soil shall be mixed with appropriate cement and aggregate, but after 28 days of normal hardening it shall have water impermeability that meets the following coefficient of permeability 8.10 cm/sec $K=26.10 \text{ cm/sec}$.

Water impermeability shall be tested by a qualified company registered for the testing of materials and constructions, according to SRPS U.M1.015/78, on cylinders, 15 cm in diameter, 15 cm high, or plates, $20 \times 20 \times 15 \text{ cm}$, that are exposed to the action of water for 8 hours under the pressure of 1 atm, and then to the action of water under the pressure of 2 atm for another 8 hours.

The grades of water impermeability of concrete are: B-2, B-4, B-6, B-8, B-12, where the numbers 2, 4, 6, 8, and 12 indicate pressures in bars that concrete (test specimens) shall meet according to SRPS U.M1.015/78.

Based on the given indicators of aggressiveness of water and soil, the cement shall be selected so as to ensure the durability of concrete. If the environment is very aggressive, it is necessary to envisage measures for the protection of concrete in the form of coating. A minimum quantity of cement per 1 m³ of finished concrete shall be 350 kilograms.

If the aggregate used for concrete, exposed to alkaline aggressive actions of water and soil, contains amorphous silicon (opal, chalcedony, chert), its potential alkali-silicate reaction shall be tested according to SRPS B B8 056/81. If concrete is exposed to occasional or permanent contact with water or damp soil, and is mixed with cement of a high alkali content (Na₂O + K₂O), the potential alkali-silicate (SRPS B B8 056) and potential alkali-carbonate (ASTM C-586) reactivity shall be tested.

For mixing concrete exposed to aggressive actions of water and soil, it is necessary to adopt a minimum amount of water needed to obtain the required strength, castability, and water impermeability, as determined experimentally.

Fresh cast concrete and prefabricated elements in an aggressive environment under normal conditions of hardening, shall not come into contact with water for at least 14 days from the date of placement, and for at least 21 days if concrete is made with pozzolanic cements.

For reinforced concrete in an aggressive environment, a minimum thickness of the protective layer of reinforcement shall be 5.0 cm, with the surface as enclosed as possible, without any sharp edges, i.e. with rounding of a minimum radius of 5.0 cm.

The concrete design, or investment/technical documents for structures whose particular parts are in an aggressive environment, shall give data on the aggressiveness of water and soil, types of adopted cement, aggregate, and W/C factor, curing of concrete, degree of water impermeability, method for ensuring water impermeability, additional protective measures, methods for control of quality of performed works, and other, full as specified in PBAB/87 from Sub-Section 8.3.1.9.

8.3.1.15. Water Absorption

Water absorption of concrete in pavement structure and pre-stressed constructions shall not be more than 1.3% of concrete mass.

8.3.1.16. Content of particles smaller than 0.25 mm in size

The total amount of cement and aggregate grains smaller than 0.25 mm for B-II concretes shall not be below the values given in Table 8.

Table 8

The largest aggregate fraction (mm)			The lowest total amount of cement and particles of 0.25 mm in size (kg/m ³ of concrete)
4	8	16	
4	8	16	500
8	16	32	425
16	32	63	350
32	63		300

8.3.2. Requirements in Production of Concrete

8.3.2.1. Designing B-II concretes and concretes for transport

8.3.2.1.1. General

Before starting the production of B-II concretes and concretes for transport, it is necessary that an authorized institution designs their mixes, by computation and experimentally, taking care of specific properties of the basic components to be used for the production of concrete. It is necessary to take care of the castability of concrete, which is primarily determined by the degree of consistency, and a maximum diameter of aggregate grains.

8.3.2.1.2. Design-Related Tests

Design-related tests shall be started in time that enables the provision of necessary results on the properties of concrete to be placed, while ensuring that, aside from proofs on the quality of concrete after 28-day aging, there must also be a proof on the quality of concrete for the age at which the construction and its elements are pre-stressed, on specimens stored under the same conditions as the construction and its elements. Apart from a mandatory proof on the quality of concrete after 28-day aging, it is not mandatory, but is possible, if needed, to conduct a test to prove the quality of concrete after 7 and 90 days.

All tests shall be completed to the satisfaction of the Engineer and all results shall be submitted for the approval of the Engineer.

8.3.2.1.3. Concrete Mix Design

The concrete mix design shall contain

1. Aggregate test certificate
2. Binder test certificate
3. Water test certificate
4. Concrete admixtures test certificate
5. Designed grain size distribution curve of mineral mixture
6. Water-cement ratio analysis and designed consistency of concrete
7. Proportions of mineral aggregate, particular fractions, cement, admixture, and water in 1 m³ of concrete,
8. Proportion of mineral aggregate, particular fractions, cement, admixture, and water for one batch, depending on the capacity of mixer
9. Results of tests on test cubes for each required grade of concrete (MB), including other tests of concrete, if so required in the design.
10. Control of measuring instruments in the concrete plant (mixer), i.e. control of scales and water gauges, performed according to SRPS U M1 050; adoption of a mix for 1 batch in the mixer, namely for:
 - cement,
 - water,
 - aggregate:
 - granulometric composition,
 - dosage by fraction,
 - particles of 0.09 mm in size in a fraction, and
 - particles of 0.063 mm in size in an aggregate fraction,
 - consistency of concrete,

8.3.2.2. Working Condition in Concrete Plants

8.3.2.2.1. Equipment in Concrete Plant

The equipment and working processes in a concrete plant shall ensure the required degree of homogeneity in the properties of fresh cast and prefabricated concrete, according to SRPS U.M1.050 and SRPS U.M1.051.

8.3.2.2.2. Thermal Calculations at Low Temperatures

If concreting is performed at low temperatures, the possibility of tempering fresh concrete shall be ensured, i.e. its relevant components (water - aggregate), according to the required temperature. The concrete plant operations shall ensure the possibility of an adequate protection of fresh concrete during handling and placement, as well as of placed concrete, and concrete during hardening, against weather conditions. Thermal calculations shall be made with respect to caloric properties of the components of concrete, forms, and ambient temperatures, and the temperature of fresh concrete that is being placed.

8.3.2.2.3. Handling Time

The duration of fresh concrete handling and transport, i.e. time from its preparation until placement, is subject to the requirement that within that time there shall be no change in the consistency of concrete. In general, the applicable rule is that the duration of handling and transport shall not be longer than 1 hour. Variations from this limit are possible based on a proven experimental procedure, or with the use of "retarders" – admixtures that slow down the cement hydration process.

8.3.2.2.4. Allowed Drop Height

The allowed drop height of fresh concrete and the height of drop chute shall depend on the concrete mix, and the Contractor shall determine them for each case separately, so as to exclude any segregation of concrete under the impact of gravity. In general, the drop height of fresh concrete shall not be over 1 m.

8.3.2.2.5. Maintenance of vessels for fresh concrete

After every filling and emptying, vessels with concrete shall be cleaned thoroughly. When using vessels that are filled continually (e.g. "transitory" silos), it is necessary to prevent any retention of old concrete on the walls of vessels in a special and adequate way.

8.3.2.2.6. White and coloured concretes

White and coloured concretes shall be mixed separately in concrete plants adequately equipped and supplied for that purpose. For handling and transport of white and coloured concretes, specifically prepared and supplied equipment shall be used. For coloured concretes only resistant pigments, non-harmful for cement clinker, may be used.

8.3.2.3. Use of Admixtures for Concrete

In order to improve properties of fresh and hardened concrete, it is necessary to use admixtures for concrete, according to SRPS U.M1.034.

8.3.2.3.1. Major Types of Admixtures for Concrete and Their Use

In general, the following admixtures may be used:

- Plasticizers,
- Air entrainers,
- Additives for concreting at lower temperatures,
- Thickeners (primarily capillary thickeners),
- Accelerators,
- Retarders,
- Colouring agents for fresh concrete,
- Inhibitors, i.e. agents for the protection of reinforcement steel against corrosion,
- Surface protection of fresh cast concrete (concrete pavement).

It is allowed to use only pre-tested admixtures for concrete according to SRPS U.M1.035, as well as for the selection of admixtures for concrete with a certain aggregate and cement according to SRPS U.M1.037.

It is necessary to check the impact of used admixtures on the properties of concrete, according to SRPS U.M1.036. Furthermore, it is also necessary to check the impact of admixtures to concrete on cement paste and mortar, according to SRPS U.M1.038, and the impact of admixtures on the corrosion of reinforcement steel, according to SRPS U.M1.044.

Admixtures shall be batched precisely. Concrete plants shall be equipped with devices for simultaneous batching of two different types of admixtures. In general, admixtures are added in a diluted state to finished fresh concrete, and to water for mixing concrete.

Devices for handling and batching of admixtures shall be resistant to corrosive impacts of admixtures.

Admixtures made of finely ground mineral materials (rock flour or similar), materials with colloid and hydrophobic properties (bentonites, ground paraffin etc.) shall not be treated as admixtures for concrete. All mentioned pre-tests shall be performed by an institution authorised for that type of activities.

All tests shall be completed to the satisfaction of the Engineer and all results shall be submitted for the approval of the Engineer.

8.3.2.3.2. Special Requirements for Micro-Aeration of Concrete

To increase water impermeability, freeze-thaw resistance, and resistance to salt, for certain concretes, and as obligatory for concretes in pavement structures, artificial micro-aeration is used, unless this is compensated for with artificial chemical/mineralogical capillary thickening.

The content and structure of micro-pores in finished concrete shall meet the specified requirements.

The batching of a selected and tested air entraining agent shall be determined carefully by the Contractor, with each particular mix of fresh concrete pre-tested. In all phases, the batching of air entrainers shall be precise, continuous, controlled in quantity, according to SRPS U.M1.031.

For the achieved content of micro-pores in fresh concrete, in the mixing phase, it is necessary to take into account the factors listed below, for an air entrainer otherwise batched in the same way:

- Type and composition of mineral aggregate, shape and surface properties of its grains, and the quantity of grains smaller than 0.25 mm;
- The amount and type of cement, particularly the grain size composition, shape and surface properties of grains;
- Consistency of fresh concrete;
- Time and method of mixing fresh concrete;
- Temperature of fresh concrete.

Technically relevant is the content of micro-pores in fresh concrete, and it refers to placed concrete. This is why it is necessary to determine the content of micro-pores in fresh concrete immediately after mixing, while including the impact of the method and duration of handling, and method of placement, particularly the vibration power and duration.

The air content (micro-porosity) shall be controlled and assessed, both on laboratory test specimens in the concrete plant, and on the test specimens taken on site from the structure, according to SRPS U.M1.031.

8.3.3. Cement Mortar

Two basic types of cement mortar are used, according to their intended use:

- Masonry cement mortar, and
- Plastering cement mortar.

Cement mortars shall be made of cement, sand, and water.

8.3.3.1. Masonry cement mortar

By consistency, two types of masonry cement mortar shall be used:

- Liquid mortar, and
- Plastic mortar.

8.3.3.1.1. Quality requirements for materials for preparation of masonry mortar

Cement that serves for mixing mortar shall meet the quality requirements set out in SRPS B.C1.011 and SRPS B.C1.012 (Sub-Section 8.4.1.2. of these Technical Specifications).

Sand for mortars may be:

- Sand from rivers (river sand), reefs, and sandy terrains (quarry sand);
- Crushed sand made of good-quality solid rock material.

Quality requirements for sand for mixing masonry mortar are set out in SRPS U.M2.010.

Quality requirements for sand for mixing masonry mortar

No.

Characteristic of quality Quality Requirement

A. Content of harmful components:

(in percentage by mass)

1. Clay balls (over 0.5 cm ³):	
For river sand	1%
For quarry sand	1.5%
2. Fine particles passing through 0.090mm sieve (wet sieving)	10%
3. Particles under 0.02 mm in size	2%
4. Organic matter	max 0.01%
5. Suspended matter	max 0.3%
6. Total sulphur, expressed as SO ₃	max 1%
7. Chlorides, nitrates, nitrites	max 0.1%

B Granulometric composition of sand shall be as follows:

Mesh	Passing through sieve	
	natural sand (%)	crushed sand (%)
4	100	100
2	70 - 100	70 - 100
1	48 - 88	45 - 90
0.5	26 - 57	30 - 57
0.25	10 - 26	16 - 37
0.09	0 - 10	0 - 10

Methods for testing particular properties of sand are set out in SRPS U.M8.002.

Water from the drinking water supply mains may be used to mix mortar without any pre-tests. Water of any other origin may be used if it meets the quality requirements set out in SRPS U.M1.058, which is proven by pre-testing.

8.3.3.1.2. Quality requirements for masonry cement mortar

Quality requirements for mortar are set out in SRPS U.M2.010.

8.3.3.1.3. Consistency of fresh of mortar

Consistency of fresh of mortar shall be according to the following values:

Type of mortar	Cone spreading (mm)
Liquid mortar	over 180
Plastic mortar	from 130 to 180

Consistency shall be determined according to the method given in SRPS B.C8.023.

8.3.3.1.4. Strength of Mortar

Strength of mortar shall be according to the following values:

Mortar grade	Compressive strength, MPa After 28 days		Flexural strength, MPa After 28 days	
	Average value, min.	Singular value, min.	Average value, min.	Singular value, min.
0.5	0.5	0.3	0.3	0.2
2.5	2.5	1.7	1.0	0.8
5.0	5.0	3.5	1.7	1.4
10.0	10.0	7.0	2.4	2.0

For testing strength, a test cement-mortar specimen shall be made and cured according to the procedure set out in SRPS U.M8.002. Compressive and flexural strengths shall be tested according to SRPS B.C8.022.

8.3.3.1.5. Frost Resistance

Frost resistance of cement mortar, if specified in the structural design as a quality requirement, shall be tested according to SRPS U.M8.002.

8.3.3.1.6. Homogeneity

Homogeneity of cement mortar shall be tested according to the procedure set out in SRPS U.M8.002.

8.3.3.2. Plastering Cement Mortar

Plastering cement mortar shall serve for making flat, smooth, or specifically finished concrete or stone surfaces. An approximate composition of plastering cement mortar (ratio of cement and sand) shall be:

- for base and finishing coats 1:4.

8.3.3.2.1. Quality Requirements for Materials for Mixing Plastering Mortar

Cement and water shall meet standard quality requirements specified under 8.3.3.1.1. The quality requirements for sand for mixing plastering mortar are set out in SRPS U.M2.012.

Quality requirements for sand for mixing plastering mortar.

No.

Characteristic of quality Quality Requirement

A. Content of harmful components:
(in percentage by mass)

1.	Clay balls (over 0.5 cm ³):	
	For river sand	1%
	For quarry sand	1.5%
2.	Fine particles passing through 0.090mm sieve (wet sieving).....	15%
3.	Particles under 0.02 mm in size	5%
4.	Organic matter	max 0.01%
5.	Suspended matter	max 0.3%
6.	Total sulphur, expressed as SO ₃	max 1%
7.	Chlorides, nitrates, nitrites	max 0.1%

B. Granulometric composition of sand shall meet the following requirements:

Coat of mortar	Type of sand	Residue on 0.50 sieve (%)
Base	Coarse	50 - 70
	Medium	30 - 50
Finishing	Fine	20 - 35
	Very fine	7 - 20

The largest grain size in base coat.....5 mm

The largest grain size in finishing coat3 mm

8.3.3.2.2. Quality Requirements for Plastering Cement Mortar

Quality requirements for mortar are set out in SRPS U.M2.010.

8.3.3.2.3. Consistency of Fresh Mortar

Consistency of fresh plastering mortar shall be according to the following values:

Type of mortar	Spreading (mm)	Largest grain (mm)
For base coat	200 – 230	2.5 – 5
For finishing coat	170 – 180	1.2

Consistency shall be determined according to the method set out in SRPS B.C8.023.

8.3.3.2.4. Strength and Quality of Mortar

The strength of mortar shall be according to the values given under 8.3.3.1.4. of these Technical Specifications. The quality of plastering cement mortar shall be checked according to SRPS U.M8.002.

8.3.3.3. Mixing of Cement Mortar

The composition of mortar shall be determined according to

- Design requirements,
- Thickness of joints or layers,
- Cement class
- Envisaged consistency.

Mixing shall ensure mortar of uniform composition and plasticity. The time of mixing shall be determined by testing for homogeneity of cement mortar for each type of mixer.

The temperature of water for mixing mortar shall not exceed 80°C, and that of sand shall not exceed 40°C.

Mortar shall be mixed only in the quantity that can be placed before the setting starts, while keeping the specified consistency.

8.3.4. Grouts for Pre-Stressing Cables

8.3.4.1. General

Grouts for grouting tensioned cables shall be prepared (mixed) and placed according to the Rules on technical measures and requirements for pre-stressed concrete and according to SRPS U.E3.015/86. The grouts shall be mixed mechanically. SRPS U.E3.015/86 shall determine the composition, quality requirements, pre-tests and control tests for grouts for grouting cables.

8.3.4.2. Pre-Testing

Each used grout shall be pre-tested by a qualified company registered for the testing of materials and constructions, as ordered by the Contractor. Before the commencement of works on the grouting of pre-stressing cables, all materials and grouts based on materials to be used shall be tested.

Test reports on the tested composition and tested materials of the same type and from the same source shall be valid for one year at most.

These tests of grouts shall be performed in laboratory conditions at the temperature of $20 \pm 2^\circ\text{C}$ and cover:

- Flow, SRPS U.M8.024/84,
- Bleeding, SRPS U.M8.023/84,
- Change in volume, SRPS U.M8.023/84,
- Compressive strength after 28 days, SRPS U.M8.022/84,
- Frost resistance, SRPS U.M8.025/84.

If grouting is performed at a temperature higher than 25°C, or lower than 5°C, it is necessary to perform some additional tests under appropriate temperature conditions, namely for:

- Flow,
- Bleeding,
- Change in volume,
- Also, in case of lower temperatures, compressive strength after 3, 7, and 28 days, on test specimens cured at 50°C for 7 days, than at 20°C until the 28th day.

8.3.4.3. Mixing and Placement of Grouts

The Contractor shall check the mixing and placement of grouts visually and by measurements according to a schedule approved by the Engineer. The Contractor shall keep a log on pre-stressing, grouting, and controls, which shall be confirmed by the Engineer.

8.3.4.3.1. Control Tests

Before use, the Contractor shall test each delivery of cement regarding water for standard consistency, setting time, volumetric soundness and fineness according to SRPS B.C8.023. Samples from each delivery shall be kept in the following amounts: cement about 3 kg, chemical additives 500 g, mineral additions about 3 kg, or dry grout about 10 kg, until the commissioning of the structure, while ensuring that the quality of taken samples is not compromised during that time.

The quality of fresh grout with materials with which the mix is prepared shall be determined at least a day before grouting. The tests shall include flow rate, bleeding, and change in volume.

Throughout the works, the flow rate of grout shall be checked several times at the upper and lower ends of the chute or pipe, and grout samples for the testing of bleeding, change in volume and 28-day compressive strength shall be taken at least once a day. For the testing for change in volume and strength, test specimens shall be made from the mix taken at the lower end of the chute or pipe. Test specimens shall be kept in tightly closed boxes for 24 hours on the site, and then for the remaining time in the laboratory.

The Contractor shall keep a log on grouting works and quality test results with the following data:

- Manufacturer's name,
- Site,
- Structural element,
- Code and dimensions of pre-stressing cables,
- Pre-stressing method,
- Date, start and end of grouting,
- Type of usable materials,
- Composition and water-cement factor of the grout,
- Data on mixer used to prepare the mix,
- Mixing time,
- Air temperature and humidity, temperature of used materials and fresh grout,
- Flow of the grout,
- Bleeding,
- Change in volume,
- Number of taken specimens,
- Conditions of curing for the specimens.
- Date of taking over the specimens for strength tests,
- Special notes,
- Sketch of elements with cable layout,
- Signature of person in charge.

Based on the data from the site and results for 28-day compressive strength tests a report on the quality of placed grout shall be prepared.

All tests shall be completed to the satisfaction of the Engineer and all results shall be submitted for the approval of the Engineer

8.3.4.3.2. Pre-stressing log keeping schedule

The schedule shall include:

- Project name,
- Name of construction,
- Name and position of the element to be pre-stressed,
- Date of concreting and prestressing of the element,
- Codes and characteristics of patented tendons,
- Layout of cables, i.e. tendons for prestressing,
- Required initial force (stress) in the cable,
- Required final force (stress) in the cable,
- Loss of force in cables due to weather impacts on concrete and cables (contraction and creep of concrete, relaxation of cables), insertion of anchor bolts, friction with the change of direction of cables, sum of losses),
- Measured force in cable tensioning,
- Cable elongation value (before and after anchoring),
- Stress obtained by direct measurements, if specified in the design,
- Notes related to the stages and sequence of tensioning.

8.3.5. Special types of concrete

Special types of concrete shall be mixed and placed, if an opportunity for that arises, according to appropriate instructions and recommendations approved by the Engineer. Special types of concrete include: pumped concrete, vacuumed concrete, sprayed concrete (shotcrete) and sprayed mortar.

8.3.5.1. Pumped concrete

Pumped concrete is considered to be fresh concrete of certain properties that is transported and cast on the site under special conditions. Basically, the system consists of a funnel into which concrete is fed from the mixer, then a pump with which concrete is pushed forward (with a direct piston action or suction-push type), and a pipe through which concrete is delivered to the place of concreting.

The principal advantage of pumped concrete is that it is supplied in that way to places hard to access, with the mixing plant out of the site. This advantage is particularly important for the concreting of tunnel lining, or for construction sites in urban areas with very restricted space. Piston pumps may transport fresh concrete to distances of up to 450 m horizontally, or up to 40 m in height, and "pressure pumps" may reach distances of up to 90 m horizontally or up to 30 m in height.

The transport of fresh concrete in this way requires mixes of certain properties, so that concrete mass could pass smoothly through pump pipes, which is determined in the schedule according to T. T. Schwine Manual, or similar internal instructions for this type of activity.

8.3.5.2. Vacuum Concrete

A special technique of work with concrete, providing good workability at a minimum water/cement ratio, is called "vacuum concrete" in practice. The procedure goes as follows: concrete mix of medium workability is cast into moulds - forms, and a considerable amount of water is sucked out from the lower layer of concrete of certain thickness by applying vacuum on the concrete surface, thus decreasing the water/cement ratio (before cement sets); since the strength of concrete depends on this ratio to a great degree, in this way a higher grade of concrete is achieved, along with a higher density, water impermeability, and general performance of hardened concrete. This type of concrete is particularly suitable for applications in the plants that manufacture finished concrete elements, particularly from B-II concrete, since moulds may be used incomparably more often than without vacuuming. One of other good properties of vacuum concrete is that it makes an excellent bond with old concrete, and is thus applicable for making a new surface on worn concrete pavements, or for any similar repairs or patching of concrete surfaces. This method of concreting, too, requires a technology schedule -- design that shall be submitted for the approval by the Engineer.

8.3.5.3. Sprayed concrete and mortar

This is a technology where cement mortar or concrete is expelled pneumatically from a nozzle (under high pressure and at high velocity) and applied to a solid base. The force of such jet that hits the base compacts the material to a such degree that it stays without leaking not only on vertical surfaces, but on ceilings or intrados in tunnel or other structures as well. The properties of sprayed concrete (shotcrete) are as good as

those of concrete placed in a usual way, but prepared according to the same mix design, and acquires its major advantages by the very method of placement. Sprayed concrete (shotcrete) does not require any forms and is applied in certain cases, such as: thin, lightly reinforced constructions (shells – corrugated roofs), tunnel lining and cuts, pre-stressed tanks, and so on. Sprayed concrete is also applied for repairing those places where concrete has already degraded, for stabilizing friable rock slopes, cuts, and cut-and-fills of roads or tunnel approach cuts, for lining steel constructions in order to protect them against fire. This concrete is very often added an admixture (accelerator) that sets quickly and thus enables a fast repair of damaged surfaces. Sprayed concrete is applied in 2-3 layers, 2 - 10 cm thick, in two different ways: the first, more frequent one, starts with a dry cement mix and wet aggregate, and the second one is with wet concrete, when it is possible to use a pump similar to the one used for pumped concrete. Both procedures are good, but the first (dry) procedure is, nevertheless, more suitable when using concrete with light aggregate, or when a quick-setting accelerator is added, and this procedure may give even thicker layers of applied concrete. For this technology it is necessary to have a schedule with appropriate mix designs and equipment, which is to be submitted for approval by the Engineer in line with SRPS U.E3.011, the preparation of which is underway.

8.3.5.4. Standard under preparation - SRPS U.E3.011

This standard (which is about to be released) determines technological and technical requirements for the design, production, and application of sprayed concrete and mortar. According to the new SRPS U.E3.011, "sprayed concrete and mortar" mean all names previously used in our country and worldwide: shotcrete, spray-concrete, gunite, etc.

Sprayed concrete or mortar has been increasingly used lately in tunnel construction, with or without a wire mesh, with mesh openings about 4 cm in size, and a 2 mm thick wire.

When sprayed concrete or mortar is to be used depends on the category of base material, and geomechanical properties of the rock to be stabilized.

Each special type of concrete shall be pre-tested by a qualified company registered for that activity and submitted for approval by the Engineer.

The producer of these concretes shall control the mixing and placement of special concretes through a laboratory, in compliance with applicable technical specifications and schedule submitted for approval by the Engineer.

For concrete for pre-stressed and composite constructions it is necessary to observe the following requirements as well, apart from all others:

- Types of cement: according to Sub-Section 8.2.2.1.;
- Amount of cement:
min. 350 kg/m³ of finished concrete,
max 420 kg/m³ of finished concrete;
- Aggregate:
- Good-quality, strong and tough materials, of a natural shape, or of cubic, crushed, shaped, that meet requirements from Sub-Section 5.2.1.;
- River sand, quartz sand if possible, shall be used;
- The sieving curve of an optimum composition of aggregate, where an optimum is considered as meeting the required strength, good castability, i.e. cohesiveness of fresh concrete, with the content of cement mortar as low as possible, considering the given values for the amount of cement.
- Concrete admixtures:
Plasticizers may be used, but air entrainers and chloride-containing admixtures are not allowed, for special concrete mixes and constructions of major importance, the creep of concrete measured from the start of aging shall also be taken into consideration according to experimental tests, and in other cases according to the new Rules on technical measures and requirements for pre-stressed concrete and based on experimental tests.

All tests shall be completed to the satisfaction of the Engineer and all results shall be submitted for the approval of the Engineer.

8.3.6. Prefabricated concrete elements

Prefabricated concrete elements may be fabricated in a concrete plant, in a testing area, or on the site immediately next to the structure. They are arranged and mounted after the concrete reaches the strength required in the design.

Hardening of concrete (aside from hardening under usual conditions) may be speeded up by applying surface temperatures, with a damp environment as an obligatory condition, which prevents the evaporation of water and eliminates negative effects of the contraction of concrete (hydrothermal treatment, steam curing). In a proportionally short time this could help in releasing forms and moulds, and thus speed up the production of various elements (pre-stressed reinforced concrete girders, columns, gutters, kerbs, and so on). Concrete elements are fabricated applying this technological method according to a special schedule for this type of fabrication of concrete elements.

The following types of prefabricated concrete elements may be installed:

- Elements made of plain concrete,
- Elements made of reinforced concrete,
- Elements made of pre-stressed concrete.

When designing, fabricating and applying prefabricated concrete elements, the provisions of SRPS U.E3.050 and other standards and technical norms relevant for this area shall be observed, along with special requirements set out in the design.

Before starting the fabrication, the manufacturer of prefabricated concrete elements shall have the necessary design documents at his disposal, according to provisions of SRPS U.E3.050/84, namely as follows:

- a) Design of the prefabricated element.
- b) Production technology design, and
- c) Quality control programme.

Minimum allowed dimensions of reinforced and pre-stressed concrete elements and their parts, as well as types of joints between elements and their quality requirements, are all set out in SRPS U.E3.050/84.

8.3.6.1. Quality requirements for materials for production of prefabricated concrete elements
Only materials and parts for installations specified in technical norms, Yugoslav standards, and the design may be used for the production of prefabricated concrete elements.

8.3.6.1.1. Aggregate

Aggregate for concrete shall be in compliance with regulations for plain and reinforced concrete (Sub-Section 8.2.1 of these Technical Specifications).

Granulometric composition of aggregate shall be adjusted to reinforcement, installation elements, shape, dimensions, and function of the prefabricated concrete element, ensuring good castability, cohesiveness, and workability of fresh concrete.

The largest grains in an aggregate mix shall not be larger than:

- 1/3 of the smallest dimension of the element to be concreted,
- the smallest spacing between reinforcing rods in a horizontal row, taking into account the position of element during fabrication,
- 1/4 of the dimension of a linear element, of an approximately square or round cross-section.

8.3.6.1.2. Cement

Cement used for mixing concrete for plain and reinforced prefabricated concrete elements shall be in compliance with regulations for plain and reinforced concrete (Sub-Section 5.2.2.), and for pre-stressed concrete – with regulations for pre-stressed concrete.

If fresh concrete is technically treated in the production of prefabricated reinforced concrete elements (heating, steam curing, addition of steam to concrete during mixing, etc.), cement may be used only if prior experimental tests determine its suitability and its behaviour during thermal treatment.

High-alumina cement may be used only for plain, non-bearing prefabricated concrete elements, or for concrete for prefabricated reinforced concrete elements, provided that prior experimental tests show its suitability and an appropriate technology is elaborated.

All tests shall be completed to the satisfaction of the Engineer and all results shall be submitted for the approval of the Engineer.

8.3.6.1.3. Water

Water for mixing concrete shall meet the quality requirements for the respective type of concrete.

8.3.6.1.4. Concrete Admixtures

Concrete admixtures, for prefabricated elements made of plain and reinforced concrete, shall be in compliance with regulations for plain and reinforced concrete (Sub-Section 8.2.4. of these regulations), and for pre-stressed concretes – with regulations for pre-stressed concrete.

8.3.6.1.5. Concrete

Concrete shall be used for the production of prefabricated concrete elements only if prior experimental tests show that it possesses properties specified in the design, rules for plain and reinforced concrete, or rules for pre-stressed concrete, as well as other technical norms and Yugoslav standards relevant for this area.

The following shall apply for the quality of concrete and mortar:

- The quality of concrete shall be determined in the design of a prefabricated concrete element or construction, and shall be designated with the grade of concrete. The design may specify that concrete, aside from the designated grade, may also be designated for other properties (tensile strength, wear resistance, degree of water impermeability, frost resistance, resistance to aggressive impacts, etc.);
- Reinforced concrete in prefabricated concrete elements shall not be envisaged with the grade of concrete lower than MB-20, and for pre-stressed concrete – lower than MB-30;
- Concrete and fine-grained concrete mortar for the construction of load-bearing joints for prefabricated reinforced and pre-stressed concrete elements shall have at least the quality of concrete for elements that are to be joined together;
- The quality of cement mortar for sealing joints shall be defined in the design, but the grade of mortar shall not be lower than M-5.

A minimum amount of cement in 1 m³ of finished concrete shall be in accordance with the regulations for plain and reinforced concrete.

If a concrete mix has a maximum grain in aggregate of 16 mm in size, the amount of cement from the paragraph above shall be increased by at least 15%, and by 30% if a maximum grain in aggregate has 8 mm in size.

The quality of concrete is proven in the following ways:

- For concrete in prefabricated concrete elements, by determining the grade of concrete according to the rules for plain and reinforced concrete;
- For prefabricated pre-stressed concrete elements of less than 28 days of aging, the producer shall provide evidence, aside from the evidence for the grade of concrete, the quality of concrete for the age at which the elements are pre-stressed, on specimens kept under the same conditions under which the elements themselves were during fabrication;
- If the achieved grade of concrete installed in prefabricated concrete elements is lower than the required one, such elements shall not be used.

As an exception to the provision of the paragraph above, when the achieved grade of concrete for a prefabricated concrete element is higher than 70% of the designed grade of concrete, the Contractor may require that the actual state of quality of produced concrete elements is determined and that additional theoretic or experimental tests of produced elements are ensured. If such tests determine that the achieved quality of concrete meets the specified requirements, the Designer may allow the use of such elements. In all other cases, fabricated or installed elements cannot be used without a proper repair of elements, aimed at bringing them to the condition specified in the design.

All tests shall be completed to the satisfaction of the Engineer and all results shall be submitted for the approval of the Engineer.

8.3.6.1.6. Steel

Steel for reinforcement and pre-stressing may be used if it meets Yugoslav standards, regulations for plain and reinforced concrete, and regulations for pre-stressed concrete.

8.3.6.1.7. Grout

The compound for grouting pre-stressing cables shall be in compliance with SRPS U.E3.015 (Sub-Section 8.3.4. of these Technical Specifications).

8.3.6.1.8. Transport and storage of elements

Prefabricated elements shall be stored and transported in the position specified for their final installation. They shall be strutted or suspended only at places indicated on drawings and protected appropriately against damaging. Damaged elements, as well as those that do not meet the requirements set out in these Technical Specifications and requirements indicated on drawings shall be replaced by the Contractor, or repaired, if so allowed by the Engineer. All prefabricated elements shall be marked in a visible and durable way, in order to ensure a safe installation in accordance with the place and position specified on detailed drawings. Each element shall be marked with the date of fabrication. Within the concrete design, i.e. work plans, the Contractor shall submit to the Engineer, for his approval, the plans of facilities that show all workshops, the flow of work process, means of transport, and drawings of elements showing all additional supporting materials and tools.

8.3.6.1.9. Installation of Elements

The assembly of prefabricated concrete elements, as well as girders in spanning structures, shall be performed in accordance with the assembly design. According to Sub-Section 9, SRPS U.E3.050, the assembly design for prefabricated girders shall also contain the following parts:

- a) Technical description and assembly requirements
- b) Time schedule for assembly work
- c) Scaffolds plan with a structural analysis and drawings,
- d) List of equipment and devices for assembly work with defined technical and other characteristics,
- e) Study on safety-at-work measures.

The assembly design shall be subject to approval by the Engineer. Prestressed girders over a single span shall be of approximately the same age. The difference in age of adjacent girders shall not exceed 14 days. The storage period for prestressed girder shall not exceed 3 months from the date of concreting of the deck, i.e. parts of cross girders concreted with a pre-fabricated girder. If the schedule of works foresees the storage of girders for more than 3 months, they shall not be tensioned immediately after concreting, but not more than three months before installation. Machines and equipment that should be employed for the finishing works on the bridge shall not cause any overload or damage on any part of the structure. The Contractor shall be solely responsible for a smooth operation of all machines and equipment in all stages of construction.

8.3.6.1.10. Measurement

The same as for 8.10.4

8.3.6.1.11. Payment

The same as for 8.10.4.

8.3.6.2. Quality of Concrete for Prefabricated Elements

Quality of concrete for prefabricated concrete elements shall meet the requirements from the rules for plain and reinforced concrete, rules for pre-stressed concrete, and SRPS U.E3.050, as well as additional requirements, if specified in the design.

The allowed variations for finished prefabricated elements are as follows:

- For parapet elements and other pre-fabricated concrete elements according to Sub-Section 7.30, SRPS U.E30.050 for accuracy degree 1
- For dimensions of cross girders - not more than 5 mm
- For other measures of length - not more than 9 mm
- For variations from vertical sides - up to 6 mm
- For variations from direction - not more than 10 mm

8.3.6.3. Quality Control

The plant for prefabrication of concrete elements shall be equipped with a laboratory, according to SRPS U.M1.052, for the control of production performed by the manufacturer in compliance with SRPS U.M1.051 and SRPS U.E3.050.

The manufacturer of prefabricated concrete elements shall control components of concrete, concrete, and finished concrete elements according to the control programme.

When manufacturing prefabricated elements on the site or in the testing area, the manufacturer shall ensure the quality control in the site-based laboratory.

The production and quality control of prefabricated concrete elements shall be in compliance with the provisions of SRPS U.E3.050 and these Technical Specifications.

8.3.7. Production, Placement, and Curing of Concrete under Special Conditions

The placement of concrete into moulds or forms at ambient temperatures below +5°C or above -30°C shall be considered as concreting under special conditions. Special measures for protection of concrete shall be ensured for concreting under special conditions.

8.3.7.1. Requirements for Low Temperatures

Requirements and technology for the production, placement, and curing of concrete at ambient temperatures below +5°C shall be given in the concrete design, if the Contractor plans to execute concrete works at low temperatures.

8.3.7.1.1. Equipment

In plants where the production and placement of concrete at ambient temperatures below +5°C are envisaged, before first frosts it is necessary to prepare and check equipment and tools to be used for the production, placement, and curing of concrete at low temperatures.

8.3.7.1.2. Aggregate

Aggregate shall be resistant to frost, particularly for several freeze-thaw cycles. Aggregate shall not contain any organic impurities that slow down the hydration of cement. The use of frozen aggregate shall not be allowed.

Aggregate may be heated, but higher temperatures (above 15°C) shall be avoided due to non-uniform heating. If coarse-grained aggregate is dry, and without frozen portions, an adequate temperature of fresh concrete may be reached by increasing temperature of sand up to 40°C.

For the heating of aggregate, water vapour, circulating in pipes, cyclones or hot air sprayers may be used, and for works of smaller scope, aggregate may be heated carefully above a channel with fire maintained in it. If the vapour circulating in pipes is used, aggregate shall be covered with tarpaulin.

Vapour sprayers are not recommended for the heating of aggregate, because they may cause differences in the content of moist.

8.3.7.1.3. Cement

When selecting cement, highly active cements with a lower standard consistency and quicker release of hydration heat shall be given priority. As a rule, cement with added pozzolane shall not be used.

It is not allowed to heat cement at a higher temperature. Cement shall be stored in a dry storage place where temperatures are not below 0°C. Temperature of at least +5°C is favourable.

8.3.7.1.4. Water

Water for mixing concrete may be heated, most favourably up to +40°C, i.e. not more than +60°C if aggregate is not to be heated.

8.3.7.1.5. Concrete admixtures

Concrete admixtures shall not slow down the process of hydration at low temperatures, increase water-permeability of concrete, and corrosion of steel in concrete. Any action of admixtures on concrete shall be checked at the temperatures of +5°C and +20°C, foreseeing even a double amount for batching.

Accelerators for concrete or freezing-inhibitors for fresh concrete may be used. For reinforced and pre-stressed concrete the use of these admixtures is not allowed if they are chloride-based.

Before concreting it is necessary to ensure that all surfaces in contact with newly placed concrete shall be at a temperature (at least +2°C) that cannot cause the freezing of new concrete or prolong its hardening.

The Contractor for concrete works shall measure the temperature of concrete that is being placed at ambient temperatures below +5°C. The temperature of fresh concrete on the place of concreting shall be at least +6°C, and the most optimum temperature is about +11°C. Temperature shall be measured during the curing of newly placed concrete. Its temperature shall be measured on the surface, under the protective cover, and the inner temperature of concrete shall also be checked.

Recorded temperature data for ambient temperature and temperature of concrete shall clearly indicate temperature periods. The temperature list shall be enclosed with the work journal.

Aside from the application of thermo-insulating materials for the protection of fresh concrete against freezing, other methods to bring heat into fresh concrete during hardening: steam treatment, electrode heating, infra-red radiation, induction heating, etc. may be applied, provided that the applied method does not cause local overheating of concrete, drying out its surface.

Before the first freezing, concrete shall have at least 50% of the required strength. Concrete that will be exposed to freezing in use shall have the required strength after the first freezing, and concrete that will also be exposed to the action of de-icing salt at the same time, shall also have the required resistance to frost and de-icing salt.

When forms or thermal protection are to be removed on very cold days, concrete shall not be exposed to sudden cooling, and the outer surfaces of concrete shall be protected.

8.3.7.2. Requirements for High Temperatures

8.3.7.2.1. General

Requirements and technology for the production, placement, and curing of concrete at ambient temperatures above +30°C shall be given in the concrete design, if the Contractor plans to execute concrete works at high temperatures.

8.3.7.2.2. Protection of Materials

In concrete plants, materials shall be protected against overheating, and cooling shall be provided for concrete components, if needed.

Cement silos shall be painted white, or protected against sun heat with a suitable protective material.

8.3.7.2.3. Cooling

In concrete plants of higher output, it is possible to install facilities for cooling water to +4°C (chillers).

Aggregate storage boxes may be fitted with water sprinklers that cool aggregate fractions by fine sprinkling.

When concreting at high temperatures, the initial workability shall be determined according to a previously defined loss of workability during transport and construction.

8.3.7.2.4. Admixtures

If retarders or workability enhancers are used, their action shall be proved previously on specimens with the selected cement and expected temperature of concrete.

Cement and composition of concrete incorporated into massive elements shall be such that the temperature of concrete incorporated into the element shall not be above +65°C in any case. Otherwise, the measures for cooling concrete components or concrete in the element itself shall be taken.

8.3.7.2.5. Prevention of Drying Out

The Contractor shall particularly take measures to prevent the drying out of placed concrete by frequent watering or use of protective chemical agents.

8.3.7.3. Composition of Concrete

Components used for the production of concrete shall be in compliance with technical norms for plain and reinforced concrete/87 and appropriate Yugoslav standards.

8.4. Concrete Plants - Technical Requirements

8.4.1. Technical Requirements for Equipment in Concrete Plants

8.4.1.1. Requirements for Concrete Plants

Concrete plants shall be designed and equipped so that their methodology and scope gives them a functional capacity to produce B-II concrete, as specified in SRPS U.M1.050/87.

The production capacity of a concrete plant is the ability to accurately batch components of concrete mixes, homogenizing concrete mixes, and mixing an envisaged number of lots per unit of time. Devices used for the production of B-II concrete shall meet the requirements set out in SRPS U.M1.050/87. Concrete plants shall be equipped with all possible safety instruments and valves and ensure a precise operation of all instruments, excluding any errors and obstacles in the batching of basic materials (components), and in the mixing and handling of concrete.

Batchers for particular components of concrete shall be provided with compliance certificates issued by an authorized institution, the validity of which is one construction season (compliance certificates on calibration of scales).

8.4.1.2. Batching Accuracy

Particular basic materials shall be batched separately and by weight. The accuracy in batching cement, mixing water, and admixtures shall be at least $\pm 1\%$, and for particular aggregate fractions $\pm 3\%$. The protection against any tempering with the nominal batching by unauthorized persons shall be fully ensured.

8.4.1.3. Handling Fresh Concrete

Discharging concrete mixers, further handling and storage of fresh concrete in the concrete plant shall be performed so as to avoid segregation, drying, heating, cooling, or exposure of concrete to precipitation.

8.4.1.4. Batching Control

Concrete plants shall ensure the possibility of a quick comparison between the planned and actually batched basic material by means of certain batching instruments.

The nominal values for each batching shall be put up in a visible place.

8.4.1.5. Batching Admixtures for Concrete

Concrete plants shall necessarily be equipped with a batcher for simultaneous feeding of at least two current admixtures for concrete. The possibility of batching diluted admixtures shall be ensured, indirectly with mixing water.

8.4.1.6. Technical Requirements

Technical requirements for the production, testing, and quality assessment for B-II concretes produced in the concrete plant, from the moment of delivery of concrete mix to the user (Contractor) into the transport vehicle (mixer), are defined in SRPS U.M1.051/87. Provisions of this standard shall also be applied for transport concretes, regardless of their category.

8.4.1.7. Laboratory Equipment

A laboratory within the concrete plant (the obligation of the producer of fresh concrete) dealing with the testing of basic materials, properties of fresh and hardened B-II concrete (over concrete specimens), according to SRPS U.M1.051, shall have a minimum laboratory equipment as specified in SRPS U.M1.052/87.

8.5. Regular Control of Production, Handling, and Transport of Fresh Concrete

8.5.1. Preparation of Specimens

Starting from the requirement that from the phase of handling and transport of fresh concrete until the phase of its placement, any subsequent change in its composition, that is of its properties, shall not be allowed, the focus of control may be in the implementation of tests on fresh concrete specimens taken in concrete plants immediately after mixing concrete (at the place of concrete production).

A certain number out of the total number of particular tests by concrete lots shall be performed on concrete specimens taken at the place of incorporation, immediately before setting. The number of these tests shall be defined considering test results, devices, the system for handling and transport of concrete, the possibility of occurrence of impacts that would change the quality and homogeneity of fresh concrete.

A certain number out of the total number particular tests shall be performed on concrete specimens taken at the place of incorporation, immediately before setting (compliance control). The number of these tests shall be defined considering test results, devices, the system for handling and transport of concrete, the possibility of occurrence of impacts that would change the quality and homogeneity of fresh concrete, according to the defined concrete design for major structures.

Certain test specimens shall be taken randomly (once at some places). If several indicators (e.g. consistency, temperature, micro-pore content) are tested and/or measured, these tests/measurements shall be performed simultaneously on a once taken specimen from the same lot of concrete for each type and class. The size of specimen taken shall be appropriate for the tests. When dividing the sampled concrete into quantities needed for testing for particular indicators, the entire specimen taken from the same lot shall be homogenized well. Samples taken in concrete plants (on the place of production) shall refer to a specific mix, type, and class of concrete.

All tests shall be completed to the satisfaction of the Engineer and all results shall be submitted for the approval of the Engineer.

8.5.2. Specification for Regular Control of Fresh Concrete

The requirements for a minimum total number of results of measurement, for the assessment of values of certain indicators, and for maximum quantities of concrete that shall be tested, and requirements for size of specimens, and measurement methods, are given in compliance with PBAB/87 (Art. 43-44). When determining the total number of tests, a requirement specifying a larger number of tests shall always be met.

All tests shall be completed to the satisfaction of the Engineer and all results shall be submitted for the approval of the Engineer.

8.5.2.1. Consistency of Fresh Concrete

Consistency of fresh concrete shall be tested once every day, when concreting, for each class of concrete (MB) according to PBAB/87 (Art. 40) on the place of production, and, if needed, on the site of placement as well.

Required degrees of consistency, depending on the means of placement, shall be determined when designing concrete, and during trial placement. If consistency is not defined in the design, as a rule, concrete of wet consistency shall be used. Variation values shall depend on the composition of concrete, particularly on the degree of consistency and method of measurement that must be defined when designing concrete, or designing concrete for major structures, or based on experiments.

The least number of specimens shall be appropriate for the method of measurement. As a rule, the consistency of concrete shall be tested by slump test (Abrams cone - SRPS U.M8.050). If approved by the Engineer, the consistency of concrete may also be tested by a flow table test (SRPS U.M8.052), Vebe test (SRPS U.M8.054), or vibration-slump test (SRPS U.M8.056).

At the place of production of concrete (in the concrete plant), or at the site of placement, if needed or instructed by the Engineer, the time of setting of concrete mixes shall be determined (for grades of concrete that are used) by the penetration resistance method as set out in SRPS U.M1.019/81.

8.5.2.2. Preparation of Samples in Moulds and Testing for Certain Properties of Hardened Concrete

Specimens in moulds shall imply different samples prepared by casting fresh concrete into moulds (cubes, beams, prisms, cylinders), for each type and class of concrete. Fresh concrete shall be taken according to a system of samples in the concrete plant immediately after mixing (at the place of production) or at the site of placement (compliance control), if specifically required. The samples shall be stored in the laboratory, under specific conditions, as set out in the applicable standard SRPS U.M1.005/84. The tests on concrete specimens in moulds make an integral part of the regular control of production and handling, and are under responsibility of the producer of concrete, according to PBAB/87 (Art. 43) until the hand-over to the Contractor, and from the moment of taking over of fresh concrete, its transport and placement, under responsibility of the Contractor (PBAB/87 Art.44).

Fresh concrete for the preparation of specimens in moulds shall be taken along with the sampling for fresh concrete testing by lots, so that concrete placed into moulds is marked with all markers from Sub-Section 8.5.2.

All sampling and testing shall be subject to the approval of the Engineer.

8.5.3. Types of Tests

8.5.3.1. Types of Tests on Moulded Specimens

The laboratory of the producer of concrete shall take individual samples of fresh concrete by lot and prepare moulded specimens according to a special, previously prepared, detailed programme, concrete design, but so that they are uniformly distributed over the entire quantity of concrete the properties of which are under test.

All sampling and testing shall be subject to the approval of the Engineer.

For certain types of concrete, moulded specimens shall be tested for the following properties:

Compressive strength on test cubes, dim. 20x20x20 cm, after 28-day aging.

- The test shall be performed fully in compliance with PBAB/87 (Art. 46) and SRPS U.M1.020/78. To check the quality of produced concrete, the test on concrete specimens shall be performed every day when concrete is produced, from each type and class of concrete used on the specific date. Class of concrete (MB) shall be assessed by lot, in accordance with the control schedule, applying one of the specified criteria (PBAB/87, Art. 46).

Tensile strength (in special cases of tensile strength) by bending prisms, 10x10x40 cm (SRPS U.M1.010/57) or splitting cylinders, 15x30 cm or cubes (SRPS U.M1.022/81).

- This test shall refer to concrete pavements and be performed once per 500 m of finished pavement, or as specified in the design, or according to SRPS U.E3.020/87 (Art. 8).

For concrete pavements, it is also necessary to perform the control tests listed below on cylindrical specimens (kerns) taken from a finished pavement, at every 500 m at least, or when specified in the design:

1. Compressive strength, according to SRPS U.M1.040/78 and minimum tensile strength, according to SRPS U.M1.010/57,
2. Water impermeability, according to SRPS U.M1.015/78,
3. Water absorption of concrete, according to SRPS B.B8.010/80,
4. Abrasive wear resistance, according to SRPS B.B8.015/84,
5. Resistance to frost and salt, according to SRPS U.M1.055/84,
6. Frost resistance of concrete, according to SRPS U.M1.016/77, with a drop in strength and loss of bulk density, fully in accordance with Sub-Section 8.3.1.8. of these Technical Specifications.

8.5.3.2. Type of Tests on Moulded Specimens according to Age of Concrete (periodic tests of moulded specimens)

Tests specified under 8.5.3.1. shall be divided, in principle, by particular types and classes of concrete, as interpreted in Sub-Section 8.1.2.2., and selected by group and indicated according to the place of direct incorporation of concrete into structures, or parts thereof. For particular main types of concrete by lot, certain sets (groups) of indicators from Sub-Section 8.5.3.1. are tested, while observing the rules that, apart from those defined in Sub-Sections 8.5.3.1. - 8.5.3.1.5., the quality tests shall be conducted in full compliance with PBAB/87.

8.5.3.2.1. Concrete for Structures

- a) Compressive strength (Sub-Section 8.5.3.1 item 1.)
 - The principal term is 28 days, periodic preparation of samples
 - Additional, non-mandatory terms are: 7, 14, 90, and 365 days,
 - For concrete in pre-stressed constructions, aside from the test for strength after 28 days, it is also necessary to provide a proof at the age of prestressing, and at the time of cable tensioning and testing of the structure on specimens stored under the same conditions in which the construction and elements are;
- b) Freeze-thaw resistance (Sub-Section 8.5.3.1, item 6);
- c) The Engineer may instruct, for some structures, or parts thereof, the performance of tests for particular properties or groups of properties according to a special programme or Final Design, which will ensure the structural testing of the quality of concrete;
- d) All mentioned tests shall be performed by a suitably equipped laboratory or a qualified company registered for testing materials and constructions that shall be subject to the approval of the Engineer. Any additional tests shall be paid extra, according to conditions set out in the contract documents if instructed by the Engineer.

8.5.3.2.2. Sampling Test Cubes

If test cubes are sampled by lot in a sufficient number during the placement of concrete, but the requirement for the class of concrete is not met because a single result in the lot is lower than the lowest allowed strength (f_{min}), and the requirement for the arithmetic mean is met, and then, if the test cubes are sampled in a sufficient number, but the requirement for the class of concrete is not met, then if the number of sampled test cubes in a lot of concrete taken during the works is less than specified, but not less than 80% of the specified number, and the class of concrete cannot be proven, and if less than 80% of the specified number of tests cubes in a lot of concrete is taken, then the procedure of subsequent determination of compressive strength of incorporated concrete in the cylindrical shape, taken from the structure, shall be undertaken according to SRPS U.M1.048/85.

All tests shall be completed to the satisfaction of the Engineer and all results shall be submitted for the approval of the Engineer.

8.5.3.2.3. Subsequent Concrete Quality Test

A subsequent determination (testing) of concrete quality based on specimens taken from the structure may be performed by also applying one of non-destructive procedures (by a sclerometer or ultra-sound method).

8.5.3.2.4. Non-Destructive Concrete Quality Tests

The procedure of non-destructive concrete quality testing shall be applied only in combination with the extraction and testing of concrete specimens from the structure.

8.5.3.2.5. Sclerometer Test for Quality of Concrete

The determination of concrete quality (in a non-destructive way) by a sclerometer test for "determining a sclerometer index and calibration curve" can be specified in compliance with SRPS U.M1.041/86.

8.5.3.2.6. Ultra-Sound Test for Quality of Concrete

The determination of concrete quality (in a non-destructive way) by a method for "determining the speed of ultra-sound and calibration curve" can also be specified in compliance with SRPS U.M1.042/87.

8.5.3.3. Other Tests

If the Designer or Investor also requires, within the Contract, other tests that are not foreseen in these Technical Specifications, as instructed by the Engineer, the Contractor shall conduct these tests. Also, all tests required in the applicable PBAB/87, but not covered in these Technical Specifications, shall be performed by the Contractor or another related institution approved by the Engineer, depending on whether these are pre-tests or regular tests, and whether the Engineer orders such tests or not. These tests too shall not be paid extra unless otherwise agreed by the Engineer.

8.5.3.4. Transport of Fresh Concrete

8.5.3.4.1. General

Transport of fresh concrete from the concrete plant, where concrete mix is prepared, to the site of placement, shall be performed in compliance with technical requirements set out in SRPS U.M1.045/87.

8.5.3.4.2. Transport and Handling

Transport and handling of fresh concrete from the place of mixing in the concrete plant to the site of placement into the structure shall be such that fresh concrete keeps the designed composition and required properties.

8.5.3.4.3. Type and Method of Transport and Handling

The type and method of transport and handling of fresh concrete shall be selected so as to provide as fast and simple transport of fresh concrete as possible, from the place of mixing to the site of placement, while keeping the homogeneity of concrete mix. In the concrete plant, at the place of production, before transporting fresh concrete, it is necessary to determine the time of setting for concrete mixes for all used grades of concrete, by the penetration resistance test according to SRPS U.M1.019/81. Fresh concrete shall be transported mechanically from the concrete plant to the site. On the site, when incorporating concrete into a structure, or element, fresh concrete may be transferred and moved with shovels, wheel-barrows, carts, tipping wagons, mechanical pumps, tower cranes, cable cranes, etc. Shovels shall be used to transfer smaller quantities of fresh concrete from platforms into forms and for homogenizing and removal of concrete from other means of transport. Wheel-barrows shall be used to transfer concrete to distances up to 30 m', and carts for up to 100m'. If the distance is greater than 150m', fresh concrete shall be stirred - homogenized - with shovels before placement.

8.5.3.4.4. Transport

The following vehicles may be used to transport fresh concrete from the concrete plant to the site of placement:

- A vehicle with a stirrer for concrete mix;
- A truck mixer, provided that the mixer rotates and stirs concrete mass at a reduced speed, as determined by the manufacturer;
- A vehicle without a stirrer for concrete mix, designed so that the vessel in which concrete mix is transported has smooth inside surfaces, is impermeable to water, and ensures that concrete mix is discharged easy and uniformly enough.

8.5.3.4.5. Transport Time

Concrete mix shall be poured out of the transport vehicle within not more than two hours from the moment when water is batched in the concrete plant, if the transport is performed in a vehicle with a stirrer for concrete mass, and within not more than one hour if the transport is performed in a vehicle without a stirrer. The transport may last longer than that if the weather is cold, and when a retarder is added to concrete, but this shall be previously determined experimentally. Adding water during the transport of concrete mass shall not be allowed.

8.5.3.4.6. Feeding Admixtures into Mixers or Vehicles

Exceptionally, if the consistency of delivered fresh concrete on the site of placement would not allow a good compaction of concrete before its placement, it is allowed to add a super-plasticizer directly into the vehicle – mixer, under conditions specified in SRPS U.M1.045/87 subject to the prior approval of the Engineer.

8.5.3.4.7. Temperature of Concrete on Site of Placement

The temperature of concrete during the discharge of concrete mass out of the vehicle shall neither be higher than 30°C, nor lower than +5°C. In cold weather (below +5°C), a higher temperature of concrete than +5°C may be required. Each delivery of concrete mass shall be accompanied with a pertaining data sheet in compliance with SRPS U.M1.045/87

8.5.3.4.8. Control on Site of Placement

Concrete mass delivered to the site shall be under constant control. At the place of discharge from transport equipment, i.e. at the site of placement of concrete, the Contractor for concrete works shall record data on typical properties of concrete and transport duration time. The consistency of concrete shall be checked visually, and measured with the slump test at least for each delivery for which this measurement is performed during the loading of vehicles, i.e. at least once in each shift, and it shall be in line with the consistency specified in the design. On the site, as needed and if specified in the design of the structure, the amount of entrained air shall be checked according to SRPS U.M1.031 and the temperature of concrete mass according to SRPS U.M1.032 at least once in every shift. Numbers of pertaining sheets and results of all tests performed on the site shall be entered into the Building Journal.

8.6. Placement of Fresh Concrete

8.6.1 Constant Operation of Concrete Plant, concrete Schedule, Commencement and Termination of Concrete Works

8.6.1.1. Site Organization and Equipment

The site organization and equipment shall be appropriate for the constant operation of the concrete plant. The constant operation of the concrete plant implies the possibility of non-stop day and night concreting, at ambient temperatures above +5°C without relevant protective measures.

8.6.1.2. Back-Up Equipment

The plant shall be provided with a back-up power generator set for the generation of power, back-up compressors for pneumatic devices and machines, equipment for the protection of concrete against unfavourable weather conditions, a sufficient number of generator sets for achieving the cohesiveness of concrete and secure supply, and other needed materials.

8.6.1.3. Concreting Schedule

Before setting to concrete each particular section or part of the structure, the Contractor shall prepare a concreting schedule every time.

The concreting schedule, or concrete design, shall show the entire operation system for the plant, i.e. preparation, handling, transport, and placement of concrete with respect to scaffolds and forms, and its protection against unfavourable weather conditions while being handled during and after the placement.

The schedule shall give the actual quantity of placed concrete and a computational proof that the concrete plant has sufficient capacities regarding all requirements, i.e. those that determine a minimum speed of progress in the incorporation of concrete into the structure.

The schedule shall also show the number and composition, by area of expertise, of the Contractor's work groups, with the names of managers in charge of the works under construction.

The schedule shall also show the composition of concrete mix, trial mix, designed according to the requirements set out in 8.3.2

8.6.1.4. Commencement of Works

The Contractor may start concreting when the Engineer confirms, by an entry made in the Building Journal, that he has accepted the condition of bedding, scaffolds, forms, and reinforcement, and approved the concreting schedule.

8.6.1.5. Suspension of Works

If the Engineer identifies that the requirements, design, or Technical Specifications have not been met, he may unconditionally suspend the concrete work and order the elimination of inadequate portions of concrete from the works. In such case, all requirements for construction joints shall be met.

8.6.2 Timber formwork and scaffolds

8.6.2.1. Technical requirements for all types of timber formwork and scaffolds

The technical requirements for design, erection, use, and maintenance of elements and constructions of supporting formwork and scaffolds made of timber and wood products in construction industry, shall be determined according to SRPS U.C9.400/84 and technical regulations PBAB (Art. 242-249). This standard does not apply to scaffolds made of steel tubes and sections, that, too, can be used for scaffolds for which a special design is prepared. Formwork consists of form surfaces made of planks or prefabricated plates, and a system of beams, posts and braces over which the load imposed on formwork is transferred to scaffolds. Although both formwork and scaffolds are temporary constructions, the stability of scaffolds and formwork shall be calculated in accordance with all acknowledged principles and usual rules of structural engineering. The quality of timber used for scaffolds and formwork shall be in compliance with SRPS U.D0.001. Round and sawn timber is used for scaffolds. For formwork, aside from planks, veneer panels, plywood panels, and similar materials may also be used. The quality of fittings used for the erection of formwork and scaffolds shall be in compliance with SRPS U.C9.200.

8.6.2.1.1. Formwork Design

All formwork plain and reinforced concrete shall be made according to measures given in the design. The Contractor shall prepare a design for every formwork, unless it is given within the Final Design of the structure, and if the Contractor cannot implement the given design with

available equipment and technology, the Contractor's alternative design shall be subject to the approval of the Engineer. For formwork for visible concrete surfaces, it is necessary to meet special requirements that shall be given in the design of the structure.

8.6.2.1.2. Quality of Formwork

Formwork shall be tightly sealed to prevent any leach and bleed of cement – sand mortar out of fresh concrete. Only materials without harmful effects on the hydration of cement and those that cannot stain the surface of concrete may be used to seal formwork.

8.6.2.1.3. Strutting and Anchoring Formwork

Formwork shall be strutted and anchored so as to prevent any later deformation or displacement due to the pressure of fresh concrete and dynamic impacts during concreting. The stability and load-bearing capacity of scaffolds and formwork shall be proven in the design by a structural analysis and ensure such security and rigidity that they can receive loads and impacts that occur during the works without settlement and harmful deformations, and that the safety of workers and any traffic on scaffolds is ensured.

8.6.2.1.4. Preparation of Formwork

Formwork that absorbs water shall be prepared before concreting so that they do not take water from concrete (sprayed with water or protected with appropriate coating).

8.6.2.1.5. Coatings for Formwork

Formwork and coatings for formwork shall not affect the hue of concrete surfaces. Coatings for formwork shall not interact chemically with concrete, nor have any harmful effect on the quality of concrete.

8.6.2.1.6. Removal of Formwork

For starting the removal of formwork for concrete that sets under normal temperature conditions (the lowest temperature of concrete above +5°C), the following general requirements shall apply:

- Formwork may be removed only when placed concrete reaches required hardness as specified in the design or concrete design.
- For pre-stressed constructions, the design shall give special instructions for the removal of formwork.

8.6.2.1.7. Fixing Formwork

The use of woven wire fittings for fixing formwork shall not be allowed. All metal elements for anchoring, tensioning, and fixing formwork shall be made so that each piece that stays in concrete, and may rust, i.e. oxidise, shall be removed, and then covered with a layer of cement mortar, at least 2 cm thick, or protected in another appropriate way, i.e. that cement mortar is incorporated in concrete mass. All crosswise anchors shall be fitted with adjusting heads that can be used for post-tensioning, and can be removed after concreting without damaging concrete.

Openings from which anchors, or adjusting heads, are taken out, shall be carefully filled with fresh concrete to be water-impermeable. For visible concrete surfaces, the arrangement of anchor holes and method of dressing them shall be appropriate technologically and visually for visible concrete.

8.6.2.1.8. Cleaning Formwork

Formwork shall be cleaned thoroughly before each use. In cold periods, formwork shall be cleaned from snow, stuck mud and ice without fail, and subject to the approval of the Engineer.

8.6.2.2. Requirements for Erection of Formwork for Concrete Edge strips and Carriageways

As a rule, according to the technology of construction, concrete pavement of roads is constructed according to the system that carriageways are limited with edge strips on both sides, or limited with edge strips on one side, and a lane for other purposes on one side. Considering the significance of traffic volume, i.e. different capabilities of concrete and asphalt traffic-ridden surfaces under different temperature conditions, a combination of parallel asphalt and concrete strips on a carriageway shall not be allowed.

When constructing a concrete carriageway, as a rule, edge strips and lanes for other purposes shall be concreted first, since they serve as formwork when concreting the carriageway, i.e. as a base for running the finisher. In exceptional cases, carriageways are concreted using other special formwork or road forms.

Formwork for edge strips or secondary lanes may be erected with special forms or road forms. All lanes and carriageways shall be concrete using finishers. This requires adequately erected systems of steel forms, i.e. road forms and slip forms. For concreting places where concreting with finishers is technically impossible, the Contractor shall submit to the Engineer for approval a proposed technical solution for concreting in such places and erection of formwork.

The evenness of upper edges of road forms and slip forms shall ensure that the requirements for evenness of concrete surfaces are achieved. The variation of form edges from the designed horizontal direction may be max. 10cm. This variation shall occur only on continuous unbroken curves, so as not to be noticeable visually. On curves of radius smaller than 2000 m, only specifically designed systems of forms, road forms, or slip forms may be used, to exclude any visible broken lines, and obtain a proper, designed curve.

Formwork, road forms, and slip forms shall be structurally fabricated and placed in such way that their stability in all directions is ensured without fail, that completely clean and smooth surfaces are obtained in full thickness of concrete, and that there is no possibility of leakage of fresh concrete, or leaching of fine cement mortar out of fresh concrete through joints or below formwork. The Contractor shall submit to the Engineer, in due time - before the commencement of concrete works, documents that prove the degree of usability of the foreseen formwork system, and the good condition of road forms and slip forms. In case of inadequate formwork, the Engineer may, before and during the works, order the replacement of, or structural addition to the entire system of formwork, road forms, or slip forms, but before the commencement of concreting.

The placed concrete on which rails are placed shall be loaded with vehicles at the age of concrete at which its required strength of at least 70% of the required class of concrete is reached. The rails shall prevent any local traffic overloading of concrete (according to Sub-Section 8.6.8.3.).

Formwork, road forms, and slip forms, shall ensure concreting in the length for at least 3-day work, and in no case less than 1000 m of pavement. Formwork removal is subject to the requirement that it shall not damage concrete, which is ensured by achieving 30% of specified hardness.



8.6.3. Construction Joints

8.6.3.1. Construction Joints on Structures

Construction joints are considered water-impermeable joints between fresh concrete and hardened (old) concrete, while meeting the requirement of good adhesion of both concretes.

The places of construction joints, their execution and continued concreting on structures shall be foreseen in advance in the design.

Manual or mechanical bush-hammering of hardened concrete surfaces at construction joints, in order to prepare them for resumed concreting with fresh concrete, shall not be allowed.

Everywhere where the design specifies that surfaces of placed concrete shall be roughened for horizontal joints, and where this is possible for all other joints, the surfaces shall be washed and cleaned under high pressure with a mixture of air and water. That type of treatment of construction joints shall be performed several hours after concreting, when concrete reaches a required degree of hardness. During such treatment it is necessary to ensure that dirt from washed concrete is not thrown onto other concrete surfaces.

The surfaces of construction joints that are impossible to treat in the above-mentioned ways shall be treated by sand-blasting or other appropriate procedures, as specified by the Designer.

After the treatment, the surfaces of works joints shall be cured, i.e. protected against drying out, and in cold periods against frost-induced damages, which generally applies to all exposed surfaces of placed concrete (covered in Sub-Section 8.6.8.). The surfaces of construction joints shall be protected against any contamination.

Before applying fresh concrete on a hardened surface of a construction joint, it shall be cleaned thoroughly by blowing out. Surfaces shall be wetted to a minimum degree ("matt surfaces").

When placing fresh concrete over hardened concrete that still has side forms unremoved, any leakage of cement-sand mortar into joints between the forms and the surface of hardened concrete shall be prevented.

Other ways of making construction joints are allowed as well (using special resin coatings, etc. combined with pre-stressing), but such joints shall be checked with pre-tests.

8.6.3.2. Construction joints on Roadway

When concreting particular lanes or carriageways, construction joints shall be divided according to places specified in the design for the construction of visible joints, and which are considered as control joints according to Sub-Section 8.6.4.2.

Construction joints shall be shaped as dowelled 'dummy' joints, later sawn, like other crosswise visible joints.

Construction joints shall be protected against mechanical damages, drying out, and in cold weather periods, they shall also be thermally protected.

8.6.4. Control Joints

8.6.4.1. General

Control joints are considered to be 'dummy' or spaced joints of two or several mutually non-connected parts based on hydration adhesion.

Control joints on structures shall be covered in the design. The work shall be executed in compliance with the design requirements.

8.6.4.2. Control Joints on Roadway

All longitudinal joints between particular pavement slabs, and all longitudinal and crosswise, subsequently sawn visual joints, shall be executed as dry control joints.

All joints on roadway shall be water-impermeable and constructed according to the design.

The construction of joints shall ensure the same properties of hardened concrete in the zone of edges, as on other road surfaces. The required evenness of concrete surfaces and joints themselves, and their uniform sawing shall be ensured.

The water-impermeability of all joints in the upper portion of concrete that will be finished as sawn and sealed shall be achieved in the way and with compounds as specified in Sub-Section 8.6.6. of these Technical Specifications.

When sawing at sealing joints between two concretes cast in two different phases, the cut shall match the actual interface, so that the joint is sawn in both parts of concrete.

All cut joints shall be saw-cut in due time using appropriate machines for cutting in concrete, and protected, until filling with sealants, against mechanical damage, drying of concrete from early phases of concrete hardening, or any other dirt or effects that would reduce the adhesion of a sealant to concrete.

The joint saw-cutting schedule shall follow the concrete placement schedule without fail. Saw-cutting shall be performed in such time intervals, after concrete placement, that irregular cracking is prevented, but the strength of concrete shall be such that concrete is not damaged when saw-cutting the edges of joints.

The 6m spacing of crosswise visual joints is envisaged on all carriageways, or as specified in the design.

On edge strips, the spacing of crosswise visual joints shall be half of the length of paving concrete slabs. For concrete edge strips at an asphalt roadway, the spacing of crosswise visual joints may be up to 5 m, or as specified in the design.

Coatings applied before additional concreting to vertical sides of hardened (old) concrete, for the adhesion of the newly concreted part, shall be applied in a particularly careful manner and in conformity with the design requirements.

Before applying coatings, any defective places on vertical surfaces shall be repaired with mortars that are adequate for the patching of concrete surfaces.

All joints in a pavement structure, except for crosswise visual joints of edge strips, shall be dowelled. In places where edge strips are exposed to traffic load, the crosswise visual joints of edge strips shall be dowelled, too.

Tying with dowels shall be performed in accordance with the design requirements and requirements set out in Sub-Section 4.5. of these Technical Specifications, and/or SRPS U.E3.020/87.

- 8.6.5. Visual Concrete Surfaces on Structures ("visual concretes")
When designing visible concrete surfaces, it is necessary to take care of special technological requirements for the preparation of formwork and joints, and preparation and placement of concrete.
All proposals for preparations shall be submitted to the Engineer for approval.
- 8.6.5.1. Experimental Model
For visual concrete, it is necessary to design a required experimentally developed model that the Contractor shall prepare before the commencement of works, and that will show the texture and visual effect of the surface, where the macro-geometry and micro-geometry of surface visibility is primarily conditioned by the type and structure of formwork.
- 8.6.5.2. Compaction and Stability of Formwork
Dense compaction and stability of formwork shall be ensured without fail.
- 8.6.5.3. Composition of Fresh Concrete
The composition of fresh concrete for visible surfaces shall be determined experimentally, with basic materials specified for use (cement, aggregate, concrete admixtures, pigments, etc.), while meeting structural and technological-rheological requirements.
- 8.6.5.4. Hardened Concrete
Visible concrete, once hardened, shall be water impermeable, resistant to leaching, carbonation, and other chemical impacts, and resistant to freezing/thawing, and industrial de-icing salts for concrete surfaces. Particular visible surfaces that make a whole shall be of uniform texture and the same colour.
- 8.6.5.5. Selection of Materials
For the execution of this type of concrete works, the Contractor shall select materials and, either in the design or concrete design, elaborate in full detail production-technology requirements and instructions to be submitted for approval by the Engineer.
- 8.6.6. Placement of Fresh Concrete and Regular Control
- 8.6.6.1. Composition and Castability of Fresh Concrete
After every concreting, the Contractor shall present to the Engineer a proof of a properly selected composition of fresh concrete, designed in compliance with Sub-Section 8.3.2., and on its favourable castability with available equipment for the placement of concrete. The equipment for placement of concrete shall be adequate for the properties of concrete and formwork, so that the required cohesiveness may be achieved.

For every composition of fresh concrete and every concrete placement procedure, before the initial commencement of concreting, the Contractor shall execute a test-trial concreting.

If the trial concreting is executed on the structure itself, i.e. scaffolds of the structure, the required quality of placed concrete shall be achieved; otherwise, the Contractor shall remove the concrete at his own expense.
- 8.6.6.2. General Requirements for Placement, i.e. for Achieving Cohesiveness of Fresh Concrete
Concrete shall be placed in a systematic and planned manner, without fail, according to a programme prepared in advance and selected system, as specified in Sub-Section 8.6.1.3. and subject to the approval of the Engineer.

A maximum heterogeneity of density, expressed as standard deviation, may be 0.04 kg/dm³ of placed concrete, unless otherwise specified in these Specifications.

Every started concrete section or structural part or element of the structure shall be concreted continuously in the initiated scope, as specified in the concreting programme, regardless of working hours, and also in case of sudden weather changes, or exclusion of certain sections of machines from operation. For that purpose, the site shall be equipped as required in Sub-Sections 8.6.1.1. and 8.6.1.2.

In case of unavoidable (unforeseeable according to the concreting programme) termination of concreting, concreting shall be ended so that it is possible (at the place of terminated work) to create a structurally and technologically proper construction joint. The formation of such construction joint is possible only upon the Engineer's approval, but according to the method specified in the technical description of the project.

The initial temperature of freshly placed concrete shall be at least +7°C during concreting. If the ambient air temperature is below -5°C or above +30°C, all measures for the normal setting of concrete shall be taken.

A maximum temperature of concrete, not placed according to a special procedure, for a higher grade of tempered concrete, shall not be higher than +24°C, and for slow-setting cements not higher than +30°C.

For special concreting (e.g. submerged concreting, shotcreting, pre-packed concrete, vacuuming, pumping, etc), special procedures for the placement of concrete shall be applied, and these shall be treated in accordance with Sub-Section 8.6.1.3., and also according to the programme from Sub-Section 8.6.1.3. in terms of Sub-Section 8.3.5.

When placing concrete, all requirements from Sub-Section 8.3.2.2. shall be met.

Fresh concrete shall be placed by vibration in layers 30-50 cm thick.

Particular successively concreted joints of concrete shall be bonded well with previous, lower layers by vibration. If a previous, lower layer of concrete is not able to receive vibration treatment any longer, the joint between that layer and the next layer shall be treated, i.e. a construction joint shall be formed according to Sub-Section 8.6.3.

Spreading of concrete case into formwork in layers, according to the vibration method (e.g. with vibrators) shall not be allowed. When vibrating spread concrete in layer, its creep shall be avoided.

8.6.6.3. Requirements for Placement and Compaction of Fresh Concrete in Pavement Structures

The placement of fresh concrete for all strips and lanes of pavement structure shall be performed using previously tested high-frequency compression-vibration pavers.

Every layer of concrete shall be compacted with at least two runs of a paver. Based on measured visual findings, the Engineer may, to ensure reaching the required degree of cohesiveness of concrete, order a larger number of runs at the Contractor's expense.

For two-layer placement, full adhesion of both layers shall be ensured. The lower layer shall be protected against drying out and other weather impacts until the placement of the upper layer.

Placement and spreading of concrete in front of the paver shall be done mechanically.

Before placement, each layer to be placed and spread separately, shall be levelled mechanically with appropriate levelling devices that work separately or are mounted on the paver, but shall run over the entire width in which concrete shall be placed.

If fresh concrete spread in front of the paver is dried out or exposed to precipitation, it shall not be incorporated in the pavement structure. The Contractor shall remove such concrete from the pavement structure at his own expense.

In case of any storing of concrete on the site of placement before regular application, concrete may be deposited on special platforms or in silos, and be protected against mixing and weather impacts.

After the last compacting run of the paver, the concrete surfaces shall be closed. This shall be done in compliance with requirements set out in Section 10. of these Technical Specifications.

Hand repair of defective surfaces or any strengthening of concrete shall not be allowed.

The surface of concrete on particular lanes, compacted with the paver, shall be treated with special high-frequency vibration plates.

After such surface treatment, the necessary geometry requirements set out in Sub-Section 4.5. of these Technical Specifications shall be met.

The surface treatment of concrete according to Sub-Section 8.6.6.3.8. shall not cause additional surface bleeding of cement-sand mortar.

Subsequent repair of traffic-ridden concrete surfaces in hardened condition shall not be allowed.

For smaller or irregular surfaces of pavement structures, where handling paver is impossible, it is allowed to spread concrete manually and compact it with high-frequency vibrating plates.

All strips and lanes of the pavement structure shall have markers in large letters. Slabs of particular carriageways shall be numbered in increasing order so that the opposite numbers on the carriageway shall be identical. Edge strips that have half of the slab length shall, too, be marked with slab numbers, with letters "A" and "B" added. On an asphalt pavement structure, concrete edge strips shall have their own designation. Every beginning and end of daily production shall be marked with the main marker for the lane (large letters and date). The duration of a one-day production is considered to be 24 hours, with the work shift starting in the morning. The marking shall be impressed into fresh concrete to the depth of at least 8 mm. The Contractor shall perform marking at his own expense. The shape and place of markings shall be determined by the Contractor and submitted for the approval of the Engineer.

Along with decisions from Sub-Section 8.6.6.3. that are general for the placement of fresh concrete into the pavement structure, all other related decisions, particularly the decisions set out in Sub-Sections 8.6.1. - 8.6.3., and Sub-Sections 8.3. and 8.5. of these Technical Specifications shall apply.

8.6.6.4. Regular Control of Placement of Fresh Concrete

The regular control of placement of fresh concrete shall be performed continually – visually and by measurement, applying all criteria and detailed requirements specified under particular items of works in these Technical Specifications and subject to the approval of the Engineer.

The visual control of measurement shall be continually performed by the Contractor's appropriate qualified personnel.

The control of measurement shall include statistical examination and determination of the following properties (characteristics) in particular:

- Density and moisture of placed concrete;
- Temperature of concrete, sub-base, and air, and relative air humidity;
- Special technical measurements, such as: evenness of pavement surface, thickness of concrete layers placed in the pavement structure, evenness of edges, and a general control of measures, geometric requirements that apply for particular structures.

Density and moisture of placed concrete

- Measurement method: with radioactive isotopes or properly conducted volumetric method;
- Criteria for conducting measurements:

When concreting all strips and lanes, measurements shall be conducted continuously, as a rule, on every separate compacted layer. The Engineer shall also order that such measurements be carried out on every other structure where this is technically required and feasible. The measurement of density and moisture of placed concrete shall be conducted in terms of prevention and control. Lots of concrete determined, by measurements, not to be of nominal density, or to exceed a maximum moisture degree, shall be compressed and corrected by decompression by appropriate measures, or removed, eliminated, from the structure or any part thereof. New measurements shall prove that corrective measures were successful.

When concreting carriageways, parking lanes, or other lanes, at least one measurement shall be performed on not more than 50 m², and when concreting edge strips - not more than 10 m², or as specified in the design for each separately compacted layer of concrete. On traffic-riden and other lanes, points of measurement shall be distributed so that limit and mean ranges of the strips are tested. Frequency and places of measurements on structures are determined and measurements are performed in the Engineer's presence. And subject to the approval of the Engineer.

The measurement of temperature of concrete, base, temperature and relative air humidity during the placement, shall be performed continually, at least three times a day when concreting pavement structure.

The Contractor shall (for the sake of control) conduct and organize, before, during, and after placement, all necessary regular and particular measurements, check whether the geometric requirements set out in the design and technical specifications are achieved, and whether measurements are conducted for the implementation of any corrections that may be needed, and shall submit all measurements for the approval of the Engineer.

When concreting pavement structures, the Contractor shall constantly perform measurement controls, particularly in order to meet requirements from Sub-Sections 8.6.2.2 and Section 10 of these Technical Specifications all to the satisfaction and approval of the Engineer.

8.6.7. Subsequent Treatment of Placed Concrete

After placing fresh concrete into the structure or pavement, the Contractor shall perform all subsequent treatments in properly selected time intervals as set out in these Specifications or design.

Concrete surfaces of construction joints shall be treated by the Contractor as shown under 8.6.3

The Contractor shall treat the "texture" of all surfaces of pavement structure according to the "brushing" procedure, in a crosswise direction with respect to the roadway centre line.

The Engineer may stipulate other methods for surface treatment of pavement structure as well, as agreed with the Contractor, and the Contractor shall implement them at his own expense.

8.6.8. Curing and Protection of Placed Concrete against Weather and Other Conditions

Immediately after concreting pavement, concrete shall be protected against:

- Rapid drying,
- Rapid transmission of heat between concrete and the base and concrete and the air,
- Precipitation (weather conditions)
- High and low temperatures,
- Vibrations (traffic-induced and other) that may also change the inner structure and adhesion of concrete and reinforcement, and other mechanical damages at the time of setting and initial hardening.

8.6.8.1. Protection of Concrete against Drying Out

Concrete pavement shall be protected after placement in order to ensure satisfactory hydration on its surface and avoid damages due to early and rapid shrinkage.

The Contractor shall protect the placed concrete against drying out with a wet procedure, or the procedure of closing up concrete surfaces by spraying them with chemical agents that shall be tested before use in an institution for that type of activity.

The protection of concrete against drying out shall be effective as early as in the first hours from the placement of concrete, as soon as the concrete surface condition permits. The effectiveness of protection shall last for at least 7 days for engineering structures, and at least 21 days for pavement structures. Immediately after placement, concrete shall be protected against sun and precipitation.

Immediately after placement and surface finishing, until curing, concrete for pavement structures shall be covered with protective materials, closed and water-impermeable roofs of light colour, protecting it against drying out.

For wet curing of concrete in pavement structures, previously thoroughly wetted concrete shall be immediately, when permitted by its degree of hardening, covered with appropriate covers that need to be kept moist until its 7-day age. In the period from day 7 to day 21, concrete surfaces shall be kept moist constantly, i.e. until concrete reaches 60% of its foreseen grade.

When protecting concrete cast in pavement structures against drying by spraying it with chemical agent, it is necessary to take care that such agents can be applied to concrete surfaces as soon as concrete becomes "matt".

The use of spray-on chemical agents shall be allowed in accordance with 8.2.5.

The duration of effective protection of concrete surfaces by sprayed chemical agents shall be, under any weather conditions, at least 21 days. This shall be proved by prior compliance tests and regular controls which shall be submitted for the approval of the Engineer.

A regular control of effective protection of concrete by sprayed chemical agents shall be performed by measuring the moist level of hardening concrete. The control measurements shall be carried out on all concrete surfaces, for the entire period for which the duration of effective protection is specified. If the protection of concrete by sprayed chemical agents is shown to be of less than sufficient effectiveness, concrete shall still be cured according to the wet curing procedure.

Spray-on chemical agents shall not have a harmful impact on the quality of concrete in any way, nor shall they affect the colour of concrete surface. Before paint marking concrete surfaces of the pavement structure, a chemically created film shall be removed completely.

If spray-on chemicals are also used for the protection of joints saw-cut in concrete, they shall not decrease the adhesion of joint fillers to concrete.

Chemicals shall be sprayed on concrete surfaces uniformly and in a specified amount, by fine sprinkling, in accordance with instructions of the manufacturer of the spray-on chemicals.

The work section of a concreted strip, or "duty" for pavement structures, which end every day, shall be marked particularly visibly with signboards showing the day of concreting. These boards may be removed only after the curing of concrete against drying ends.

8.6.8.2. Protection of Placed Concrete Against Cooling and Freezing

In cold intervals, the Contractor shall protect placed concrete thermally by an adequate procedure.

Considering regional climatic conditions, for every concreting in the period when a drop in temperature below +5°C may be expected, the Contractor shall have a sufficient amount of adequate agents for thermal protection of the base layer and placed concrete.

8.6.8.3. Protection of Placed Concrete Against Mechanical Damages and Dirt

The Contractor shall properly protect every placed and hardened concrete against any mechanical damages.

For the protection of all construction and control joints in the pavement structure, decisions from Sub-Sections 8.6.3.1., 8.6.3.2., and 8.6.4.2 shall apply.

In principle, the pavement structure may be burdened with traffic load, only after the Engineer's prior written approval, as specified in Section 10 of these Technical Specifications. For loading concrete with guided working vehicles, general decisions from Sub-Section 8.6.2.2. shall apply, but the loading possibility shall be proven based on performed tests of achieved strength of concrete and calculated estimate of load-bearing capacity. Before loading the pavement structure with other lighter transport vehicles, at least 70% mechanical strength of the required grade of concrete shall be reached. Before loading with heavier vehicles, 100% mechanical strength of the required grade of concrete shall be reached. The pavement may be loaded with tracked and other vehicles the weight of which on the pavement is not transferred over rubber tracks, only with special safety measures and subject to the Engineer's approval.

After finished after-treatment of pavement surface, the Contractor shall keep it clean until the final handover of pavement to the Investor or user of services.

8.7. Testing Achieved Quality of Hardened Concrete and Taking Over of Structure or Its Parts

8.7.1. General Provisions

The achieved quality of hardened concrete shall be controlled and established by "destructive" and "non-destructive" tests on moulded specimens, and by direct tests and measurements of structures, i.e. by assessing the achieved grade of concrete by lots according to PBAB/87 (Art. 46), or SRPS U.MJ.048/85, SRPS U.MJ.041/86, and SRPS U.MJ.042/84.

The tests shall be organized and conducted, and their results assessed according to all requirements set out in these Technical Specifications and applicable PBAB/87 and subject to the approval of the Engineer.

Tests on moulded specimens shall be performed according to specification given in Sub-Section 8.4.3.2. of these Technical Specifications.

Tests on specimens taken from a structure and measurements on structures shall be performed and defined according to a special programme to be submitted for approval by the Engineer, and as specified in these Technical Specifications and/or applicable PBAB/87 rules.

The Contractor shall remove all materials and equipment that obstruct sampling, testing and measuring from places on structures determined by the Engineer for extraction of cylinders, or for "non-destructive" tests, and from places on a structure or any parts thereof determined by the Engineer for trial load tests. The Contractor shall not stand in way of sampling, testing, and measuring on structures.

Any defective places on concrete of a structure, or parts thereof, and any variation from the design, shall be properly repaired or replaced or reconstructed by the Contractor, i.e. brought into compliance with the design requirements, and these Technical Specifications all in accordance with the instructions of the Engineer.

8.7.2. Taking Over Concrete in Structures

The quality of concrete in structure shall be generally assessed based on the results of tests on moulded specimens, by lots for each grade of concrete, prepared during the production as specified in Sub-Section 8.5.3. and in line with the quality requirements for particular characteristics according to designs and these Technical Specifications, and/or PBAB/87 and submitted for the approval of the Engineer.

Based on any indications of doubt and results of tests for reached quality of concrete, and/or structure, the test results shall be supplemented with results of other tests on the structure or its parts As directed by the Engineer

A trial load test, or other test methods as determined by the Designer and/or Investor and as instructed by the Engineer shall be performed for those constructions or structures for which it is specified.

The acceptance of structures or parts of a structure shall be carried out based on actually executed works within the project and tests that prove the quality of concrete and components required in the design and these Technical Specifications, i.e. based on PBAB/87 rules, and trial tests performed on the structure, or its segments.

With a centralized mixing of concrete and its transport by modern means of transport, mixer trucks, or agitators, if possible, concrete shall be transported on the site by pipelines, i.e. a pump. The application of "pumped" concrete shall ensure the continuity in the execution of concrete works.

Additives, i.e. admixtures for concrete – superplasticizers shall be used in order to eliminate segregation of concrete, and to make the "pumping" work easy. Their task is to increase plasticity, which is manifested as increased sliding (plasticization) of concrete.

The application of "pumped" concrete requires a reorientation of work on the site. Work timing shall be strictly planned (by means of cyclograms), along with a full coordination between the supply (feeding) and the placement of concrete.

8.7.3. Taking Over Concrete Pavement

8.7.3.1. General

The quality of concrete pavement shall be assessed based on results of tests on extracted concrete cylinders and additional "non-destructive" tests performed directly on the structure, according to SRPS U.E3.020/87 (Sub-Section 8.4.2).

8.7.3.2. Quality Assessment

Whether the pavement meets the quality requirements shall be established based on the results of tests performed on extracted cylinders, complemented with special measurements performed on the pavement, according to SRPS U.E3.020/87 (Sub-Section 5.6.) and subject to the approval of the Engineer.

8.7.3.3. Sampling

For all tests, concrete cylinders, diam. 10, 15, or 20 cm. shall be extracted from the concrete pavement in full thickness. Diamond drill bits shall be used for drilling.

8.7.3.4. Quality of Concrete in Pavement

The quality of concrete in pavement structures on drilled cylindrical specimens shall be controlled for the following characteristics:

- Compressive strength
- Tensile splitting strength
- Water impermeability
- Water absorption
- Freeze-thaw resistance
- Resistance to frost and salt
- Wear resistance in dry and water-saturated condition
- Thickness of cement-concrete slabs
- Evenness in the height and direction of cement-concrete pavement.

For all test mentioned in Sub-Section 8.7.3.4., except for the water-impermeability tests, separate cylinders shall be drilled. Water impermeability shall be tested on extracted cylinders, where compressive strength and tensile splitting strength tests are required on them. Before any destructive tests, the concrete cylinders shall be dried at the temperature of +105°C.

For testing compressive strength, tensile splitting strength, and water impermeability, freeze-thaw resistance, resistance to frost and ice, wear resistance, and water absorption, concrete cylinders shall be extracted at every 500 m at least, or as specified in the design. When requirements for certain properties are not achieved, the Contractor shall, at his own expense, extract additional cylinders in accordance with SRPS U.M1.048, and only the "destructive" method shall be applied in the scope defined by the Engineer within the design. Cylinders shall be extracted from the concrete pavement at the 60-day age of concrete.

The subsequent determination of flexural tensile strength of concrete shall be performed on cylinders taken from a pavement slab, provided that a correlation between the compressive strength and the flexural tensile strength is determined beforehand on the trial section, on at least three prisms that were cut from the pavement slab in the immediate vicinity of the place from which cylinders were taken.

The tensile strength of concrete in the pavement shall be determined on extracted cylinders when the age of concrete is 90 days, when the ration of the height (v) of cylinder to the diameter (d) of cylinder is at least 1.1. Bored cylinders shall be cut for the test on their bottom side with respect to their position in the pavement. For the possibility of a convincing calculation of the tensile strength of concrete cylinders with respect to the tensile strength of cubes, it is necessary to first establish their correlations in a laboratory, according to Sub-Section 8.7.3.4. These tests, performed at the Contractor's expense, shall be conducted by a qualified company registered for the testing of materials and constructions.

All tests shall be completed to the satisfaction of the Engineer and all results shall be submitted for the approval of the Engineer.

The water-impermeability of concrete pavement shall be determined at the 90-day age of concrete, according to SRPS U.M1.015. Water impermeability shall be tested on cylinders and cubes.

The water absorption of concrete pavement shall be determined on concrete parts of cylinders, when the age of concrete is 90 days. A concrete cylinder shall be cut in four 5 cm cylinders, normal to its axis.

The freeze-thaw resistance of concrete pavement shall be established on cylinders applying the method from Sub-Section 8.3.1.8.

The wear resistance of concrete pavement shall be determined using Bohme's method, when the age of concrete is 90 days, on 7.07x7.07x7.07 cm cubes cut out from concrete cylinders, in compliance with SRPS B.B8.015. The cubes are cut out from concrete cylinders so that the upper wearing surface of the cylinder remains unremoved. For tests in dry and water-saturated condition, it is necessary to prepare separate cubes every time from two separately drilled cylinders.

The tests of concrete quality according to Sub-Section 8.7.3.4. if needed or required in the design, shall be complemented with non-destructive testing for strength and water-impermeability directly on the pavement, applying the principle of large statistical samples, at the age of concrete of 60 and 90 days, in order to get the best possible picture about the heterogeneity and indication of local defective places or parts of the pavement.

8.7.3.5. Control of Pavement Geometry

It is necessary to check whether the geometry requirements for the pavement are met according to the following characteristics:

- Thickness of concrete,
- Unevenness of surfaces,
- Riding comfort index according to AASHO test,
- Deviation of height from the reference level.

The thickness of concrete slabs in pavement shall be determined on all drilled cylinders for tests according to Sub-Section 8.7.3.4. If the requirements specified in Section 10 are not met the applicable criteria for taking over shall be as given in Sub-Section 8.7.3.4.

The unevenness of pavement surface shall be determined in the longitudinal direction of particular lanes, where 'a lane' shall always mean the width between two longitudinal joints. When taking over carriageways, the relevant evenness of approximately 1 m from the right edge of carriageway shall be measured, looking in the driving direction, and on other lanes at the middle and in the longitudinal direction.

Evenness shall be measured in full length, uninterruptedly, using a planograph or 4 m levelling staff.

When measuring with a staff, each subsequent measurement shall overlap the previous one in the length of 2 m. If a distance between two adjacent uneven segments is less than 6m, a one-sided addition shall be reduced to a half of that distance.

The riding comfort index according to AASHO test shall be determined with a special apparatus in the longitudinal direction of particular lanes.

For lanes to be taken over, the relevant riding quality index approx. 1 m from the left edge of lane, looking in the driving direction, and for other lanes in the middle and in the longitudinal direction. In case of any failed requirements set out in Section 10., the same criteria shall apply as in Sub-Section 8.7.3.5.2.

The height deviation – the pavement surface level - from the reference level shall be determined by means of geodetic survey instruments. In order to enable such measurements, the Contractor shall prepare, along the road alignment, a system of fixed and surveyed height benchmarks from which control surveys may be done. Any deviation of the pavement surface from the reference level shall be surveyed along the centre line of particular lanes at every 15 m.

All measurements shall be submitted to the Engineer for approval.

8.7.3.6 Acceptance of concrete

The acceptance of concrete in the two-layer pavement structure shall be carried out based on tests and measurements that prove the proper condition of works, fully in accordance with these Technical Specifications.

All tests and measurements shall be submitted to the Engineer for approval.

8.8. Final Evaluation of Quality of Concrete in Structure

The final evaluation of the quality of concrete to be given for B-II concrete shall include:

- Documents on taking over of concrete by lots;
- Opinion on the quality of placed concrete issued based on a visual inspection of structures, perusal of documents on construction, and verification of results from the regular production control records, including the results of the control of compliance with quality requirements.

Based on the final evaluation of the quality of concrete in a structure, the safety and durability of the structure is proved, or an additional proof of the quality of concrete is requested. The final evaluation of the quality of concrete shall be given by the Engineer based on available documents and inspection of the structure and its elements.

8.9. Maintenance of Structure

Concrete and reinforced concrete structures shall be maintained in a safe and functional condition as specified in the design. If the structure suffers a damage, the necessary protective measures, including remedial measures, shall be taken subject to the approval of the Engineer.

8.9.1 Frequency of Control Inspections

The design of structure shall define the frequency of control inspections of the structure that include:

- A visual inspection, including a survey of location and size of fissures and cracks, as well as damages to the structure crucial for its safety;
- Control of deflection of main load-bearing elements of the structure under permanent load. In case of a highly aggressive environment, the condition of the protective coating on reinforcement shall also be checked.

8.10. Concrete for Structures

8.10.1 Scope and Content of Works

The works covered in this Sub-Section of Technical Specifications include the provision of all facilities, equipment, materials, and labour, and the execution of all operations related to materials that are used for: storage, measurement, and handling of materials, for batching and mixing, and, unless otherwise specified in other Sub-Sections of these Technical Specifications, for assembling formwork, transport, placement, curing, and finishing of all concrete for bridge structures, construction of concrete piles, and other auxiliary works on concrete structures, in accordance with terms and provision of the Contract, and in full compliance with this section of the Technical Specifications, drawings, and the Engineer's instructions.

8.10.2 Technical Legislation

PBAB 87 "Rules on technical norms for plain and reinforced concrete" ("Off. Journal of SFRY" No. 11/87) and the Comment on provisions of PBAB (Off. Journal, 1988)

PPB "Rules on technical measures and requirements for pre-stressed concrete" ("Off. Journal of SFRY" No. 51/71)

SRPS B.B2.010. Screened aggregate for concrete. Technical requirements

SRPS B.C1.011. Portland cement. Portland cement with additives. Metallurgical cement. Pozzolanic cements. Technical requirements (1982)

SRPS B.C1.014. Sulphate-resisting cements. Portland cement. Metallurgical cement. Technical requirements (1982)

SRPS U.M1.058. Mixing water for concrete. Technical requirements and testing methods (1985)

SRPS U.M1.034. Concrete admixtures. Definition and classification (1981)

SRPS U.M1.035. Concrete admixtures. Quality and quality control (1982)

SRPS U.M1.037. Pre-testing for selection of concrete admixtures with specific aggregate and cement. (1981)

SRPS U.M1.020. Determination of compressive strength of test specimens made of fresh concrete (1978)

SRPS U.M1.050. Control of production capacities of concrete plants (1987)

SRPS U.M1.051. Control of production in concrete plants for concrete (1987)

SRPS U.M1.052. Minimum equipment for laboratories within concrete plants (1987)



8.10.3. Materials

8.10.3.1. Aggregate

Sub-Section 8.2.1. shall apply.

8.10.3.2. Cement

Sub-Section 8.2.2. shall apply

8.10.3.3. Water

Sub-Section 8.2.3. shall apply

8.10.3.4. Concrete Admixtures

Sub-Section 8.2.4 shall apply.

8.10.3.5. Concrete

8.10.3.5.1. Classification of Concrete

The designs shall indicate a class of concrete for each element of the structure, or for the entire structure, covering only the grade of concrete (MB), or the grade of concrete and other properties that concrete shall have under special conditions of the environment.

For everything else, Sub-Sections 8.1. and 8.3. shall apply.

8.10.3.5.2. Concrete Properties under Special Conditions of Environment

8.10.3.5.2.1. General Provisions

A prerequisite for production of concrete with special properties implies that such concrete shall be designed, mixed, and placed properly, in compliance with Sub-Section 8.3.7.

8.10.3.5.2.2. Water Impermeable Concrete

Sub-Section 8.3.1.4. shall apply.

8.10.3.5.2.3. Frost-Resistant Concrete

Sub-Section 8.3.1.8. shall apply

8.10.3.5.2.3.1. Concrete Resistant to Frost and Salt

Sub-Section 8.3.1.8.1 shall apply.

8.10.3.5.2.4. Concrete Resistant to Chemical Impacts

Sub-Sections 8.3.1.9 and 8.3.1.10. shall apply.

8.10.4. Execution of Concrete Works

8.10.4.1. General Requirements

Before construction of structures and elements from plain, reinforced, and pre-stressed concretes, the Contractor shall, based on their structural design, according to Art. 232 of PBAB, prepare the concrete design that contains:

- a) Concrete mix designs, quantities, and technical requirements for designed classes of concrete;
- b) Plan for concreting, organization, and equipment,
- c) Method of transport and placement of concrete mix,
- d) Method of curing placed concrete,
- e) Programme of control tests for concrete components,
- f) Programme for control, sampling, and testing of concrete mix and concrete by lots,
- g) Plan for assembly of elements, scaffolding design for complex structures, and formwork design for special types of formwork

8.10.4.2. Scaffolds and Formwork

See Sub-Section 8.4.5.3. Scaffolds and Formwork

8.10.4.3. Reinforcement and Cables

See Sub-Sections 8.4.5.6.2. and 8.4.5.6.7., and Sub-Section 8.10.6, respectively

8.10.4.4. Placement of Concrete

Sub-Section 8.6. shall apply.

8.10.4.5. Underwater Concreting

Underwater concreting shall be performed in such a way that cement and water do not segregate from the concrete mix. Concrete for load-bearing elements cast underwater shall contain at least 400kg of cement per cubic metre of finished concrete, a granular material with a maximum grain size of 32 mm, a plasticizer as an admixture for concrete, with the slump of about 15 cm according to the cone slump test. Cement shall be of appropriate quality and resistant to any aggressive action of water.

The concreting funnel shall consist of pipes, at least 25 cm in diameter, designed from segments with flanges and seals. Concreting funnels shall be supported so as to enable the movement of the discharging end all over the working surfaces, and to enable fast lowering when it is necessary to slow down or stop the flow of concrete.

The discharging end shall be closed at the commencement of works, in order to prevent the penetration of water into the tremie, and shall be at 20 cm from the bottom at most. When the batch is poured into the funnel, the flow of concrete shall be controlled by carefully raising the discharging end, while keeping it in placed concrete at all times.

The flow of concrete shall be continual. The pumping of water and cleaning of the surface may start only when concrete has hardened.

8.10.4.6. Bedding Mortars

Bedding mortars shall be made of mortar mixed with expansion cements, where a minimum reached strength shall comply with concrete of grade MB 45. In terms of quality of applied materials, the provisions of this Sub-Section shall apply. Bedding mortars shall be placed so that over-pressure is present at all times; it is possible to apply the principle of communicating vessels or the grouting procedure. Mortars shall have a permanent increase in volume of at least 1%. Beddings thicker than 50 mm shall be reinforced separately. Within the works on bearings, gulleys, and similar elements where the application of bedding mortar is foreseen, the Contractor shall enclose with the work technology design all necessary proofs that the foreseen composition of mortar to be used for bedding is in full compliance with specified requirements. The mentioned design, along with a detailed work technology description, is subject to the Engineer's approval.

8.10.4.7. Finishing of Surfaces and Tolerances

All concrete surfaces shall be thoroughly treated during placement. The treatment shall be such that coarse-grained material is pulled down from the surface and that mortar leans fully against formwork in order to create a flat finished surface without water and air bubbles or voids. As soon as concrete hardens enough, and formwork is removed, the entire surface shall be cleaned thoroughly, removing any traces of formwork or projecting parts, in order to leave a flat surface, without depressions or flaws. For pavement slabs, after concrete is placed and compacted, it shall be levelled to the limits and height indicated on the cross section and finished to obtain a smooth and flat surface. The quality of work shall be such that when the finished surface is controlled with a 4 m long levelling staff, it shall not show any deviation larger than 10 mm from the height specified on the cross section. Other allowed variations in the finishing concrete works are:

- a) For dimensions on the cross sections of columns and supports: not more than 6 mm,
- b) For other dimensions of columns and supports: not more than 10 mm, while the height levels on bearing blocks may vary by not more than 5 mm,
- c) Flatness of vertical or inclined surfaces shall be within the 8 mm range, measured with a 3m levelling staff
- d) Deviation of columns and walls from the vertical plane, measured with a plummet, shall not exceed 6 mm.

The method of execution of finishing works for special elements or parts of the structure shall be given on drawings or indicated in the Priced Bill of Quantities.

8.10.4.8. Measurement

The amount to be paid to the Contractor at an agreed unit price for the quantity of incorporated concrete, as indicated in the Priced Bill of Quantities (m³, m², m³, piece), shall be determined in plans, specifications, or by the Engineer. The volume of reinforcing steel shall not be deducted, but the volume of incorporated structural steel shall be deducted.

8.10.4.9. Payment

For the amount determined in the above-described way, the Contractor shall be paid at the agreed unit price that makes a full compensation for all works and materials as stated in the description of the scope and content of works.

8.10.5. Prefabricated elements

Sub-Section 8.3.6 shall be applicable.

8.10.6. Prestressing concrete structures and elements

8.10.6.1. Scope and Content of Works

Works within this Section of Technical Specifications cover the procurement of plants, equipment, materials, and labour, and execution of all prestressing-related operations in compliance with the terms and conditions of Contract, and in full conformity with this Section of Technical Specifications, structural analyses, drawings, and the Engineer's instructions.

8.10.6.2. Technical regulations

Structures and elements made of pre-stressed concrete shall be in compliance with:

- "Rules on technical measures and requirements for pre-stressed concrete" ("Off. Journal of SFRY", No. 51/71)
- "Rules on technical norms for steel wires, rods, and ropes for prestressing constructions" ("Off. Journal of SFRY", No. 41/85)
- "Rules on amendments to the Rules on technical norms for steel wires, rods, and ropes for prestressing constructions" ("Off. Journal of SFRY", No. 21/88)
- SRPS U-13.015 Grouts for grouting cables. Technical requirements.

8.10.6.3. Prestressing System

The Contractor shall select the prestressing system, while ensuring the following requirements to be met, regardless of the applied system:

- The safe anchoring of prestressing elements and their suitability for the transfer of forces into concrete,
- The actual friction losses shall match the computed losses, and
- The suitability of planned measures for the protection of cables against corrosion over time.

For prestressing a structure and its members, the design specified certified systems made locally by IMS and SPB – the systems for post-tensioning, i.e. applied only when concretes reach a certain strength. The prestressing system selected by the Contractor shall be as specified in the Tender Unless otherwise agreed with the Designer and the Engineer.

8.10.6.4. Materials

8.10.6.4.1. Prestressing Steel

Only steel that meets the requirements from the "Rules on technical norms for steel wire, bars, and ropes for prestressing structures" may be used for prestressing steel. The quality of pre-stressing steel shall be proved with the Manufacturer's compliance certificate, and a compliance certificate (quality certificate) issued by a qualified company registered for activities that include steel quality testing. Prestressing steel shall be transported in clean, dry, and closed transport vehicles. Steel shall be stored in completely dry rooms, with a wooden floor with no possibility of condensation. At the time of acceptance of cables and ropes, and prior to incorporation, cables shall have no marks of oxidation, dents, rough spots, notches, or any other damage.

8.10.6.4.2. Protective ducts

Ribbed, flexible ducts, made of white sheet metal, shall be used for cabling. They shall be rigid enough to keep their shape under the weight of cable and concrete during concreting, yet flexible enough to follow the cable line without any problem. Ducts shall be tight to cement slurry, and made of material that does not cause the corrosion of prestressing steel, either directly or in an electro-chemical action.



8.10.6.4.3. Anchors

For all anchors, according to their number and type, the Contractor shall possess compliance certificates. The certificates shall cover bushes and wedges. The Contractor himself shall fabricate spiral elements from GA 240/360 according to the Catalogue for prestressing systems. Tie-plates are not covered in compliance certificates. Anchor bolts shall be stored on the construction site, protected from dampness, dirt, and mechanical damage. Until the tensioning of cables, anchor bolts shall be protected against weather conditions and mechanical damage. Before pre-stressing, anchors shall be inspected, with any dirty surfaces cleaned.

8.10.6.5. Execution of Works

8.10.6.5.1. Fabrication of Cables

When fabricating cables, the Contractor shall follow the instructions given for the adopted prestressing system. Before cutting wires, or ropes, the Contractor shall perform a numerical check of given theoretical lengths of cables, and increase the lengths by a necessary length of grip, depending on the type of press and foreseen tensioning, on one or both ends. All wires or ropes in a cable shall be kept parallel, and shall thus be interconnected. The formed cable may remain straight or bent in a convenient ellipsoid or round shape, depending on the method of transport to the place of insertion, but shall have an attached plate with the cable marker. Formed in this way, cables shall be stored properly, unless inserted into ducts immediately.

8.10.6.5.2. Cabling

When cabling, the designed position of both the resultant and singular cables shall be achieved. Therefore, it is necessary to lay protective cable ducts on fixed supports that will also remain an unchanged position during the installation work. Holders of cable ducts shall be placed at 1-2 m spacing, and even less spaced at bending points. Ducts shall be tied firmly to their holders. Tie-plates for anchors shall be placed normally to the cable axis, and fixed firmly to formwork so as not to become displaced during concreting work. Allowed deviations of the resultant of cables with respect to the designed position may be not more than 2% from the height on cross section, and deviations of singular cables not more than 2 cm. Special attention shall be paid to the jointing of protective duct segments and to the bond between ducts and tie-plates. These bonds shall ensure water tightness, aside from keeping a fixed position during concreting. Depending on the length and shape of cable, a number of plastic straws for deaeration shall be placed, as well as grouting joints. Cables inserted in the structure or an element thereof, shall be subject to inspection and approval by the Engineer prior to approval for concreting.

8.10.6.5.3. Prestressing

The tensioning of cables may start only when concrete has reached the required minimum strength. When prestressing is performed at the age of concrete younger than 28 days, the strength of concrete shall be determined on test specimens cured under the same conditions as concrete in the structure. Prior to commencement of prestressing works, it is necessary to elaborate a prestressing programme. The prestressing programme shall be elaborated by the Contractor based on data from the Design, and approved by the Engineer, and the programme shall contain, apart from the prestressing time, data on prestressing force, sequence of tensioning of cables and elongations for each cable with an appropriate view of the contraction of concrete in length due to stress, and also the values for friction and yielding.

The cable tensioning sequence shall be determined in a way to avoid the creation of prohibited stress. After the Engineer has accepted the programme and approved the commencement of pre-stressing, the following preliminaries shall be performed: check the movability of cables, inspect anchor blocks, set up required scaffolds, power supply connections, and shorten cables to a minimum length for the press to grip. After shortening the cables, anchors with wedges and a press shall be set up. The prestressing procedure shall be carried out in compliance with the operation manual for hydraulic prestressing systems. The diagrams for calibration of a hydraulic kit shall not be older than 6 months. A maximum temporary force in a cable, at the anchorage point, shall not exceed 70 % of the prescribed typical breaking force. The magnitude of force in a cable shall be determined by a pump pressure gauge. The measurement of elongations of a cable, and its comparison with the reached force shall serve to assess whether friction losses have been calculated correctly. In case of significant differences, it is necessary to check the calculation of forces given in the Design.

A log on cable tensioning shall be kept during the work. All measures taken during prestressing shall be noted by the Contractor, with a copy submitted to the Engineer. If the sum of deviations from the designed prestressing force measured on the pressure gauge, expressed in %, and deviations from prescribed elongation, expressed in %, too, for each cable, is greater than 15%, this shall be reported in writing to the Engineer. Also, if the deviation from the prescribed total prestressing force, or from the total prescribed elongation, is greater than 5%, this shall be reported in writing to the Engineer. This procedure shall be carried out whether the Engineer is present or not during cable tensioning operations. In special cases, the Engineer may order a measurement of forces on critical cross-sections along the cable, with special instruments that will be set up in advance. These places shall be protected well after completed work.

8.10.6.5.4. Grouting Cables

In order to protect placed cables against corrosion and bond them to the surrounding concrete, protective ducts for prestressing shall be carefully grouted with a selected grout. The composition of grout, quality requirements for applied materials, prior and control testing of grout for grouting cables, and the grouting procedure are all defined in:

SRPS U.E3.015 Grouts for grouting cables. Technical Requirements / 1986 /

All cables shall be grouted within two days after the prestressing has been completed and approved by the Engineer. Immediately after concreting, all protective ducts shall be cleaned from water that penetrated into them. This shall be performed thoroughly by blowing them out with compressed-air. Then, before grouting, the ducts shall be protected against re-penetration of water. It is also necessary to prevent any circulation of air in the ducts. If protective agents for a temporary protection of cables against corrosion are applied, and such protection requires the Engineer's approval, it is necessary to check that the stipulated properties of grout mix and necessary bonds have not been disturbed.

All materials used for the preparation of grouts, shall be carefully batched and measured, the entire procedure running in accordance with provisions of the mentioned standard. Grouting shall be performed at temperatures above +5°C. If the frost is expected after grouting or grouting is performed at temperatures below +5°C, but above 0°C, all the provisions stipulated in SRPS U.E3.015 Sub-Sections 7.6. and 7.7. of this mentioned standard shall be applied, provided that all pre-tests have given satisfactory results in compliance with SRPS U.E3.015 Sub-Section 5.3.

8.10.6.6. Alternatives

If the Contractor offers another system of prestressing which fails to meet requirements given in the Design, with respect to the position of total prestressing force and the magnitude of final effective prestressing forces, the Contractor shall submit with his alternative offer summarized documents, suitable for control, that shall contain: the prestressing system, the type of cables, the number of wires, ropes, or bars

in a bundle of steel, the surface areas, diameters, and grade of steel, the method of assembly and type of anchoring, the prestressing force in time $t=0$ and $t=$ infinity, as well as the methods of protection and control.

The calculations shall include the losses due to friction, shrinking, yielding, and relaxation of steel. The proof of stress notation on all cross-sections of structures and for all loading phases as well as the result of difference in load on substructure elements (columns and foundations) shall be given.

All works to be performed shall be in accordance with provisions of the Technical Specifications referred to in this Section, as well as in accordance with all other specified design and construction requirements.

Acceptance of the Contractor's alternative offer shall be decided by the Designer and the Investor and as instructed by the Engineer.

8.10.6.7 Measurement

All steel for pre-stressing shall be calculated according to the computed weight of installed cable lengths, as shown on drawings or instructed by the Engineer. No compensation shall be given for any material, labour, forms, equipment, and other works needed for the procurement, preparation, installation, pre-stressing, and grouting of cables, including anchors, plates, and hoops, protective ducts for cables, spacers, washers, and cable supports, grout, and all other secondary activities that the Contractor shall perform during the execution of works, as determined by the Engineer and specified herein.

8.10.6.8 Payment

For the amount determined in the way described above, the Contractor shall be paid at the agreed unit price per 1 kg of steel, and this shall be the full compensation for the scope and content of work within this item.

8.11. Measurement

The works on a structure, or a part of it shall be measured, in principle, in cubic meters of placed concrete, unless otherwise specified in the agreed Priced Bill of Quantities, or Technical Specifications for particular types of works.

8.12. Payment

The amount measured as specified in Sub-Section 8.10. of these Specifications shall be charged at the unit price stated in the agreed Priced Bill of Quantities. This price shall be a full compensation for procurement and installation of all materials and for all work, transport, tools, equipment, supplied energy, scaffolds, formwork, and everything else needed to complete the work, and the Contractor shall have no right to claim any subsequent payment.

8.13. Forms

The types of pretests for concrete are to be shown in a standard format summary sheet to be called form "A" to be agreed with the Engineer.

A completed form "A" shall be submitted with interim or final payment certificates to the Investor, i.e. Engineer. If the form "A" does not include certain obligatory pre-tests, the Contractor shall proceed as specified in relevant Sub-Sections of these Technical Specifications or contract documents, while adding such test at an appropriate place in form "A".

8.14. Regular Control Tests

The summary of scopes of regular control tests are to be shown in a standard format sheet to be called the list "B" to be agreed with the Engineer.

The Engineer shall compile a list of performed regular control tests and submit it to the Investor with interim and final payment certificates.

A. Legislation

A/1. STANDARDS

A/1.1. ROCK AND AGGREGATE (GRANULAR MATERIAL)

SRPS L J9.010	Laboratory sieves
SRPS L J0.001	Laboratory sieves and sieving tests
SRPS L J0.002	Sieving tests
SRPS B B0.001	Natural stone. Sampling stone and rock aggregate
SRPS B B2.009	Natural aggregate and rock for the production of aggregate for concrete. Technical requirements
SRPS B B2.010	Screened aggregate (granular material) for concrete. Technical requirements
SRPS B B3.100	Fractionated rock aggregate for concrete and asphalt
SRPS B B3.050	Technical requirements for rock aggregates for modern road surfacing
SRPS B B3.100	Rock aggregate. Fractionated rock aggregate for concrete and asphalt. Minimum quality requirements
SRPS B B3.200	Natural stone. Tiles for floors and plinths. Shape, measures, and classification
SRPS B B8.001	Testing of natural stone. Frost resistance by using sodium sulphate
SRPS B B8.002	Testing of natural stone. Testing for frost resistance.
SRPS B B8.003	Natural stone. Testing for mineralogical/petrographic composition (natural stone)
SRPS B B8.004	Rock aggregate. Testing for mineralogical/petrographic composition (rock aggregate)
SRPS B B8.010	Testing of natural stone. Determination of water absorption
SRPS B B8.012	Natural stone. Testing for compressive strength
SRPS B B8.013	Testing of natural stone. Testing for weather resistance
SRPS B B8.014	Testing of stone for toughness
SRPS B B8.015	Testing for resistance to abrasive wear
SRPS B B8.017	Testing of stone for flexural strength
SRPS B B8.018	Testing of stone with a Deval machine
SRPS B B8.019	Testing of crushed stone for resistance to impact with the Treton apparatus
SRPS B B8.029	Rock aggregate. Determination of granulometric composition by dry sieving method
SRPS B B8.030	Rock aggregate. Determination of bulk density in loose and compacted condition
SRPS B B8.031	Rock aggregate. Determination of bulk density and water absorption

SRPS B.B8.032	Testing of natural stone. Determination of bulk density with pores and voids, bulk density without pores and voids, and coefficients of bulk density and porosity
SRPS B.B8.034	Rock aggregate. Determination of light particles
SRPS B.B8.035	Rock aggregate. Determination of surface moisture in aggregate
SRPS B.B8.036	Rock aggregate. Determination of the amount of small particles by wet sieving method
SRPS B.B8.037	Rock aggregate. Determination of weak – friable grains in coarse aggregate
SRPS B.B8.038	Natural and crushed rock aggregate. Determination of clay ball content in aggregate
SRPS B.B8.039	Rock aggregate. Approximate determination of contamination with organic matter. Calorimetric method
SRPS B.B8.040	Rock aggregate for concrete and mortar. Testing of aggregate contaminated with organic matter.
SRPS B.B8.042	Rock aggregate. Chemical testing of aggregate for concrete and mortar
SRPS B.B8.043	Testing of natural stone. Testing of coarse rock aggregate for wear resistance with a Deval machine
SRPS B.B8.044	Natural crushed rock aggregate. Testing for frost resistance with sodium sulphate
SRPS B.B8.045	Testing of natural stone. Testing of natural and crushed aggregate with "Los Angeles" machine
SRPS B.B8.047	Testing of natural stone. Definition of shape and surface appearance of grains in aggregate
SRPS B.B8.048	Rock aggregate. Determination of grain shape by calliper rule method
SRPS B.B8.049	Rock aggregate. Determination of grain shape by volumetric coefficient method
SRPS B.B8.056	Stone and rock aggregate. Determination of alkali-silica reactivity. Chemical method
SRPS B.B8.057	Rock aggregate. Testing of alkali-silica reactivity by mortar prism method
SRPS U.M8.030	Determination of crushing resistance of aggregate for concrete
ASTM C-586	Standard test method for determination of potential alkali reactivity of carbonate rocks for concrete aggregates (Cylindrical rock specimen method)

A/1.2. CEMENT

SRPS B.C1.001	Testing of cement. Standard sand
SRPS B.C1.009	Cement. White Portland cement. Definition, classification, quality requirements, and testing of whiteness
SRPS B.C1.011	Cement. Portland cement. Portland cement with additives. Pozzolanic cement. Definition, classification, and technical requirements
SRPS B.C1.012	Cement. Method of delivery, packaging, storage, and sampling
SRPS B.C1.013	Low-heat cements. Definition, classification, technical requirements, and application
SRPS B.C1.014	Cements. Sulphate-resisting cement. Portland cement. Metallurgical cement. Definition, classification, and quality requirements
SRPS B.C1.015	Cement. High-alumina cement. Definition, classification, and technical requirements
SRPS B.C1.018	Pozzolanes. Quality and testing
SRPS B.C8.020	Cements. Method for chemical testing of Portland clinker-based cements
SRPS B.C8.021	High-alumina cement. Chemical testing methods
SRPS B.C8.022	Cement. Testing of cement for strength
SRPS B.C8.023	Cement. Methods for testing of physical properties of cement
SRPS B.C8.024	Determination of specific surface area of Portland cement
SRPS B.C8.025	Cement. Autoclave expansion of cement
SRPS B.C8.026	Determination of specific surface area of cement, pozzolane, slag, and similar
SRPS B.C8.027	Cements. Determination of hydration heat of cement by vacuum flask method
SRPS B.C8.028	Cements. Determination of hydration heat of Portland cement with additives by dissolution method
SRPS B.C8.029	Cement. Shrinkage of cement mortar due to drying
SRPS B.C8.050	Determination of air content in cement mortar
SRPS U.M8.015	Chemical and physical testing of blast furnace slag
SRPS U.M9.011	Blast furnace slag. General provisions
SRPS B.C1.020	Building lime. Types, applications, and quality requirements

A/1.3. WATER

SRPS U.M1.058	Concrete. Mixing water for concrete. Technical requirements and testing methods
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A/1.4. CONCRETE ADMIXTURES

SRPS U.M1.034	Concrete. Concrete admixtures. Definitions and classification
SRPS U.M1.035	Concrete. Concrete admixtures. Quality and quality control
SRPS U.M1.036	Concrete. Concrete admixtures. Testing of impacts of admixtures on properties of concrete
SRPS U.M1.037	Concrete. Concrete admixtures. Pre-testing for selection of concrete admixtures with specific aggregate and cement
SRPS U.M1.038	Concrete. Concrete admixtures. Testing of impacts of concrete admixtures on cement paste and mortar
SRPS U.M1.039	Concrete. Concrete admixtures. Testing of physical and chemical properties
SRPS U.M1.044	Concrete. Concrete admixtures. Testing of impacts of admixtures on corrosion of reinforcement steel

A/1.5. CONCRETE

SRPS U.M1.004	Testing of concrete. Test specimens (concrete test specimens). Shape, measure, and allowed variations
SRPS U.M1.005	Concrete. Making and curing of concrete test specimens for strength tests
SRPS U.M1.010	Testing for flexural tensile strength of concrete on prisms (concentrated mid-span load)
SRPS U.M1.011	Testing for flexural tensile strength of concrete on prisms (load at one-thirds of span)
SRPS U.M1.012	Testing for compressive strength of concrete on fragments of prisms obtained from their flexural failure. Modified cube method
SRPS U.M1.014	Concrete. Action of materials aggressive to concrete and protection against them
SRPS U.M1.015	Concrete. Testing of concrete for water-impermeability
SRPS U.M1.016	Concrete. Testing for frost resistance
SRPS U.M1.019	Concrete. Determination of setting time for concrete mixes by penetration resistance
SRPS U.M1.020	Concrete. Determination of compressive strength of test specimens made of fresh concrete
SRPS U.M1.022	Concrete. Testing for tensile splitting strength of concrete
SRPS U.M1.025	Concrete. Determination of static modulus of elasticity by compression
SRPS U.M1.027	Concrete. Determination of creep
SRPS U.M1.028	Concrete. Testing for homogeneity of concrete for mixing with a concrete mixer.
SRPS U.M1.029	Concrete. Determination of volumetric deformations

- SRPS U.M1.030 Concrete. Determination of composition of fresh concrete by rinsing
 SRPS U.M1.031 Concrete. Determination of air content in fresh concrete
 SRPS U.M1.032 Concrete. Measurement of temperature of fresh concrete
 SRPS U.M1.040 Concrete. Determination of compressive strength of test specimens made of hardened concrete
 SRPS U.M1.041 Concrete. Determination of sclerometer index and calibration curve
 SRPS U.M1.042 Concrete. Determination of ultra-sound velocity and calibration curve
 SRPS U.M1.045 Concrete. Transported concrete. Technical requirements
 SRPS U.M1.046 Testing of bridges with trial load
 SRPS U.M1.048 Concrete. Subsequent determination of compressive strength of placed concrete
 SRPS U.M1.050 Control of production capacities of concrete plants
 SRPS U.M1.051 Control of production in concrete plants for B-II concrete
 SRPS U.M1.052 Minimum equipment for laboratories within concrete plants
 SRPS U.M1.055 Concrete. Testing of concrete surface for resistance to frost and de-icing salt
 SRPS U.M1.057 Concrete. Granulometric composition of aggregate mixtures for concrete
 SRPS U.M1.090 Concrete. Determination of adhesion between reinforcement and concrete
 SRPS U.M8.050 Testing of concrete for consistency by slump test
 SRPS U.M8.052 Testing of concrete for consistency by flow table test
 SRPS U.M8.054 Concrete. Determination of consistency of concrete by Vebe test
 SRPS U.M8.056 Concrete. Testing of consistency of concrete by vibration-slump test
 ASTM C-156 Standard test method for determination of water retention by means of protective materials for curing concrete
 SRPS U.E3.020 Technical requirements for construction of cement-concrete pavement
- A/1.6. PREFABRICATED CONCRETE ELEMENTS
- SRPS U.E3.050 Prefabricated concrete elements. Technical requirements for fabrication and placement
 SRPS U.N2.062 Prefabricated concrete products. Kerbs. Technical requirements
- A/1.7. SPRAYED CONCRETE AND MORTAR
- SRPS U.E3.011 Sprayed concrete and mortar. Technical requirements
 SRPS U.E3.012 Testing of tensile splitting strength of sprayed concrete
- A/1.8. GROUTS
- SRPS U.E3.015 Grouts for pre-stressing cables. Technical requirements
 SRPS U.M8.022 Grouting. Testing of compressive strength of grout
 SRPS U.M8.023 Grouting. Testing of bleeding and volumetric changes of grout
 SRPS U.M8.024 Grouting. Testing of flow of grout
 SRPS U.M8.025 Grouting. Testing of frost resistance of grout
- A/1.9. TIMBER SCAFFOLDS AND FORMWORK
- SRPS U.C9.400 Design and erection of wooden constructions. Technical requirements
- A/1.10. CEMENT MORTARS
- SRPS U.M2.010 Masonry mortar
 SRPS U.M2.012 Plastering mortar
 SRPS U.M8.002 Masonry and plastering mortar. Testing methods
- A/2. BOOKS OF RULES
- A/2.1. Rules on technical norms for plain and reinforced concrete (OIF, Journal of SFRY No. 11 dated 23rd February 1987)
 A/2.2. Rules on technical norms for pre-stressed reinforced concrete constructions in environments exposed to aggressive actions of water and soil
 A/2.3. Rules on mandatory application of particular standards for:
- aggregate (granular material)
 - cement
 - water
 - admixtures for concrete
 - concrete
 - prefabricated concrete elements
 - grouts
 - concrete sewer pipes, and
 - other related to concrete work.

Section 9

Asphalt pavements

Contents

- 9.1. Mesh reinforcement
- 9.2. Spraying of Bituminous Emulsion
- 9.3. Construction of Base Course with Bitumen Bound Aggregate BNS 22SA (Bit 60)
- 9.4. Construction of Base Course with Bitumen Bound Aggregate BNS 32SA (Bit 60)
- 9.5. Construction of Wearing Layer with Stone Mastic Asphalt 0/11S
- 9.6. Construction of Wearing Layer with Asphalt Concrete AB 11 (Bit 60)
- 9.7. Wearing Course of Bituminous Concrete BC 8

9.1. Mesh reinforcement

9.1.1 Description

Mesh reinforcement is a layer in the pavement structure intended to prevent the propagation of cracks onto a new asphalt layer. The mesh reinforcement laying works shall be performed according to these technical instructions or the mesh reinforcement manufacturer's instructions, subject to the Designer's and Engineer's approval.

9.1.2 Technical requirements

Characteristics of mesh reinforcement

Mesh reinforcement shall meet the following requirements:

- Mesh size up to 20x20mm
- Tensile strength min. 20 kN/m
- Heat resistance min 190 °C
- Weight min 220 gr/m²
- Strip width min 250 cm
- Strip length max. 50 m.

9.1.3 Procedure

The work execution procedure implies:

- Preparation of underlying surface
- Spreading, fixing, and protection of mesh reinforcement

Preparation of Underlying Surface

Before laying mesh reinforcement, the underlying surface shall be cleaned from all dirt to the satisfaction of the Engineer. Before placing mesh reinforcement, the underlying surface shall be sprayed with a binder. The amount of binder shall be about 0.45 kg/m². A suitable diluted polymer-modified bitumen, a polymer-modified bituminous emulsion, or a hot polymer-modified bitumen may be used as binder. Spraying shall be performed so as to form a homogenous layer. The underlying surface, before applying a binder and mesh reinforcement shall be levelled so that any uneven spots both longitudinally and crosswise are not larger than 8 mm under a 4 m long straight edge.

Spreading, Fixing, and Protection of Mesh Reinforcement

The mesh shall be spread by hand or mechanically. Once laid, the mesh shall be flat in both directions, fixed, and slightly tensioned (strip elongation up to 3%). A strip may be up to 50 m long. If shorter, strips may be extended up to 50 m in length. Longitudinally, strips are joined by 30cm overlaps. Once tensioned, the strip is fixed to the underlying surface at both ends with special rivets. A one-layer surface treatment is applied over the mesh to protect it during the execution of works.

9.1.4 Laying of Asphalt over Mesh

Asphalt mix is laid mechanically. The underlying surface shall be dry. The air temperature in the shade shall be at least +10°C. All other issues are subject to the requirements for the construction of asphalt layers given in these Technical Specifications and subject to the approval of the Engineer.

During asphalt laying, machines and transport vehicles shall not turn suddenly or brake on the mesh. Transport required for the technology of work shall be minimized. A quick start of vehicles on the laid mesh is forbidden.

9.1.5 Quality Control

A sheet with mesh properties shall be supplied and verified by the Manufacturer, who shall also furnish the quality guarantee for the mesh. Before the commencement of works the Engineer shall check the required properties of mesh at every 200 m² of mesh.

The quality of spread, tension, and fixation of mesh shall be checked visually. The application of binder and asphalt layers shall be controlled in accordance with procedures defined for these operations.

Before laying an asphalt layer over a laid mesh, the Contractor shall request the Engineer's inspection and approval.

If the mesh is laid improperly or not tight, it shall be removed and the mesh laying procedure repeated. Any work over an improperly laid mesh shall not be allowed.

9.1.6 Measurement and Payment

Measurement and payment shall be done per 1 square metre (m²) of laid mesh at the contracted price that includes all work and materials needed to execute this item of works (preparation of underlying surface, application of binder, procurement and placement of mesh, etc.).

9.2. Spraying of Bituminous Emulsion

Prior to making reinforcing layers, the underlying surface shall be dry, and shall not be frozen in any case. After levelling and final compaction, all free grains shall be removed from the surface with a rotary brush. This shall be done carefully, not to disturb material deeper down the layer. The cleaned surface shall be uniform and free from segregated areas.

Before cleaning, the underlying surface shall be levelled according to designed values. Its flatness shall be checked with a 4m long straight edge, according to requirements given in the Specifications.

The underlying surface prepared in this way is ready for spraying with bituminous emulsion.

If the surface is extremely dry or dusty, it shall be uniformly sprinkled with water, waiting for all water on the surface to evaporate, and then sprayed with bituminous emulsion.

For spraying a layer made of crushed aggregate, an anionic emulsion shall be used: AN-55, AN-60, or AN-65, fully in compliance with SRPS U.M3.022.

The quantity of emulsion used shall be about 700 g/m², so that after the evaporation of water, oils, and other ingredients, 300 g/m² of pure binder remain. After spraying, the surface shall dry for at least 24 hours.

Spraying shall be done with a sprayer, evenly and uniformly over the entire surface.

Calculation and payment shall be done per 1 m² of sprayed surface.

9.3. Construction of Base Course with Bitumen Bound Aggregate BNS 22SA (Bit 60)

9.3.1 Description

This item of works includes the procurement, preparation, laying, and compaction of a mixture of granular mineral material and bitumen.

9.3.2 Basic Materials

For the construction of base course with bitumen bound material, the following basic materials shall be used:

- Crushed carbonate rock material 0/4; 4/8; 8/16, and 16/22 ; 22 mm
- Rock flour of carbonate composition;
- Bit 60 binder.

9.3.3 Quality of Basic Materials

9.3.3.1 Chippings

Chippings shall be composed of carbonate rock mass of the following properties:

- Compressive strength in dry and water-saturated condition min 140 MPa
- Frost resistance, drop in mean compressive strength after 25 cycles max 20%

Chippings shall meet the following requirements:

- Wear according to Los Angeles test method max 30%
- Grains of unfavourable shape max 20%
- Content of silty particles under 0.09 mm in size max 5%
- Bitumen-coated aggregate surface min 100/80
- Absorption of water on 4/8 mm fraction 1,2%

9.3.3.2 Granulometric composition

The grain size distribution curve shall be such that the grain size accumulation curve lies within the following limit range:

Square mesh, mm	Passing through sieve, % mass, BNS 22s
0.09	5-11
0.25	8-17
0.71	13-27
2.00	24-40
4.00	34-53
8.00	50-70
11.20	61-81
16.00	75-94
22.40	97-100
31.50	100

9.3.3.3 Rock Flour

Rock flour shall fully meet the criteria set out in JUS B.B3.045 for Quality Class I.

9.3.3.4 Bitumen

Bitumen may be Bit 45 or Bit 60. Bitumen shall fully meet the criteria set out in JUS U.M3.010.

9.3.3.5 Mix

In an asphalt mix, the proportion of bitumen shall be about 4%. A precise content of bitumen shall be determined in a trial asphalt mix. Mineral mix grain size accumulation curves shall fall within the limits stated in Sub-Section 9.3.3.2 above.

Properties of test specimens according to the Marshall test shall be as follows:

- Void content (v1 %) 3-9%
- Stability (kN) min 6.0
- Stability/flow ratio (kN/mm) 2-2
- Voids in mineral mix filled with bitumen 50-70%

9.3.4 Work Technology

9.3.4.1 Preparation of Underlying Surface

An asphalt layer may be laid over a surface that is dry and not frozen in any case. Prior to the commencement of works, the underlying surface shall be cleaned thoroughly with steel brushes and blown out with a compressor. After the surface has been cleaned, the Contractor will survey the reference level and evenness of the surface. In places where the underlying surface varies from the specified height by more than +15 mm, the Contractor shall repair the surface according to requirements set out in the design and subject to the approval of the Engineer, i.e.:

- In places where the surface level is below the specified reference level, the repair shall be done by increasing the thickness of layer of asphalt mix with asphalt concrete - wearing course or BNS;
- In places where the surface level is above the specified reference level, excessive asphalt mass shall be removed by grinding.

9.3.4.2 Preparation and Transport of Asphalt Mix

The asphalt plant shall be equipped with a screen, 22.4 mm mesh, to remove unpermitted coarse grains from mineral mix.

The temperature of bitumen shall be 150-160°C. The temperature of asphalt mix in the mixer shall be within the range 150-170°C (in exceptional cases 175°C).

9.3.4.3 Laying of Asphalt Mix

The temperature of asphalt mix on the site shall neither be lower than 140°C nor higher than 175°C.

9.3.4.4 Work Execution Period

A base course of specifications as set out herein may be laid only in the period from 15th April to 15th October, i.e. in the period when air temperatures are higher than 5°C in windless conditions, or min 10°C with wind, unless otherwise agreed in writing by the Engineer.

Asphalt mix shall not be laid during misty or rainy weather.

The temperature of underlying surface shall not be lower than +5°C

9.3.5 Quality control

9.3.5.1 Pre-Testing of Asphalt Mix

Prior to the commencement of works, the Contractor shall prepare a trial asphalt mix design in an authorized laboratory, in full compliance with requirements set in these Technical Specifications.

No operation shall start before the Contractor has proposed the trial mix design to the Engineer for approval and the Engineer has issued formal written approval. Compliance certificates for basic materials and trial mix shall not be older than 6 months. If any changes in basic materials or their selection occur, the Contractor shall submit to the Engineer a written proposal for modification of the adopted asphalt mix, i.e. propose a new trial mix design for approval, before the use of these materials starts.

9.3.5.2 Verified Job Mix Formula for Asphalt

The quality of a trial asphalt mix shall be verified through trial work, with the asphalt mix adopted in the plant, and the application quality on a trial section. If the quality of basic materials on site is not in compliance with these Technical Specifications, the Contractor shall ensure new basic materials of good quality. If the batching of basic materials, according to the trial mix formula, cannot meet all specified requirements for physical and mechanical properties of asphalt mix and for constructed layer, it is necessary to modify the batching of basic materials and repeat the trial procedure.

Only when the trial procedure meets all specified requirements, the Engineer shall adopt the trial mix and give his approval for work to continue.

The proving job mix formula for asphalt shall be prepared in an authorized operative laboratory which shall be subject to the approval of the Engineer.

9.3.5.3 Quality Control

To ensure the specified quality in the course of construction, the control laboratory approved by the Engineer shall perform regular control tests, namely:

9.3.5.4 Testing of Bitumen

The Contractor may procure bitumen only provided that for each delivery he ensures the Manufacturer's compliance certificate that will be immediately presented for approval to the Engineer and/or laboratory. Apart from looking into the Manufacturer's compliance certificate, the operative control laboratory shall perform regular tests as directed by the Engineer (PK, penetration, and point of failure), as follows:

- At the beginning of works, and
- At every 500 t of supplied bitumen
- All other tests as required by the Engineer

9.3.5.5 Testing of Filler

The laboratory shall test the granulometric composition of filler:

- At the beginning of works, and
- At every 100 t of supplied filler.
- Whenever required by the Engineer

9.3.5.6 Testing of Asphalt Mix and Constructed Layer for Physical/Mechanical Properties

These tests shall be performed by the operative laboratory:

- At the beginning of works, and
- At every 1000 m²
- Whenever required by the Engineer

A specimen of asphalt mass shall be taken from hot, just laid, asphalt mix, behind the paver. The control of compaction and voids in the surfacing shall be performed on "cores" extracted from a finished layer at the same place where a specimen of hot asphalt mix is taken.

9.3.6. Criteria for Calculation of Executed Works

9.3.6.1. Evenness of Layer

Measurement shall be performed by the Contractor and submitted for checking and approval by the Engineer on cross sections, with spacing not larger than 20 m.

Measurements shall be done with a 4 m straight edge (left, right, middle), and/or with a transprofilograph, continuously in full length. The criteria are as follows:

- Evenness 0-4 mm is satisfactory and acceptable.
- Evenness above 4-mm is not satisfactory or acceptable and the noncompliant area shall be rectified, or removed and replaced as directed by the Engineer at the full cost of the Contractor.

9.3.6.2. Variation in Specified Height of Layer

Measurements shall be performed on every profile:

- Permitted deviation of the surface of the base course shall not exceed ± 10 mm when compared with the designed value.
- Deviation above 10 mm shall not be accepted and the noncompliant area shall be rectified, or removed and replaced as directed by the Engineer at the full cost of the Contractor.

9.3.6.3. Content of Residual Voids in Compacted Marshall Specimen

If residual voids are in excess of 6% limits, the base course layer value shall be rejected and the noncompliant area shall be rectified or removed and replaced as directed by the Engineer at the full cost of the Contractor.

9.3.6.4. Granulometric Composition of Mineral Mix

If the granulometric composition of an extracted mineral mix deviates from the limit curve for required physical and mechanical properties, the base course layer shall be rejected and the noncompliant area shall be rectified, or removed and replaced as directed by the Engineer at the full cost of the Contractor.

9.3.6.5. Rolling (Compaction) of Surfacing

For under compaction in excess of 3%, the works shall be rejected and the noncompliant area shall be rectified, or removed and replaced as directed by the Engineer at the full cost of the Contractor.

9.3.7. Measurement and Payment

Measurement and payment shall be per m^2 of an actually constructed asphalt layer of specified thickness, fully in accordance with this description, the Technical Specifications, and subject to the approval of the Engineer.

9.4. Construction of Base Course with Bitumen Bound Aggregate BNS 32SA (Bit 60)

9.4.1. Description

This item of works includes the procurement, preparation, laying, and compaction of a mixture of granular mineral material and bitumen, in a single layer of thickness as specified in the Design.

9.4.2. Basic materials

For the construction of base course with bitumen bound material, the following basic materials shall be used:

- Crushed carbonate rock material 0/4; 4/8; 8/16; 16/22, and 22/32 mm;
- Rock flour of carbonate composition;
- Bit 60 binder.

9.4.3. Quality of Basic Materials

9.4.3.1. Chippings

Chippings shall be composed of carbonate rock mass of the following properties:

- Compressive strength in dry and water-saturated condition min 160 MPa
- Frost resistance, Na₂SO₄, loss after 5 cycles max 5%
- Wear according to Los Angeles test method max 28%
- Grains of unfavourable shape max 20%
- Content of silty particles under 0.09 mm in size max 3%
- Bitumen-coated aggregate surface min 100/80
- Absorption of water on 4/8 mm fraction 1.2%

The grain size distribution curve shall be such that the grain size accumulation curve lies within the following limit range:

Square mesh, mm	Passing through sieve, %
0.09	4-10
0.25	7-15
0.75	12-23
2.00	20-35
4.00	29-46
6.00	41-62
11.20	50-71
16.00	61-82
22.40	76-94
31.50	97-100
45.00	100

9.4.3.2 Rock Flour

Rock Flour shall fully meet the criteria set out in SRPS B B3.045 for Quality Class I.

9.4.3.3 Bitumen

Bitumen may be Bit 60. Bitumen shall fully meet the criteria set out in SRPS U M3.010.

9.4.3.4 Mix

In an asphalt mix, the proportion of bitumen shall be about 4%. A precise content of bitumen shall be determined in a trial asphalt mix. Mineral mix grain size accumulation curves shall fall within the limits stated in Sub-Sections above (9.3.3.2).

Properties of test specimens according to the Marshall test shall be as follows:

- Void content (v/v%)..... 5-9%
- Stability (kN)..... min 8.0
- Stability/flow ratio (kN/mm)..... 2.5

9.4.4 Work Technology

9.4.4.1 Temperature of Bitumen and Asphalt Mix

The temperature of bitumen shall be 150-165°C. The temperature of aggregate shall not be higher than the temperature of bitumen by more than 15°C. The temperature of asphalt mix in the mixer shall be within the range 150-170°C (in exceptional cases 175°C).

9.4.4.2 Preparation of Underlying Surface

Preparation shall comply with the requirements of Sub-Section 9.3.4.1.

9.4.4.3 Spraying

Suitable bituminous emulsion shall be used for spraying. Spraying shall be done with a sprayer, with 0.2 kg/m².

9.4.4.4 Work Execution Period

The base course with specifications as set out herein may be laid only in the period in the period from 15th April to 15th October, i.e. in the period when air temperatures are higher than 5°C in windless conditions, or min 10°C with wind unless otherwise agreed in writing by the Engineer. Asphalt mix shall not be laid during misty or rainy weather. The temperature of underlying surface shall not be lower than +5°C.

9.4.4.5 Laying of Asphalt Mix

BNS is laid with a paver. A manual work is allowed only where a paver cannot be used because of spatial restrictions and subject to the approval of the Engineer. The temperature of asphalt mix at the place of laying shall neither be lower than 140°C nor higher than 160°C.

9.4.4.6 Compaction

Rollers of various types and weight may be used for compaction, with the requirement to reach a compaction degree of min 98%. Single runs of rollers shall always overlap.

9.4.4.7 Construction Joints

When resuming work after longer pauses, irregular ends shall be trimmed vertically in full thickness and coated with a hydro-carbon binder.

9.4.5 Quality control

The quality control shall cover the pre-testing of quality, regular tests, and control tests.

To ensure a prescribed quality in the course of works, the control laboratory approved by the Engineer shall perform regular control tests as directed by the Engineer.

9.4.5.1 Pre-Testing of Asphalt Mix

Prior to the commencement of works, the Contractor shall elaborate a trial asphalt mix design in an authorized laboratory approved by the Engineer, fully in accordance with the requirements from these Technical Specifications. No operation shall start until the Contractor has proposed a trial mix design to the Engineer for approval and the Engineer has issued formal approval. Compliance certificates for basic materials and trial mix shall not be older than 6 months. If any changes in basic materials or their selection occur, the Contractor shall submit to the Engineer a written proposal for modification of the adopted asphalt mix design, i.e. propose a new trial mix design for approval, before the use of these materials starts.

9.4.5.2 Job Mix Formula for Asphalt

The job mix formula for asphalt shall be determined through trial work in the asphalt plant and by its application.

If the quality of basic materials on site is not in compliance with these Technical Specifications, the Contractor shall ensure new basic materials of good quality. If the batching of basic materials, according to the trial mix formula, cannot meet all specified requirements for physical and mechanical properties of asphalt mix and for constructed layer, it is necessary to modify the batching of basic materials and repeat the trial procedure to the full satisfaction and approval of the Engineer.

Only when the trial procedure meets all specified requirements, the Engineer shall adopt the trial mix and give his approval for work to continue. The proving job mix formula for asphalt shall be prepared in an authorized operative laboratory approved by the Engineer.

In the course of works, the granulometric composition of rock mix of particular test samples may vary from the trial and job mixes within limits prescribed in SRPS U.E9.021 'Table 14' and subject to the approval of the Engineer.

9.4.5.3 Regular Testing of Component Materials

Scope and frequency of regular tests of component materials (filler, bitumen) is defined in SRPS U.E9.021 –Sub-Section 14.2.2.

9.4.5.4 Testing of Asphalt Mix and Constructed Layer for Physical/Mechanical Properties

Testing of asphalt mix and constructed layer for physical/mechanical properties. These tests shall be performed by the operative laboratory:

- At the beginning of works, and
- At every 2000 m²
- Whenever required by the Engineer

A specimen of asphalt mass shall be taken from hot, just laid, asphalt mix, behind the paver. The control of compaction and voids in the surfacing shall be performed on "cores" extracted from a finished layer at the same place where a specimen of hot asphalt mix is taken.

9.4.6 Criteria for Calculation of Executed Works

9.4.6.1 Evenness of Layer

The criteria stated in Sub-Section 9.3.6.1 shall apply.

9.4.6.2 Variation in Specified Height of Layer

The criteria stated in Sub-Section 9.3.6.2 shall apply.

9.4.6.3 Content of Residual Voids

The criteria stated in Sub-Section 9.3.6.3 shall apply.

9.4.6.4 Granulometric Composition of Mineral Mix

The criteria stated in Sub-Section 9.3.6.4 shall apply.

9.4.6.5 Rolling (Compaction) of Surfacing

The criteria stated in Sub-Section 9.3.6.5 shall apply.

9.4.7 Measurement and Payment

Measurement and payment shall be performed per m² of an actually constructed asphalt layer of specified thickness, fully in accordance with this description and criteria, the Technical Specifications, and subject to the approval of the Engineer.

9.5. Construction of Wearing Layer with Stone Mastic Asphalt 0/11S

9.5.1 Description and Purpose of Work

This item of works includes the procurement, preparation, laying, and compaction of a wearing layer with stone mastic asphalt SMA 0/11S.

Stone mastic asphalt is a mix of crushed aggregate and sand of discontinuous grain distribution curve that, due to a relatively high content of aggregate (70- 80%), has an extremely skeletal structure that is filled with bituminous mastic composed of filler, dope, polymer-modified bitumen, and stabilizing fibres.

The basis for preparation of technical specifications for this item of works is SRPS U.E4.015 (Construction of skeletal asphalt surfacing for maintenance, strengthening, and construction of a new pavement structure) and SMA 0/11 - ZIV Asphalt-Stb, 1998. *Empfehlungen für die Zusammensetzung, die Herstellung und den Neubau von Splittmastixasphalt, FGSV 1966.*

9.5.2 Basic materials

- Crushed high-grade chippings 2/4, 4/8, and 8/11 mm;
- Crushed sand 0/2 mm (silicate or carbonate)
- Rock flour of carbonate composition,
- Cellulose fibres, and
- Polymer-bitumen PmB 60S.

9.5.3 Quality of Component Materials

Polymer-Bitumen PmB 60S

Polymer-modified bitumen, based on SBS-polymer, 50-90S type, according to Austrian specifications ONORM B3613 (Elastomer-modifizierte Bitumen für den Strassenbau—Anforderungen) shall be used as binder, with the characteristics as given in the table below.

Test type	PmB 50-90C	Test method
Penetration at 25°C (1/10 mm), (100 r/5s)	50 – 90	SRPS B.H 8.612
Softening point according to PK, (°C)	> 65	SRPS B.H 8.613
Frass breaking point (°C)	< -19	SRPS B.H 8.616
Ductility, (cm), at 25°C	> 50	SRPS B.H 8.615
Cleveland flash point, (°C)	> 250	DIN ISO 2592
Reversible elastic deformation at 25°C,%	> 80	ÖNORM C 9219
Homogeneity during storage, Δ PK, (°C)	~2.0	TL PmB Teil I (1991) Tube Test
After R/FOT according to ASTM D 2872		
Mass loss, % (m/m)	< 0.5	-
Change in penetration at 25 °C, (%)		SRPS B.H8.612
• decrease	< 40	
• increase	< 10	
Reversible elastic deformation at 25°C,%	> 80	ÖNORM C 9219

Instead of polymer-bitumen PmB 60S, standard road bitumen Bit 60 may be used, with the addition of 0.6% (m/m), with respect to asphalt mix, of polymer-modified bitumen cellulose granules.

Rock Flour

Rock flour for the preparation of asphalt mix SMA 0/11S shall be of carbonate composition, Quality Class I, according to SRPS B.B3.045.

Crushed Sand 0/2 mm

Crushed sand 0/2 mm, for the preparation of SMA 0/11S, may be of either silicate or carbonate composition, provided that it meets the following requirements:

Granulometric distribution of crushed sand 0/2 mm

Square mesh size (mm)	Passing through sieve, % (m/m)
0.09	0 – 10*
0.25	15 – 35
0.71	40 – 85
2.00	90 – 100
4.00	100
Grading modulus	1.70 – 2.55

* If the content of filler (particles < 0.09 mm in size) is larger than 10%, sand may be used only if of carbonate composition, and if the sand equivalent is larger than 60%. Silicate sand, with more than 10% of filler, shall not be used regardless of the sand equivalent value.

Physical/chemical properties of crushed sand 0/2 mm

CHARACTERISTICS	QUALITY REQUIREMENTS
Content of particles < 0.09 mm in size, % (m/m)	< 10
Sand equivalent, %	> 60
Content of clay balls, % (m/m)	0
Content of organic impurities, % (m/m)	0

Chippings

For the preparation of stone mastic asphalt, eruptive rock chippings shall be used, with the granulometric composition in conformity with requirements set out in SRPS U.E4.014/90 and SRPS B.B3.100.

Rock aggregates shall be accompanied with valid compliance certificates issued by an authorized laboratory pursuant to the "Ordinance on mandatory compliance testing of fractionated rock aggregate for asphalt and concrete", published in the Official Journal of SFRY No. 41 dated 19th June 1987. Chippings shall possess the following physical/mechanical characteristics:

	Standard	Characteristics	Quality requirements
1.	SRPS B.B8.045	Resistance to crushing and wear according to Los Angeles method	< 18 % (m/m)
2.	SRPS B.B8.120	Polished value	> 48 VPK
3.	SRPS U.M8.096	Percentage of rock aggregate surface coated in polymer-bitumen	> 100/90
4.	SRPS B.B8.044	Frost resistance with sodium sulphate, mass loss after 5 cycles	< 3 % (m/m)
5.	SRPS B.B8.031	Water absorption on 4/8 mm fraction	< 1.2 % (m/m)
6.	SRPS B.B8.048	Proportion of grains with the maximum-to-minimum size of grain >3:1	< 20 % (m/m)
7.	SRPS B.B8.037	Proportion of weak grains in fractions > 4 mm	< 3 % (m/m)
8.	SRPS B.B8.038	Proportion of clay balls in a particular fraction	< 0.25 % (m/m)

9.5.4. Composition of Mineral Mix for SMA 0/11S

Granulometric Composition of Mineral Mix

The proportion of basic materials in mineral mix shall be adjusted in such way that the grain size accumulation curve lies within the following limit range :

Mesh size	Limit range SMA 0/11S
0.09 MM / 0.09 mm	11 - 13
0.25 MM / 0.25 mm	13 - 17
0.71 MM / 0.71 mm	16 - 22
2.0 MM / 2.0 mm	23 - 27
4.0 MM / 4.0 mm	23 - 32
8.0 MM / 8.0 mm	50 - 64
11.2 MM / 11.2 mm	95 - 100
16.0 MM / 16.0 mm	100

Allowed deviations in granulometric composition

Allowed deviations in the granulometric composition of rock mix in a job mix formula and individual specimens in the course of production; from the granulometric composition of rock mix in a trial mix formula shall be within the following tolerances

Tolerances for variations in granulometric composition of mineral mix

Square mesh size	Allowed variation of the granulometric composition of rock in a job mix and particular specimens during the production process from the granulometric composition of rock in a trial asphalt mix, \pm % (m/m)
0.09 MM / 0.09 mm	\pm 0.5
0.25 MM / 0.25 mm	\pm 1.0
0.71 MM / 0.71 mm	\pm 1.5
2.0 MM / 2.0 mm	\pm 1.0
4.0 MM / 4.0 mm	\pm 2.0
8.0 MM / 8.0 mm	\pm 3.0

Orientalional asphalt mix formula

An orientational asphalt mix formula is

- Filler 0-0.09 mm.....	10%
- Sand 0.09-2 mm.....	15%
- Chippings 2-11 mm.....	75%
Total	100%

In order to achieve good resistance to deformation, the ratio of fractions 0/2, 2/4, 4/8 and 8/11 mm in mineral mix shall be 1:1:3:4, and for good resistance to wear, the ratio of fractions shall be 1:1:2:4.

An optimum composition of asphalt mix and polymer-bitumen shall be determined when preparing trial and job asphalt mix formulae.

9.5.5. Quantity of Polymer-Bitumen

The content of polymer-bitumen in asphalt mix SMA 11S shall fall within the range 6.0-6.5%. A precise amount of binder shall be defined when preparing trial and job mix formulae.

An optimum amount of polymer-bitumen in asphalt mix shall be checked with the Schellenberg test.

9.5.6. Quantity of Stabilising Fibres

In mixing SMA-11S, bitumen-impregnated cellulose fibres in granular shape are used as a stabilising admixture in the amount of 0.4% (m/m) in proportion to asphalt mix. Special mountable batchers are used to batch cellulose granules in the right amount per mass

9.5.7. Trial asphalt mix design

Prior to the commencement of works, the Contractor shall prepare a trial asphalt mix design in an authorized laboratory approved by the Engineer in full compliance with requirements set in these Technical Specifications

No operation shall start before the Contractor has proposed the trial mix design to the Engineer for approval and the Engineer has issued formal written approval. Compliance certificates for basic materials and trial mix shall not be older than 6 months. If any changes in basic materials or their selection occur, the Contractor shall submit to the Engineer a written proposal for modification of the adopted asphalt mix, i.e. propose a new trial mix design for approval, before the use of these materials starts.

Testing of Characteristics of Component Materials

When designing a trial asphalt mix, the supplied specimens of basic materials shall be subjected to the following tests:

- Testing of polymer bitumen: softening point according to PK, penetration at 25°C, penetration index, ductility at 25°C, reversible elastic deformation, homogeneity and thermostability tests, relative density at 25°C, and Frass breaking point.
- Testing of rock flour: granulometric composition, Rigid voids, and density at 25°C.
- Testing of sand: granulometric composition, proportion of particles smaller than 0.09 mm in size, sand equivalent, and grading modulus.
- Rock aggregate: granulometric composition of fractions, water absorption for 4/8 mm chippings fraction, resistance to crushing and wear (Los Angeles), adhesion of binder to aggregate, and grain shape.

Designing of Asphalt Mix Formula and Physical/Mechanical Properties

The granulometric composition of rock mix in a trial mix formula shall be designed within the limit range given in these Technical Specifications. The mineral mix and quantity of polymer bitumen shall be designed so that the physical/mechanical properties of asphalt mix meet the following requirements:

Physical/Mechanical properties of Marshall specimens

	Type of specimen	Characteristic	Standard	Trial and job asphalt mix
1.	Laboratory test specimen compacted with 2 x 50 blows at the temperature of $155 \pm 5^\circ\text{C}$	Marshall stability at 60°C . (kN)	SRPS U. M8.090	> 8.0
2.		Stability/Flow ratio at 60°C , (kN/mm)	SRPS U. M8.090	> 2.0
3.		Void content, % (v/v)	SRPS B. B8.031	3.5 - 4.5
4.		Voids in rock mix filled with bitumen, % (v/v)	SRPS B. B8.031	70 - 85
5.		Voids in mineral mix, % (v/v)	SRPS B. B8.031	17 - 19

Characteristics of Constructed Asphalt Layer

A constructed layer SMA 0/11S shall possess the following properties:

	Characteristics	Quality requirements
1.	Voids in constructed layer, % (v/v)	3 - 5
2.	Compaction degree, %	> 98 %
3.	Evenness of layer determined with a 4 m levelling staff	< 3 mm
4.	Variation of the surface of layer from the specified reference level	< 3 mm
5.	Variation from the specified cross fall	< ± 0.2 %
6.	Granulometric composition of extracted mineral mix shall lie within the range set out in these Technical Specifications	-
7.	Variation of the amount of binder from the amount specified in the trial asphalt mix	< ± 0.3 % (m/m)
8.	Physical/mechanical properties of asphalt specimens shall meet the requirements from these Technical Specifications	-

Report on Preparation of Trial Asphalt Mix Formula

The report on preparation of trial asphalt mix formula shall contain:

- Data on origin, quality, and properties of component materials
- Data on proportion of rock material fractions in mineral and/or asphalt mix
- Granulometric composition of mineral mix
- Optimum content of binder
- Physical/mechanical properties of a laboratory test specimen, and
- Grain size distribution chart for mineral mix.

The Report on trial mix formula shall be accompanied with compliance certificates for component materials, not older than 6 months, and a valid compliance certificate for rock material issued by an authorized laboratory, pursuant to the "Ordinance on mandatory testing of fractionated rock aggregate for asphalt and concrete" issued in the Official Journal of SFRY No. 41 dated 19th June 1987.

9.5.8. Job Mix Formula for Asphalt

Prior to the commencement of works, a job mix formula for asphalt shall be prepared and submitted for the approval of the Engineer. The job mix formula for asphalt shall serve as proof that the asphalt plant can produce asphalt mix of quality designed in the trial asphalt mix design to the full satisfaction and approval of the Engineer. The pre-requisite for proving the trial asphalt mix formula is the verification of quality of component materials stored in the asphalt plant.

Proving Quality of Produced Asphalt Mix (Trial Production)

The production of asphalt mix is considered proven when the testing of at least three specimens of asphalt mix taken from continuous production shows that:

- The granulometric composition of rock mix is within the allowed range of deviations set out in these Technical Specifications
- The proportion of binder for each specimen is within the allowed range of deviations of ± 0.3 % (m/m) from the values given in the trial asphalt mix design, and
- Physical/mechanical properties of all specimens meet the requirements set out in these Technical Specifications.

The job mix formula for asphalt is to be given in a form of written report.

When a job mix formula for asphalt in the asphalt plant cannot fully fit into allowed variations, it is necessary to correct the trial mix formula for asphalt with the Designer's approval and also subject to the approval of the Engineer.

The trial mix formula for asphalt shall be redesigned, if it cannot be proven in the asphalt plant due to major differences in the composition and properties of component materials in the asphalt plant or due to specifics of the asphalt plant, or as otherwise directed by the Engineer.

9.5.9. Proving Quality of Laid Asphalt Mix (Trial Section)

Prior to the commencement of works, a trial section shall be constructed. The trial section serves as proof that the job mix, with an appropriate work technology, can construct a regulating course in the quality specified in these Technical Specifications to the full satisfaction and approval of the Engineer.

In the course of construction of a trial section, the following shall be controlled:

- Asphalt mass transport method
- Temperature during rolling
- Rolling method
- Compaction, and
- Evenness of constructed surface.

The quality of a trial section is considered to be proven once the testing of at least three specimens from the laid asphalt layer obtain satisfactory characteristics in accordance with the criteria from these Technical Specifications and subject to the approval of the Engineer.

The assessment of trial section quality, including test results, shall be given in the form of a written report.

Based on the proved quality of trial production and trial section, the Engineer shall approve the commencement of works in writing.

9.5.10. Technology of Work

Production of Asphalt Mix

Asphalt mix shall be produced mechanically. For the production of asphalt mix, a discontinuous plant, with a minimum capacity of 60 t/h and automatic batching and production control, shall be used.

The asphalt plant shall have at least two back-up tanks, and a working tank for storing polymer-bitumen. The tanks shall be equipped with thermometers.

The asphalt plant shall have an incorporated automatic batcher by mass for cellulose granules. The batching method, according to the Manufacturer's instructions, shall foresee the feeding of granules along with rock material directly into the asphalt mixer, followed by rock flour, and, after 10-15 seconds of mixing in dry, by binder.

The asphalt plant shall have sieves according to adopted trial mix, and batchers for component materials shall have four scales for: rock aggregate, rock flour, polymer-bitumen, and cellulose granules.

The asphalt plant shall be equipped with thermometers for binder and mineral aggregate, and also for hot asphalt mix in a silo.

The number of pre-batchers shall be at least six; each of them shall have mechanical and automatic flow regulation.

A cyclone in the asphalt plant shall have an option to adjust the degree of dedusting and removal of silty particles in order to remove the content of filler above 10% in sand fractions, as needed.

The plant shall have at least 4 hot bunkers for fractions of rock material. There shall be appropriate square mesh sieves put in place in the plant, so that the following fractions could be provided in hot bunkers:

- Fraction 0/2 mm (with max 10% particles below 0.09 mm)
- Fraction 2/4 mm
- Fraction 4/8 mm – fraction 8/11 mm

Furthermore, in the set of sieves, there shall also be a limit sieve that will remove grains of chippings above 11 mm in size.

Immediately after production, asphalt mass shall not be stored, but transported to the place of laying without delay, so as not to cool down.

To prevent asphalt mass to stick to the transport hopper, it is necessary to regularly lubricate the hopper with 40% silicone emulsion sprayed through an automatic nozzle.

Acceptance and Storage of Basic Materials

The Contractor shall ensure all required quantities of rock material, as foreseen for this project, on stockpiles at least 10 days before the commencement of works.

Rock aggregate foreseen for the production of asphalt mix shall be stored on special, new stockpiles. It is not allowed to mix it with earlier supplies of material. The stockpiles shall be on a firm surface (concrete, asphalt, macadam); it is forbidden to use stockpiles on earth surfaces. The stockpiles shall be at sufficient distance to prevent any mixing of fractions; the stockpiles shall be clearly marked by aggregate fractions.

Rock flour shall be stored in a special silo that shall be previously emptied from any prior supplies.

Polymer-bitumen shall be delivered to the asphalt plant immediately before the commencement of production of asphalt mass in order to avoid any unnecessary storage in a higher temperature. The delivery schedule for polymer-bitumen shall be arranged so that the amount of binder delivered to the asphalt plant is immediately used for the production of asphalt mix. In the asphalt plant, polymer-bitumen shall be discharged into working and back-up tanks previously emptied from old bitumen.

The delivery of basic materials shall be submitted for the approval of the Engineer based on a quality certificate issued by an authorized institution.

Preparation of Rock Aggregate

Rock aggregate shall be dried and heated in a heating drum at the temperature of 170-180°C.

In no case shall the temperature of aggregate be higher than the temperature of binder by more than 15°C.

Preparation of Binder - Temperatures of Polymer-Bitumen and Asphalt Mix

Temperatures of polymer-bitumen, during storage and preparation of asphalt mix, shall not be higher than those shown in the table below. Also, the time of exposure of polymer-bitumen to elevated temperatures during storage shall be limited. Polymer-bitumen should be exposed to elevated temperatures as little as possible, in order to prevent its demixing and separation of polymer on top of bitumen.

Optimum working temperatures for polymer-bitumen and SMA mix

Temperature of PmB	Recommended	Maximum
In a tank	155° C	165°C
SMA at the mixer discharge point	170°C - 175°C	180°C

Before the process of mixing with rock material, it is recommendable to additionally homogenize polymer-bitumen. This is achieved by recirculating binder from one tank to another.

Mixing

The time of mixing, and the entire batching and mixing process shall be adjusted so that all aggregate grains are coated with binder uniformly. The mixing time shall be determined by the Contractor and submitted for the approval of the Engineer.

Hot mineral mix, cellulose granules, and rock flour shall be mixed together in the asphalt mixer for 10-15 seconds, and then heated binder shall be added, with everything mixed together for another 30 seconds. The mixing of asphalt mix components shall be proportioned according to the approved job mix formula.

To prevent the sticking of asphalt mass, the hopper shall be sprayed with 40% solution of silicone emulsion or water solution of potassium soap.

Temperature of aggregate, polymer-bitumen and asphalt mix shall be in compliance with temperatures stated in Sub-Section 9.9.4. If the temperatures of asphalt mix, after mixing, are lower or higher than those specified in the table, the mass shall be discarded. The same applies to the mix, if foamy or contains moisture.

Asphalt Mix Transport

Transport vehicles for asphalt mix shall have a tipping mechanism. Every truck shall have a tarpaulin to protect asphalt mix from cooling, weather conditions, dust, and wind, i.e. to keep its temperature until laying and prevent the moistening of asphalt mix. The temperature of asphalt mix during laying shall neither be lower than 165°C nor higher than 180°C. The Contractor shall ensure a sufficient number of trucks for transport, with regard to the capacity of asphalt plant, transport distance, and the size of site, in order to avoid interruptions in the work of paver. The paver shall not stop!

The hopper of a truck for transport of asphalt mix shall be clean and sprayed before every feeding with an agent that prevents asphalt mix from sticking to its sides. The most suitable agents for that are a 40% silicone emulsion, or a water solution of potassium soap. The use of oil derivatives for spraying is not allowed.

Every truck of delivered asphalt mix shall be accompanied with a delivery note with specified weight, temperature, and time of loading of asphalt mix, signed by the Contractor and submitted for the approval of the Engineer. Without this document, the laying of delivered asphalt mix shall not be allowed.

It is allowed to keep asphalt mix in silos in the asphalt plant up to 2 hours, or if the silos are thermally insulated, that time can be longer, all this provided that the temperature of asphalt mix remains within the prescribed range and subject to the approval of the Engineer.

*Laying of Asphalt Mix**General Note*

The construction of an asphalt layer may start only when the Engineer accepts and confirms approval for the report on trial section, and/or report of performed trials.

Weather Conditions During Construction

A wearing layer made of stone mastic asphalt may be constructed only in warm and dry weather, only in the period when air temperatures are higher than +10°C in windless conditions, or min. +15°C with wind. The temperature of underlying surface shall be higher than +10°C. The Contractor and Engineer shall pay particular attention to that, because SMA mix cools down rapidly and the prescribed compaction will not be reached.

The laying of asphalt mix may start only when approved by the Engineer.

*SMA Laying Machines***Pavers**

Pavers shall be electronically guided over a steel wire rope or laser-guided.

Rollers

For the compaction of SMA layers, only 10-tonne static steel-rim rollers shall be used. The use of combined rollers or rubber-tyre rollers is not allowed. Vibrations during rolling are not allowed. 4-5 rollers in total are needed. Rollers shall have functional water sprayers for wheels.

Preparation of Underlying Surface

The underlying surface on which the asphalt layer is to be constructed shall be dry and dedusted (with compressed air). The surface on which SMA 0/11S is laid shall be dry and clean, and shall not be frozen. Before constructing the layer, the underlying surface shall be sprayed with bituminous emulsion in the amount of 0.2 kg/m².

Temperature of Mix on Place of Construction

The temperature of spread asphalt mix on the place of construction shall neither be lower than 165°C nor higher than 180°C. Asphalt mix that does not have a specified temperature shall be discarded.

Spreading of Asphalt Mix

The layer shall be spread mechanically, with a paver with automatic height guidance.

The Contractor shall set the timing of production, transport, and spreading of asphalt mix so as to avoid interruptions in the work of paver, since longitudinal joints are not foreseen.

The paver shall be adjusted regarding all elements, and its speed adjusted so that the layer has a flat surface, and its thickness and cross fall are as specified in the design. There shall be no segregated spots, nor scratched places due to the unheated screed, or asphalt stuck to the screed; there shall be no oily stains, etc. Before the commencement of work, the screed shall be heated from a separate source (butane-gas). The compaction obtained with the paver shall be at least 90% of the laboratory value.

Compaction of Asphalt Mix

The compaction of asphalt mix shall be performed in a standard way, with 10-tonne static steel-rim rollers. The use of vibrations is not allowed. Rollers go immediately behind a paver and shall pass 6 runs in one direction to achieve the specified compactions, which is determined on a trial section. Rolling shall start at the temperature of 170°C, with an optimum temperature between 160°C and 140°C. Rolling shall be finished when the temperature drops below 130°C. A minimum compaction of the layer shall be 98 %.

Rollers are not allowed to stay on a still non-compacted layer of asphalt, when the temperature is over 80°C. For filling up with water, rollers shall be out of the working surface. All precaution measures shall be taken to prevent any leakage of oils, diesel, and lubricants to the pavement under rollers.

During rolling, the thickness, profile, and evenness of layer shall be checked constantly.

Longitudinal and Transverse Joints

If traffic cannot be diverted in the course of works, and one half of the road has to be constructed at a time, it is necessary, when joining the layer of asphalt concrete – SMA mix, use a joint tape. This tape is used for all asphalt layers in the surfacing, and for the bond between concrete and asphalt, or asphalt and stone. Joint tapes are bitumen-coated machined thermoplastic sections that soften under higher temperature (heating). These tapes contain different admixtures, with mineral filler. The tape, which shall be placed vertically or at 20° angle, should be higher by approx. 5 mm than the layer thickness. A usual height of these tapes is 25-30mm. The width of tape is 10 mm and shall not be increased.

The tapes are placed in the same weather conditions as asphalt: in dry weather and at ambient temperatures over +5°C. After the completion of works, the redundant part of tape above the pavement shall be cut and ground.

Opening to Traffic

A properly rolled layer of asphalt may be opened to traffic not earlier than 24 hours after rolling.

9.5.11. **Quality Assurance**

Quality assurance requires the pretesting of quality, the testing of job mix, the construction of a trial section, regular and control tests, fully in compliance with these Technical Specifications and to the full satisfaction and approval of the Engineer.

Regular Tests

The primary objective of regular control is to have the clearest possible comprehension of the quality of basic materials, produced and laid asphalt, in order to act in the production process if needed and thus ensure the specified quality of asphalt. Regular tests shall be performed by the Contractor or at the Contractor's expense, by a laboratory registered for that type of control subject to the approval of the Engineer.

Laboratory Equipment for Regular Control

The laboratory shall have all equipment for specified tests, for regular tests in the production process, and for tests performed during the production of a job mix formula for asphalt and the work on a trial section, as defined in these Technical Specifications. The regular control includes the testing of component materials and asphalt mix, as follows:

- Polymer-bitumen (PK, penetration)
- Rock flour (granulometric composition)
- Crushed sand (granulometric composition)
- Chippings 2/4, 4/8, and 8/11 (granulometric composition)
- Granulometric composition of rock mix
- Content of binder in asphalt mix, and
- Physical/mechanical properties of asphalt mix.

Asphalt mix specimens are taken at the place of production or construction from a hot, just spread asphalt mix behind the paver. The control of compaction, voids, and thickness shall be performed by the extraction of asphalt specimens (cores) at the same place where the specimens of hot asphalt mix are taken.

The scope and frequency of regular tests shall be such to ensure a uniform quality in compliance with these Technical Specifications, namely:

- Regular tests of rock flour, crushed sand, and chippings shall be performed at every 500 t of produced asphalt mix
- Regular tests of polymer-bitumen shall be performed at the beginning and at every 25 t of consumed polymer-bitumen, and
- Regular tests of the composition and physical/mechanical properties of asphalt mix shall be performed at every 500 t of produced asphalt mix.

Control tests

Control tests shall be performed by the Contractor or, at his expense, at a laboratory registered for this type of work subject to the approval of the Engineer.

Control tests include the testing of quality of: polymer-bitumen, rock flour, sand, and chippings.

The scope and frequency of control tests shall be such to ensure a comprehension of quality of constructed layer in compliance with these Technical Specifications, namely:

- Polymer-bitumen - at least 1 specimen at every 50 t of delivered polymer-bitumen (full-scale testing in accordance with these Technical Specifications)
- Rock flour - at least 1 sample at every 1000 t of produced asphalt (granulometric composition, proportion of voids in dry compacted condition)
- Crushed sand - at least 1 sample at every 1000 t of produced asphalt (granulometric composition, content of particles <0.09 mm, and sand equivalent)
- Chippings - at least 1 sample from each fraction at every 1000 t of produced asphalt (granulometric composition, content of particles < 0.09 mm, grain shape, and content of friable grains).

In the course of works, the physical/mechanical properties and composition are checked on the samples of asphalt mix taken from hot, just spread, asphalt mix at every 1000 t of produced asphalt mass. The quality of constructed layer shall be determined by the extraction of cores at the same place where hot asphalt mix samples are taken, at least at 6000 m² of constructed layer, when the following is tested: density, thickness, voids, compaction, and adhesion to the underlying surface.

Furthermore, evenness, variations from the profile and reference levels, and the position of centre line shall be checked as well.

9.5.12. Criteria for Calculation of Executed Works

Evenness of Layer

Measurement shall be performed with a 4 m straight edge (left, right, middle), or bump integrator, continuously in full length.

The criteria are as follows:

- The criteria stated in Sub-Section 9.3.6.1 shall apply.

Variation in Specified Height of Layer

Measurements shall be performed on every profile.

- The criteria stated in Sub-Section 9.3.6.2 shall apply.

Content of Residual Voids

The criteria stated in Sub-Section 9.3.6.3 shall apply.

Granulometric Composition of Mineral Mix

The criteria stated in Sub-Section 9.3.6.4 shall apply.

Compaction (Rolling) of Surfacing

The criteria stated in Sub-Section 9.3.6.5 shall apply.

9.5.13. Calculation of Works

Measurement and Payment:

Measurement and payment shall be performed per m² of an actually constructed stone asphalt layer, fully in accordance with this description and criteria, the Technical Specifications, and subject to the approval of the Engineer.

9.6. Construction of Wearing Layer with Asphalt Concrete AB 11 (Bit 60)

9.6.1. Description

This item of works includes the procurement, preparation, laying, and compaction of asphalt concrete in a 5 cm thick layer. The basis for elaboration of technical specification for this item of works is SRPS U.E4.014.

9.6.2. Basic materials

- High-grade crushed chippings 2/4 mm, 4/8 mm, 8/11 mm;
- Crushed sand 0/2 mm (carbonate)
- Rock flour of carbonate composition
- Bitumen BIT 60 (PK=49-55; Pen=50-70).

9.6.3. Quality of Basic Materials

9.6.3.1. Chippings

Chippings shall be made of rock mass of the following properties.

Property	Quality requirements
Compressive strength	min 160 MPa
Abrasion wear	max 12 cm ³ /50 cm ²
Frost resistance	good *

* / Drop in mean compressive strength after 25 freeze-thaw cycles – max. 20 %

Chippings shall meet the following requirements.

1. Granulometric composition of fractions according to SRPS U.E4.014/90
2. Wear, Los Angeles test..... max 16%
3. Content of grains of unfavourable shape max 20%
4. Content of friable grains..... max 3%
5. Content of clay balls in a single fraction, according to SRPS B.B8.038 max 0,25%
6. Bitumen-coated surface of aggregate, SRPS U.M8.096 min 100/90

9.6.3.2. Sand

For sand, high-grade crushed sand obtained from rock mass of carbonate composition may be used. The granulometric composition of sand shall meet the following requirements:

Sieve mesh in mm		Passing through sieve in % weight Crushed sand 0/2 mm
0,09	0,09	0-10 *
0,25	0,25	15-35
0,71	0,71	40-85
2	2	90-100
4	4	100

* / If sand contains over 10% of filler fractions it may be used provided that the sand equivalent is over 60%

Sand shall also meet the following requirements:

1. Sand equivalent min 60%
2. No clay balls shall be present in sand
3. Sand shall not contain organic impurities
4. No clays of particles glued together shall be formed in sand.

9.6.3.3. Rock Flour

Carbonate rock flour, Quality Class I according to SRPS B.B3.045 shall be used. The use of rock flour made of ground dolomite rock is not recommendable due to its lower adhesion to bitumen.

Prior to the commencement of works, the Contractor shall provide, from an authorized laboratory for the approval of the Engineer, a quality certificate for rock flour, which will guarantee for the quality according to SRPS B.B3.045 (Quality I).

9.6.3.4. Bitumen

Bitumen Bit 60 shall be used as binder, with the following properties: softening point (ring-and-ball PK 49-55°C), penetration 50-70, penetration index higher than -1,0, content of paraffin max 2%, and ductility min 100 cm. Other properties according to SRPS U.M3.010.

9.6.3.5 Mineral Mix Composition

The proportion of basic fractions in mineral mix shall be adjusted so that the grain size accumulation curve is as follows:

Sieve and screen mesh		Pre-tests and trial machine operation Passing through sieve and screen in % weight
0,09	0,09	3-12
0,25	0,25	8-28
0,71	0,71	16-38
2	2	31-54
4	4	49-69
8	8	75-90
11,2	11,2	97-100
16,0	16,0	100

9.6.3.6 Asphalt Mix Composition

An orientational asphalt mix composition is as follows:

- Filler 0-0.09 mm	8%
- Sand 0.09-2 mm	25%
- Chippings 2-11 mm	67%
Total	100%

- Binder Bit 60 – the amount of binder needed for asphalt mix to meet the specified qualities shall be determined in a trial asphalt mix formula.

An optimum amount of bitumen in asphalt mix shall not be less than 5.0%, in order to prevent rapid fatigue of asphalt concrete. For chippings of rock mass origin, that use a small amount of bitumen for coating, so that an optimum amount of bitumen would be below 5.0%, it is necessary to apply the upper limit grain size accumulation curve regarding filler and sand, and the lower limit values on the grain size accumulation curve for chippings.

9.6.3.7 Physical/Mechanical Properties of Asphalt Mix

Asphalt mix compressed into Marshall's moulds at 147-153°C and mineral mix of extracted asphalt mass shall meet the following requirements:

No.	Type of test	Quality requirements	
		Pre-tests and trial operation of the machine	Control tests
1.	Residual voids (%)	3-6	2.5-7.5
2.	Stability (kN)	7	7
3.	Flow (mm)	4	4
4.	S/F ratio	1.8	1.8
5.	Tolerances for variations of the sieving line of extracted mineral mix with respect to the mix adopted by trial machine operation	sieve 0.9 mm sieve 0.25 mm sieve 0.71 mm sieve 2 mm sieve 4 mm screen	>1.0 >2.0 >2.0 >1.0 >3.0 >3.0
6.	Tolerance for variations in the amount of binder with respect to the adopted mix formula	Determined through pre-tests, and the tolerance is within limits >0.3% of the value determined in the trial asphalt mix composition	

9.6.4 Properties of Constructed Wearing Layer

A constructed layer of asphalt concrete shall have the following properties

No.	Properties	Quality requirements
1.	Residual voids (S)	2.5-7.5
2.	Rolling (compaction) of layer (%)	min 95
3.	Evenness of layer under 4 m levelling staff	max 6 mm
4.	Variation of layer surface from specified height	max > 3 mm
5.	Variation from specified cross fall	max > 0.2%

9.6.5 Work Technology

9.6.5.1 Preparation of Underlying Surface

An asphalt layer may be laid over a surface that is dry and not frozen in any case. Prior to the commencement of works, the underlying surface shall be cleaned thoroughly with steel brushes and blown out with a compressor. After the surface has been cleaned, the Contractor will survey the reference level and evenness of the surface and submit all survey data for the inspection and approval of the Engineer. In

places where the underlying surface varies from the specified height by more than +15 mm, the Contractor shall repair the surface according to requirements set out in the design and subject to the approval of the Engineer, i.e.:

- In places where the surface level is below the specified reference level, the repair shall be done by increasing the thickness of layer of asphalt mix with asphalt concrete - wearing course
- In places where the surface level is above the specified reference level, excessive asphalt mass on the surface shall be removed by grinding.

9.6.5.2 Preparation and Transport of Asphalt Mix

The asphalt machine shall be equipped with a 16 mm mesh screen, to remove unpermitted coarse grains from mineral mix.

The temperature of bitumen shall be 150-165°C. The temperature of aggregate shall not be higher than the temperature of bitumen by more than 15°C.

The temperature of asphalt mix in the mixer shall be within the range 150-170°C (in exceptional cases 175°C).

9.6.5.3 Laying of Asphalt Mix

The temperature of asphalt mix on the site shall neither be lower than 140°C nor higher than 175°C.

9.6.5.4 Work Execution Period

A wearing course of specifications as set out herein may be laid only in the period from 15th April to 15th October unless otherwise approved by the Engineer, i.e. in the period when air temperatures are higher than 5°C in windless conditions, or min 10°C with wind. Asphalt mix shall not be laid during misty or rainy weather. The temperature of underlying surface shall not be lower than -5°C.

9.6.6 Quality control

9.6.6.1 Pre-Testing of Asphalt Mix

Prior to the commencement of works, the Contractor shall prepare a trial asphalt mix design in an authorized laboratory approved by the Engineer, in full compliance with requirements set in these Technical Specifications.

No operation shall start before the Contractor has proposed the trial mix design to the Engineer for approval and the Engineer has issued formal written approval. Compliance certificates for basic materials and trial mix shall not be older than 6 months. If any changes in basic materials or their selection occur, the Contractor shall submit to the Engineer a written proposal for modification of the adopted asphalt mix, i.e. propose a new trial mix design for approval, before the use of these materials may start.

9.6.6.2 Verified Job Mix Formula for Asphalt

The quality of a trial asphalt mix shall be verified through trial work, with the asphalt mix adopted in the plant, and the application quality on a trial section. If the quality of basic materials on site is not in compliance with these Technical Specifications, the Contractor shall ensure new basic materials of good quality. If the batching of basic materials, according to the trial mix formula, cannot meet all specified requirements for physical and mechanical properties of asphalt mix and for constructed layer, it is necessary to modify the batching of basic materials and repeat the trial procedure. Only when the trial procedure meets all specified requirements, the Engineer shall adopt the trial mix and give his approval for work to continue.

The proving job mix formula for asphalt shall be prepared in an authorized operative laboratory approved by the Engineer.

9.6.6.3 Quality control

To ensure the specified quality in the course of construction, the control laboratory approved by the Engineer shall perform regular control tests, namely:

Testing of Bitumen

The Contractor may procure bitumen only provided that for each delivery he ensures the Manufacturer's compliance certificate that will be immediately presented to the Engineer and/or laboratory for approval.

Apart from looking into the Manufacturer's compliance certificate, the operative laboratory shall perform regular tests (PK, penetration, and point of failure), as follows:

- At the beginning of works, and
- At every 200 t of supplied bitumen
- Whenever directed by the Engineer

Testing of Filler

The laboratory shall test the granulometric composition of filler:

- At the beginning of works, and
- At every 100 t of supplied filler.
- Whenever directed by the Engineer

Testing of Asphalt Mix and Constructed Layer for Physical/Mechanical Properties

These tests shall be performed by the operative laboratory:

- At the beginning of works, and
- At every 2000 m²
- Whenever directed by the Engineer

A specimen of asphalt mass shall be taken from hot, just laid, asphalt mix, behind the paver. The control of compaction and voids in the surfacing shall be performed on "cores" extracted from a finished layer at the same place where a specimen of hot asphalt mix is taken.

9.6.7 Criteria for Calculation of Executed Works

9.6.7.1 Evenness of Layer

The criteria stated in Sub-Section 9.3.6.1 shall apply...

9.6.7.2 Variation in Specified Height of Layer

The criteria stated in Sub-Section 9.3.6.2 shall apply...

9.6.7.3 Content of Residual Voids

The criteria stated in Sub-Section 9.3.6.3 shall apply...

9.6.7.4 Granulometric Composition of Mineral Mix

The criteria stated in Sub-Section 9.3.6.4 shall apply...

9.6.7.5 Rolling (Compaction) of Surfacing

The criteria stated in Sub-Section 9.3.6.5 shall apply...

9.6.8 Measurement and Payment

Measurement and payment shall be performed per m² of an actually constructed asphalt concrete layer, 4 cm thick, fully in accordance with this description and criteria, the Technical Specifications, and subject to the approval of the Engineer

9.7 Wearing Course of Bituminous Concrete BC 8

9.7.1 Description

This Item shall include supply, mixing, placing and compacting bituminous concrete in 3 cm thick layer. The basis for work specification is SRPS U E4.014.

9.7.2 Basic Materials

- Crushed noble stone grit 2/4 mm, 4/8 mm,
- Crushed sand 0/2 mm (carbonate)
- Stone flour, carbonate composition
- Bitumen Bit 60 ((PK = 49-55; Pen. =50-70)

9.7.3 Basic Materials Quality

9.7.3.1 Stone Grit

Stone grit shall be prepared of rock massif with following properties:

Properties	Quality requirements
Compressive strength	min 120 MPa
Wear by grinding	max 35 cm ³ /50 cm ²
Resistance against frost	good*

*. The loss of mean compressive strength after 25 freezing/thawing cycles shall be max. 20%

Stone grit shall meet the following properties:

1. Grading of fraction Acc to SRPS U.E4.014
2. Abrasion by Los Angeles method max. 22%
3. Unfavorable shaped grains contents... max. 20%
4. Feeble grains contents max 3%
5. Clay balls contents in particular fraction acc. to SRPS B B8.038 max 0,25%
6. Aggregate surface cover by bitumen min 100/90 (SRPS U.M8.096)

9.7.3.2 Sand

The noble crushed sand produced of carbonate rock mass shall be used for sand fraction.

Grading of sand shall meet the following requirements:



Sieve openings in mm	Passing the sieve, in weight %
	Crushed sand 0/2 mm
0,09	0-10 *
0,25	15-35
0,71	40-85
2	90-100
4	100

*/ When contents of filler fractions would exceed 10%, such sand may be used under condition that sand equivalent exceeds 60%.

The sand shall meet also the following properties:

1. Sand equivalent shall be min 60%
2. Clay balls are not permitted within sand
3. Sand shall not contain organic impurities
4. Balls of adhered particles shall not be permitted within the sand

9.7.3.3 Stone Flour

Only I class carbonate stone flour shall be used, quality as required by SRPS B.B3.045. Use of stone flour from grinded dolomite rock is not desirable, for lower adherence to bitumen.

Contractor shall provide quality attest issued by an authorized laboratory before work commencement, as to guarantee the quality as required by SRPS B.B3.045 (I quality)

9.7.3.4 Bitumen

Binder shall be bitumen Bit 60 which is characterized by: softening point (ring and ball PK 51 – 55°C), penetration 50-70, and penetration index above -10, paraffin contents max. 2%, and ductility min 100 cm. Other properties according to SRPS U. M3.010.

9.7.3.5 Mineral Mixture Composition

Participation of basic fractions with mineral mixture shall be adjusted as to achieve the following grade curve:

Sieve and coarse sieve openings	Preliminary tests and machine dummy run
	Passing the sieve and coarse sieve in weight %
0,09	4-12
0,25	11-27
0,71	20-41
2	38-56
4	56-74
8	96-100
11,2	100

9.7.3.6 Asphalt Mixture Composition

Tentative asphalt mixture composition shall be as follows:

- Filler	0-0,09 mm	8%
- sand	0,09-2 mm	25%
- stone grit	2-8 mm	67%
	Total	100%

Binder BIT 60 – the quantity as necessary to achieve asphalt mixture that meets requirements shall be established with trial mix.

Optimum bitumen quantity in asphalt mix should not be below 5%, as to prevent quick fatigue of bituminous concrete. With stone grit originated from rock massif asking for small bitumen quantity and reducing the bitumen quantity below 5.0% the upper limit of grading line should be used in filler and sand range, but lower limit values within stone grit range.

9.7.3.7 Physical-Mechanical Properties of Asphalt Mixture

Asphalt mixture, when compressed into Marshall's cast at 147-153°C, and mineral mixture of extracted asphalt mass, shall both meet the following requirements:

No.	Test Type	Quality Requirements	
		Preliminary testing and trial machine operation	Control tests
1.	Remaining voids (%)	3-8	3-8
2.	Stability (kN)	min 8	min 8
3.	Flow (mm)	2-4	2-4
4.	Relationship S/F	2,0	2,0
5.	Grading line discrepancy tolerance of the extracted mineral mixture related to proposed mixture by trial machine operation	sieve 0,9 mm sieve 0,25 mm sieve 0,71 mm sieve 2 mm sieve 4 mm coarse sieve	>1,0 >2,0 >2,0 >1,0 >3,0 >3,0
6.	Tolerance of binder quantity discrepancy related to proposed mix formula	Shall be established based on of preliminary testing, and tolerance shall be within limits >0,3% of the value as established for preliminary asphalt mix formula	

9.7.4 Properties of Placed Wearing Course

The placed bituminous concrete course shall have following properties:

No.	Properties	Quality requirements
1.	Remaining voids (5)	3-8
2.	Layer compactness (%)	min 97
3.	Course Flatness under 4 m. long straightedge	max 6 mm
4.	Course surface deviation of required height	max >3 mm
5.	Deviation of required cross-fall	max >0,2%

9.7.5 Work Technology

9.7.5.1 Bedding Preparation

Asphalt course may be laid over dry and not frozen bedding. The bedding shall be cleaned by steel brushes and the dust shall be blown off by compressors before work commencement. After the cleaning completion, the Engineer shall establish the gradient and bedding flatness. On sections where the surface differs of the heights designed for more than +15 mm, Contractor shall obligatory correct the bedding, in conformity with requirements from Design, i.e.:

- On spots where the bedding surface is under the required level, the correction shall take place by increasing asphalt mixture course using bituminous concrete
- On spots where the bedding surface is above the required level, the correction shall consist of removing asphalt mixture surplus using cutting machine.

9.7.5.2 Preparation and Transport of Asphalt Mixture

Asphalt machine shall be supplied with coarse sieve with 16 mm openings, as to remove non-acceptable coarse grains within mineral composition.

Bitumen temperature shall be 150 – 160 °C. Aggregate temperature shall not exceed bitumen temperature for more than 15 °C.

Asphalt mix temperature in mixing machine shall remain within limits 150-170°C (exceptionally 175°C).

9.7.5.3 Placing Asphalt Mixture

Asphalt mixture temperature at placing location shall not be under 140°C and over 175°C

9.7.5.4 Season for Work

Wearing course, as specified within, shall be placed exclusively between April 15, and October 15, i.e. during the period when air temperature is above 5°C, without wind, or, when wind, temperature shall be over 10°C. Placing mixture shall not take place when foggy weather, or when rain. Bedding temperature shall not be below +5 °C.

9.7.6 Quality Control

9.7.6.1 Preliminary Testing of Asphalt Mixture

Before work commencement, the Contractor is obliged to prepare the preliminary asphalt mixture design with authorized laboratory, in full accordance with requirements of this Work Specification. No work shall take place before the preliminary mixture was proposed to Engineer for approval. Attest on basic materials and preliminary mixture shall not be older than 6 months. When any change in basic materials occurs, or the material choice is changed, the Contractor shall propose in written to Engineer the alteration of previously determined asphalt mixture, i.e. he shall propose a new mixture for approval before he commences the use of such materials

9.7.6.2 Proved Job Mix

Asphalt mixture quality shall be proved during probation work at asphalt plant, where the mixture shall be accepted, and the construction quality shall be proved on trial section. When the basic materials quality, established on site, differs of this Work Specification, the Contractor shall provide new basic materials of appropriate quality. When it is not possible to meet all requirements for physical-mechanical properties of asphalt mixture and for constructed layer by proportioning basic materials according to probation mixture, the proportioning correction is obligatory, as well as the probation work. Engineer shall accept the job mixture only when all requirements are met during the probation work, and then the approval for continuous work may be issued.

Job mix shall be proved by authorized Laboratory.

9.7.6.3 Quality Control

The Employer or the laboratory, engaged by the Employer, shall carry out regular control testing as to assure the quality required during construction, as follows:

9.7.6.4 Bitumen Testing

The Contractor shall procure bitumen only under condition that for each shipment a manufacturer attest is provided, which shall be immediately presented to Engineer, i.e. to Laboratory.

Independently of information on manufacturer attest, the Laboratory shall perform regular testing of reduced volume (PK, penetration, and breaking point) as follows:

- At the work commencement, and
- At each 200t of bitumen delivered

9.7.6.5 Filler Testing

The Laboratory shall test grading curve of filler as follows:

- At the work commencement, and
- At each 100 t of filler delivered

Testing physical-mechanical properties of asphalt mixture and layer constructed shall be performed by authorized Laboratory as follows:

- At the work commencement
- At each 2000 m².

Sampling asphalt mixture shall take place from the hot, just spread asphalt mixture behind paver. Compactness and voids control in the compacted layer shall take place by taking cores from the layer completed, at the same spot where hot mixture sampling took place.

9.7.7 Criteria for Payment

9.7.7.1 Layer Flatness

Measurement shall be done by Engineer on cross sections, but the distance between sections shall not exceed 30 m.

Measurement shall take place using straightedge 4 m. long (left end, right end, middle), or using Bump-Integrator, continuously along the length.

Criteria are as follows:

- Flatness 0-6 mm is satisfactory
- Flatness 6-10 mm is not satisfactory, and 5-25% of such surface shall not be paid
- Flatness over 10 mm is not satisfactory, and 100% of such surface shall not be paid

9.7.7.2 Layer Surface Deviation of Required Height

Measurement shall take place on each cross section:

- When height lowering 4-8 mm, 10-25% of such surface shall not be paid
- When height lowering 8-10 mm, 26-50% of such surface shall not be paid
- When height lowering over 10 mm, the work shall not be accepted

9.7.7.3 Remained Void Content

- When remaining voids within 8-9% limit, the value of wearing course shall be reduced for 5-25% of surface covered by sample.
- When remaining voids 9-10%, the value of wearing course shall be reduced for 25-50% of surface covered by sample.
- When remaining voids are over 10% limit, work shall not be accepted for the area covered by sample tested.

9.7.7.4 Mineral Mixture Grading Curve

When the Grading Curve of extracted mineral mixture differs from limit curve for required physical-mechanical properties, the value of wearing course to be paid to Contractor shall be reduced 5% for the area covered by sample tested.

When the number of results, deviating of permissible values for filler and bitumen fraction, exceeds 5%, asphalt course shall not be accepted as satisfactory.

9.7.7.5 Surfacing Compactness

- For compactness loss 1-3%, work value shall be reduced for 2-10% of surface covered by sample tested.
- For compactness loss 3-5%, work value shall be reduced for 10-50% of surface covered by sample tested.
- For compactness loss over 5%, the work completed shall not be acceptable.

9.7.8 Measurement And Payment

The quantity to be paid for shall be the number of square meters (m²) of the asphalt course completed in required thickness 3 cm, in full accordance with this specification and criteria."

Section 10
Concrete pavements

Contents

- 10.1. Description
- 10.2. Materials
- 10.3. Concrete
- 10.4. Production of Concrete
- 10.5. Execution of Works
- 10.6. Quality Control
- 10.7. Evenness, Height, and Direction
- 10.8. Calculation and Payment of Executed Works

10.1. Description

This item of works includes the procurement, mixing, and casting of fresh concrete as surfacing, and the curing of fresh and hardened concrete. This item also includes the procurement and placement of kraft paper or PVC foil under the concrete slab, over the base course made of crushed stone.

10.2. Materials

For the construction of cement-concrete surfacing, the following basic materials shall be used:

- Crushed rock aggregate
- Cement
- Water
- Steel
- Chemical admixtures for concrete

The quality of basic materials shall fully comply with the Technical Specifications and all applicable standards.

10.2.1. Crushed Rock Aggregate

Crushed rock aggregate used for the construction of cement-concrete pavement shall meet the following criteria:

- Crushed rock aggregate shall meet SRPS B.B3.100 and SRPS B.B2.010 standards;
- Wear resistance, Los Angeles, SRPS B.B8.048, grading Bmax 22%
- Frost resistance of aggregate 4 mm, SRPS B.B8.044max 5%
- Mineral and chemical composition of aggregate shall not contain any components harmful for concrete;
- Granulometric composition of aggregate shall be determined based on its delivery, sieving.

The granulometric composition of aggregate shall be such that the specified grade of concrete is achieved. The grain size accumulation curve should, if possible, lie within the zone given in the table below. The given recommendations are not mandatory, and other curves of continuous or discontinuous grading may be used as well, if pre-tests show that they give the required grade of concrete subject the approval of the Engineer.

Mesh (mm)		Passing (%)
0,2	0,2	3-7
1,0	1,0	18-30
3,15	3,15	33-46
8	8	52-62
16	16	62-77
31,5	31,5	100

10.2.2. Cement

For the construction of concrete pavement, class 35 and 45 cement shall be used, made of Portland cement clinker that meets the quality requirements according to SRPS B.C1.011/01 and B.C1.013 standards. Other cement quality requirements are:

- Content of admixtures not more than 20% (m/m), of which pozzolane not more than 5% (m/m);
- Carbonate contentup to 10% (m/m);
- Fineness (residue on sieve) \leq 10%
- Start of setting \geq 60 (\geq 50)min
- End of setting \leq 600min
- Flexural strength after 28 days40 MPa

10.2.3. Water

Mixing water for concrete shall be clean and clear. Water shall not contain any substances harmful for concrete, such as: sulphuric, hydrochloric, carbonic and humus acids, chlorides, magnesium sulphates, etc, or waste water. Water shall be tested constantly and fully meet the standard SRPS U.M1.058.

10.2.4. Steel – dowels and tie bars

The designed solution foresees the application of dowels and tie bars, according to design details. For dowels and tie bars, GA 240/360 steel shall be used. Lengths and diameters of reinforcing steel, and the length of insulation – coating, are given in design details. Baskets for fixing dowels and tie bars in proper positions in cement-concrete pavement decks shall be made of welded mesh reinforcement, wire diameter 6 mm. If a modern equipment for the construction of cement-concrete pavements is used, where dowels are inserted into fresh concrete, such baskets are not needed.

Mesh reinforcement and reinforcing bars for dowels and tie bars shall be transported and stored in compliance with regulations for plain and reinforced concrete. The grade of steel shall be checked according to regulations for plain and reinforced concrete and relevant standards.

10.2.5. Chemical Admixtures for Concrete

When preparing concrete, it is allowed to use plasticizers, air-entrainers, or admixtures giving other properties that meet the quality requirements set out in SRPS U.M1.035, subject to the approval of the Engineer. Before preparing concrete with admixtures, it is necessary to check whether the admixture meets its purpose, according to SRPS U.M1.037 and SRPS U.M1.035. Specimens of concrete prepared with admixtures shall be tested for:

- Chemical and physical/chemical properties
- Impact of admixtures on the corrosion of steel in concrete
- Impact of admixtures on properties of hardened concrete.

Admixtures to concrete shall be controlled regularly, with the constancy of their quality monitored in compliance with SRPS U.M1.035. All tests shall be completed to the satisfaction of the Engineer and all results shall be submitted for the approval of the Engineer.

10.2.6. Materials for Joints

Fillers and sealants may be used to fill joints. Fillers in expansion joints shall not prevent the extension of concrete pavement slabs, but shall be rigid enough not to lose their form during compaction of concrete. They shall not be water soluble, nor absorb water from fresh concrete. Fillers made of soft wood, if used, shall be of regular edge, knot-free, flat, and properly protected. If control joints are foreseen with bottom fillers, they shall be made of suitable non-friable material, protected soft wood or plastics usually, and of appropriate shape, so as not to lose their form during the placement of concrete. Sealants shall be elastic and adhere well to concrete. They shall fully comply with the standards for joint sealants for concrete pavements, SRPS U.M3.095. As primer for the sides of joints between the slab and the edge strip, very liquid agents shall be used that could be spread in very thin layers.

10.2.7. Surface Treatment Agents

Chemical protective agents may be used to protect, cure, and impregnate the surface of cement-concrete pavement. The applied film of a protective agent shall act effectively for at least 7 days, without disturbing the cement setting process in any way, and without any harmful physical impacts on the concrete surface.

10.3. Concrete

10.3.1. Mechanical Properties

For the construction of cement-concrete surfacing, concrete shall meet the following quality requirements:

- Grade of concrete min MB 40
- Flexural tensile strength according to SRPS U.M1.010 min 5.00 MPa
- Water-impermeability class according to SRPS U.M1.015 min α 6
- Frost resistance class according to SRPS U.M1.010 min 200
- Salt resistance, damage degree SRPS U.M1.055 0
- Wear resistance ($\text{cm}^3/50 \text{ cm}^2$), SRPS B.B8.075
 - In dry min 18
 - In moist max 35

10.3.2. Composition of Concrete Mix

The composition of concrete mix for cement-concrete pavement slabs shall be determined based on pre-tests of fresh and hardened concrete with specified materials, for specified conditions of construction, and project purpose, as set out in the regulations for plain and reinforced concrete for B-II category. The amounts of concrete mix components shall be computed in mass and absolute volumes, and the mix formula shall be expressed in kg.

All tests shall be completed to the satisfaction of the Engineer and all results shall be submitted for the approval of the Engineer.

Particles smaller than 0.25 mm

Total amount of cement and aggregate grains smaller than 0.25 mm shall not be less than 350 kg/m^3 of placed concrete.

Amount of Water and Consistency

The amount of water and consistency of fresh concrete shall be determined according to the regulations for plain and reinforced concrete so as to ensure easy placement and good compaction of concrete, achieving specified properties in fresh and hardened concrete, while applying available tools and equipment. The highest value of water-cement ratio for cement-concrete pavement slabs shall be 0.50.

Quantity of Micro-Pores

Concretes for cement-concrete pavements shall be aerated due to their exposure to frost and salt. The amount of entrained air in fresh concrete (according to SRPS U.M1.031) shall be 3-5%.

10.4. Production of Concrete

Concrete mix for cement-concrete pavement shall be produced in concrete plants that, regarding equipment and work procedures, shall meet requirements set out in SRPS U.M1.050; SRPS U.M1.051, and SRPS U.M1.052, i.e. have the capacity to accurately batch concrete mix components in a foreseen number of batches per unit of time, while achieving allowed tolerances for the content of mass of each fraction and total amount of aggregate $\pm 3\%$, calculated from the total mass of required aggregate. The content of cement shall be within the limit of $\pm 2\%$ of required mass. The content of water $\pm 2\%$ of required mass or volume. The content of each admixture = 3% of required mass.

10.5. Execution of Works

10.5.1. Concrete Production Control

For B-II concrete, all tests of concrete in concrete plants shall be conducted fully in accordance with SRPS U.M1.051, while achieving the required capacity of concrete plant and laboratory for monitoring work on the plant-based production of concrete.

All tests shall be completed to the satisfaction of the Engineer and all results shall be submitted for the approval of the Engineer.

10.5.2. Concrete Pavement Construction Procedure

Concrete for cement-concrete pavement slabs shall be cast according to the concrete design, in compliance with the regulations for plain and reinforced concrete and the requirements of these Technical Specifications. Before the commencement of works, the underlying surface shall be completely clean, previously repaired, and dry and subject to the inspection and approval by the Engineer.

10.5.3. Formwork and Track

Concrete shall be placed between fixed formwork that need to be secured against displacement in any direction, in order to achieve the required width, height, and evenness of cement-concrete pavement, or with a paver with hauled slip-forms. As forms, steel and concrete (e.g. a previously constructed cement-concrete edge strip) may be used.

Every formwork shall be coated with appropriate release agents, according to concrete casting. Formwork and rails to be used by compaction and levelling machines, and surfaces used by concrete casting machines that are not rail-guided, shall be stable and clean in order to ensure the required height and evenness of cement-concrete pavement.

10.5.4. Transport of Concrete

Concrete shall be transported to the place of casting in a way and under conditions that prevent any segregation and drying of concrete, as well as any changes in the composition and properties of concrete.

10.5.5. Placement of Concrete and Reinforcing Steel

The placement of concrete may start when the place of concreting (underlying surface, formwork, etc.) are prepared in full compliance with the structural and concrete designs. For cement-concrete pavements, concrete shall be spread and cast mechanically. Tie bars and dowels shall be placed on baskets before the casting of concrete, according to design details, if such work technology is applied. If concrete is constructed with state-of-the-art equipment, dowels shall be inserted in fresh concrete during its placement.

Concrete shall be compacted over the entire surface and in full thickness of layer completely and uniformly, using machines that act in full width of the placed strip, and run uniformly and uninterruptedly. The needed number of runs with a paver, or vibratory board and vibrators, shall be determined on a trial bay. If evenness and uniformity of concrete on the surface are not achieved, on such placed concrete shall be added and compacted in an additional run of paver, or by other means. Any addition of cement, water, or mortar is not allowed. The entire placement of cement-concrete pavement slabs shall be completed:

- In warm and dry weather, in max 2 hours
 - In cold and moist weather, in max 3 hours
- from the commencement of concrete preparation in the concrete plant.

For the finishing of pavement, vibratory floats shall be used, so that they are guided diagonally or normally to the road centre line and act in the full width of the strip of cement-concrete pavement.

10.5.6. Concreting at Low and High Temperatures

If concreting is done at temperatures below $+5^{\circ}\text{C}$ and above $+30^{\circ}\text{C}$ special measures for the execution of concrete works under special conditions shall be taken, according to the regulations for plain and reinforced concrete. The temperature of concrete at the place of casting shall not be:

- Lower than $+10^{\circ}\text{C}$ at air temperature around 0°C
- Lower than $+20^{\circ}\text{C}$ at air temperature below -3°C
- Higher than $+30^{\circ}\text{C}$ at air temperature above $+25^{\circ}\text{C}$

10.5.7. Interrupted Concreting

Every interruption in work shall be foreseen with the concreting plan in the concrete design, and shall match with the completion of one bay, in order to ensure the construction of a technically adequate joint in cement-concrete pavement.

10.5.8. Construction of Control Joints

At control joints, concrete shall have the same properties and quality as on other parts of the cement-concrete pavement slab. The procedure for construction of joints shall ensure that joint grooves are of specified dimensions. Control joints shall be duly cut, in order to prevent an uncontrollable cracking of cement-concrete pavement slab due to contraction of concrete.

10.5.9. Construction of Construction-Contraction Joints

At contraction joints, concrete shall have the same properties and quality as on other parts of the cement-concrete pavement slab. The procedure for construction of joints shall ensure that joint grooves are of specified dimensions. Contraction joints may be structural and construction joints. In contraction joints, the vertical surface (side) of hardened concrete shall be permeated well with primers. The amount of that agent shall depend on its viscosity and the porosity of concrete. Before resuming works, a finish coat shall be applied over the dried coat of primer, in the amount of $1.0-1.5/\text{kg/m}^2$.

10.5.10. Cutting and Sealing of Joints

Machines for notching and cutting shall ensure a straight cut with sharp edges. Before filling, grooves and cuts shall be dried and cleaned. Appropriate brushes, and compressed air if needed, shall be used for cleaning. Sides of cuts shall be primed first. Sealant shall be filled into cuts with appropriate tools, filling them up to the surface, and with additional re-fills if needed.

10.5.11. Curing and Protection of Concrete

Cement-concrete pavement shall be protected and carefully cured during and after the placement of concrete. Curing shall start immediately after performed surface finishing of freshly cast concrete. For curing fresh and hardening concrete, moistening may be used (spraying or moistening over proper materials on the concrete surface - jute or bass) or appropriate protective liquid chemicals.

A protective chemical agent shall be uniformly sprayed on surfaces over dried cement-concrete pavement slabs, in order to achieve a uniform film (closed surface). Cement-concrete pavement shall be protected immediately after construction with low, mobile protective "roofs" of a light colour, closed on all sides, for at least 6 hours. The entire surface of cement-concrete pavement shall be kept moist for at least 7 days or until the concrete reaches 60% of the specified class. Covers (made of straw or other materials) shall be used to prevent rapid drying of young concrete, until it reaches at least 50% of specified strength.

10.5.12. Impregnation

For the protection of concrete against the action of salt, the surface of cement-concrete pavement slabs may be impregnated with appropriate agents. The efficiency of an impregnating agent shall be pre-tested and verified.

All tests shall be completed to the satisfaction of the Engineer and all results shall be submitted for the approval of the Engineer.

10.5.13. Opening to Traffic

Concrete pavement may be used for on-site traffic when concrete reaches at least 70% of its specified class subject to the prior approval of the Engineer. Cement-concrete pavement shall be opened to traffic after 28 days from the date of completion of last slab on the section, or earlier if the strength of concrete specified in the design is reached subject to the prior approval of the Engineer. Concrete shall reach the designed frost resistance.

10.6. Quality Control

The control of quality shall be performed fully in compliance with SRPS U' E3.020, Section 8.

All tests shall be completed to the satisfaction of the Engineer and all results shall be submitted for the approval of the Engineer

10.7. Evenness, Height, and Direction

The allowed variations of the surface of cement-concrete pavement from the evenness of designed height and direction in any place on the pavement shall be within the following limits:

- Evenness ± 4 mm
- Height ±20 mm
- Direction ±30 mm

Variations in evenness shall be determined with a straight edge, 4 m long, in any position. Allowed variations of the surface of cement-concrete pavement shall not cause any noticeable uneven spots, or accumulation of liquids on the pavement.

10.8. Calculation and Payment of Executed Works

The executed work, previously accepted by the Engineer, shall be calculated in m². If variations are greater than allowed in these specifications, the Contractor shall, at his own expense, remove the surfaces of poor quality and construct a new, good concrete pavement, according to these specifications.

Executed and previously calculated work shall be paid at unit prices from the contract given per m².



Section 11 Structures

Contents

- 11.1 Retaining and Retaining-Facing Walls
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11.1 Retaining and Retaining-Facing Walls

11.1.1 Excavation for Retaining Structure Foundation

Item Description

The item includes manual or machine excavation of natural original soil of the 3rd and 4th category per percentages determined by the Design.

The excavation shall be done per sizes provided by the Design. Excavation depth is provided by the Design and may vary from 0 to 6 m'. The excavated pit shall be timbered after the excavated depth of 1,00 m'. The type of timbering and timbering technology shall be proposed for approval by the Contractor in accordance with his available equipment and adopted technology. The Engineer shall approve the selected timbering type and technology. Timbering shall support foundation pit to remain stable both during the excavation and during the execution of supporting/ retaining structure. It is also necessary that the terrain around the foundation pit remains stable during execution of foundation.

Excavation for strip foundations shall be done in tunnel liners, whose length is determined by the Design, or by the Contractor subject to the approval of the Engineer.

Besides excavation, the item includes throwing of excavated soil 2-3 ml from the foundation pit, either manual or machine loading of excavated soil into transporting means and transportation to the disposal area anticipated by the Design or proposed by the Contractor subject to the approval of the Engineer. The excavated soil shall be unloaded by tipping and then spread either manually or by machine.

In the vent of underground water in the foundation pit, the water should be pumped out. It should be ensured that pumping of underground water does not cause suffusion of vertical and horizontal sides of foundation pit.

This item also includes excavation in moisture soil.

Equipment

The hand tools like pick, spade, shovel, hand-barrow, etc., shall be necessary for the excavation of foundation pit in the 3rd and 4th category soil, if done manually.

If excavation is performed by machine, the Contractor should have excavator of the sufficient capacity to ensure effective excavation of anticipated foundation excavation.

The sufficient quantity of tipping trucks shall be provided for the transportation and tipping of excavated material to the disposal area.

Manual spreading of unloaded material on the disposal area shall be done by shovels, or if done by machine by grader or smaller size bulldozer.

Measuring

Measuring of works on soil excavation for the foundation of supporting structure shall be done in m³ of the works actually performed and approved by the Engineer.

Payment

The payment for executed works on excavation for supporting structure foundations shall be made in dinars per m³ of actual works done as determined by measuring.

11.1.2 Concreting of Retaining Structure

Item Description

Concrete works on retaining structure shall be done per sizes provided by the Design. Concrete shall be of class as specified by the Design. This item shall also include execution of formworks, and if necessary scaffolding. Prior to commencement of concrete works, the Contractor shall submit for the inspection and approval of the Engineer both the formworks and scaffolding to enable checks of the stability of formworks and scaffolding to avoid deformation and demolition of structures during, or immediately upon completion of concrete works.

Materials

Retaining structure shall be made of concrete class as anticipated by the Design. The concrete shall be composed of componential materials mineral aggregate, sand, cement, water and necessary agents added to concrete that correspond to the norms of the Standardization Institute of SAM.

Fresh and hardened concrete shall fulfil quality conditions stipulated by the Design, particularly compressive strength, and if required, frost resistance.

Prior to execution of reinforced concrete (RC), it shall be necessary to make concrete tests required by the Design by registered and accredited organization for this type of laboratory testing works and as approved by the Engineer.

Execution of Works

The formworks and scaffolding shall be executed first. Both the formworks and scaffolding shall be executed in good quality as to avoid structure deformation during concreting works. The material used for execution of scaffolding shall be steel pipes. Formworks and particularly the scaffolding part that belongs to exposed part of the structure shall be executed of high quality steel sheet or high quality boards oil-coated as ensure smooth concrete surface.

It is recommended that the concrete shall be made in concrete plants and transported to the works by means of concrete mixers. Concrete shall be compacted in layers of 30 to 50 cm by advanced compaction devices. The technology of building in of concrete shall be such as to ensure later hardened concrete which is to fulfil not only anticipated physical-mechanical features, but aesthetic as well even and smooth surfaces, even edges free from segregated spots, etc.

The scaffolding and horizontal formworks may be removed 28 days after concreting of structural elements, while the vertical formworks may be removed after 10 days.

Immediately upon completion of concrete works, and during the concrete hardening process, it is necessary to cure and protect concrete from the heat or cold weather depending on the season when concreting is performed.

Equipment

Concrete shall be made in concrete plants with weight-batching of component materials (mineral aggregate, cement, water, agents). Period of mixing time shall be sufficient as to ensure uniform concrete production. Transportation of concrete from the plant to the works/build-in spot shall be done by mixing trucks and shall not exceed 60 minutes.

Concrete compaction during building-in shall be done by suitable vibrating-devices of sufficient power as to receive compact built-in concrete. This is to be achieved by selecting vibrating devices, like pervibrators, platvibrators, etc., on the site in agreement with the Engineer.

Norms for Execution and Quality Control of Concrete Works

The adherence to below listed norms and working rules shall be ensured during the execution of concrete works:

- Rule Book on technical conditions for concrete and reinforced concrete (Official Gazette of SFRY No. 11/87);
- Comments on the stipulations of the Rule Book for concrete and reinforced concrete (Official Gazette 1988);
- Technical conditions, separated aggregate for concrete, SRPS B B2.010;
- Portland cement, Portland cement with agents SRPS B.C1.011;
- Sulphate-resistant cements, technical conditions SRPS B C1.014;
- Water for concrete production, technical conditions SRPS U.M1.034;
- Agents to concrete, definition and classification SRPS U.M1.035;
- Agents to concrete, quality and control SRPS U.M1.035;
- Pre-building in of concrete testing for selection of agents SRPS U.M1.037;
- Determining compressive strength of concrete cube SRPS U.M1.020;
- Testing production efficiency of concrete plant SRPS U.M1.050;
- Testing of production in concrete plants, SRPS U.M1.051

All tests shall be completed to the full satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

Measuring

The quantity of constructed retaining structure shall be measured in cubic meters (m^3) of actually executed concreting approved by the Engineer.

Payment

The Contractor shall be paid the contracted price per $1 m^3$ for the quantity of actually performed works per $1 m^3$, i.e. complete and high quality concreted retaining structure per the Design together with formworks and scaffolding. The price shall represent the compensation for the supply of all materials, execution of scaffolding and formworks, usage of plant and equipment and the labor price needed for the execution of retaining structure.

11.1.3 Supplying, Cutting and Placing of Reinforcement

Item Description

This Item includes supplying, cutting, and placing of steel reinforcement needed for reinforcing of retaining structure.

The reinforcement used for reinforcing of concrete structures may be of wires $\Phi < 12 \text{ mm}$ round or rods $\Phi > 12 \text{ mm}$ or round steel (C/A-240/360) or high-tensile ribbed bars (RA-400/500) depending on Design solution.

The reinforcement may be classified per type as main, distribution and structural steel. The type of reinforcement to be used shall be as specified by the Design.

The reinforcement of the retaining structure shall be placed in accordance with the plans/schedule and the specification of the Design, per type, diameter and spacing.

The reinforcement to be placed before concreting shall be corrosion-free. If there is a corroded layer on the reinforcement (volume), it should be removed by steel brushes.

The reinforcement shall be machine-treated in reinforcement workshop.

Treated reinforcement shall be transported to the site by adequate means of transportation.

Splicing, if necessary, shall be made in accordance with regulations.

The overall works on cutting and placing of reinforcement shall be performed per Rule Book on technical norms for reinforced concrete and subject to the approval of the Engineer.

The construction welded nets, if anticipated by the Design, shall be applied per the Design plans in accordance with *SRPS U.M1.091*

Equipment

The Contractor shall necessarily possess the following equipment and work tools for proper cutting, transporting and placing of reinforcement.

The reinforcement shall be cut and bent per Design Specification in the reinforcement workshop, equipped with adequate machines. The reinforcement shall be fixed into slabs, beams and cages as anticipated by the Design. Reinforcement shall be transported from the workshop to the site by adequate transportation means as to avoid reinforcement being damaged during transportation. Loading and unloading of reinforcement from the truck shall be performed by crane, as well as its placing on the build-in spot in the structure on the site.

Measuring

The reinforcement actually built into the structure, shall be calculated in kilograms per diameter and length approved by the Engineer.

Payment

The payment of reinforcement actually built-into the structure shall be made as measured per contracted price in dinars for 1 kilo of built-in reinforcement.

11.1.4 Mineral Filler behind Supporting Structure

The function of mineral filler behind the supporting structure and in the ditches is to ensure delivering of drained underground water to the inspection chamber, or to the drainage outlet onto the terrain surface, as well as to ensure hardness in the ditch sufficient to receive and bear the soil pressure.

Mineral filler consists of:

- Sandy-gravel soil
- Stone chips 1-6 cm, and
- Crushed stone 7-25 cm.

The layer of stone chips shall be executed per the drawing in the Design. This layer is to be laid above the drainage pipe. The minimum layer height shall be 30 cm. Stone chips function is to protect the pipe from concentrated pressure of the crushed stone filler. Thus protected, perforated pipe is safe and can bear the pressure of the crushed stone filler.

The function of the crushed stone filler, grain size 7-25 cm, is to ensure hardness of the ditch both to receive and to bear the compressive force of the surrounding terrain and underground water. The significant function of the crushed stone filler for the ditch is to facilitate draining of water.

Mineral grains which of the stone chips and crushed stone fillers are composed of, shall be resistant to the effects of water and the effects of chemical constituents of chlorides, nitrates, and nitrites. Besides, mineral grains of crushed stone shall have compressive strength that exceeds 100.000 kPa, which is necessary to avoid crushing of stones upon the execution of filler.

Stone chips filler shall be built-in compaction-free by filling and planning.

Crushed stone filler shall be built-in by filling and manual spreading of stone grains as to fill in the cavities and openings in the filler. The filler needs not to be compacted.

The filler behind the retaining wall shall be executed in sandy-gravel soil material. The grain size distribution of mineral grains shall be continual. Uniformity coefficient of sandy-gravel soil shall be $C_u > 4$, and Curve coefficient $C_c = 1-3$.

Measuring

Actually executed quantity of works shall be measured by cubic meter (m^3) approved by the Engineer.

Payment

Actually executed quantity of works shall be paid per Contract prices for 1 m^3 of executed works.

11.1.5 Compressed Clay Plug at the End of Ditch

Each either collecting or draining ditch shall be mandatory closed by clay plug per the Design. The function of clay plug is to prevent breakthrough of surface waters and small particles into the drainage.

Clay plug shall be executed of hard clay of *CL* classification with addition of optimal quantity of water per *standard Proctor Test*.

Measuring

Actually executed quantity of works shall be measured in cubic meters (m^3) approved by the Engineer.

Payment

Actually executed quantity of works shall be paid per contract prices for 1 m^3 of executed works 1 m^3 .

11.1.6 Geotextile**Scope and Content of Works**

Geotextile shall be placed at the perimeter of the ditch.

Geotextile functions are:

- separation of natural original soil from the drainage fill;
- ensuring undisturbed circulation of underground waters from the natural original soil into the ditch;
- preventing of suffusion of small particles from the natural original soil due to measuring of underground water level.

Prior to placing geotextile, the terrain shall be leveled, and weeds, large stones and sharp rocks removed, as well as larger recesses filled.

Geotextile shall be placed as to form an overlap between the strips that are to be joined. Overlaps shall be length wise secured by small piles of filling material placed at each 1 to 2 m to avoid moving. Geotextile strips are sewn in such a way as to have ends to be joined placed face side to face side and bent in the width of 100 mm, provided that seam runs parallel with the edge of joined surfaces at the distance of 50 mm from the edge. Seam hardness shall be 50% of geotextile tensile strength.

After having been joined, geotextile is laid in the ditch and then the ditch filling with drainage material commences.

Receipt of Geotextile

Upon unloading of geotextile rolls on the site it is necessary to check their quantity, as well as whether they correspond to the technical specifications provided by the Design.

Keeping of Geotextile

It is of utmost importance to ensure protection of geotextile from damage prior to placement. The product is delivered factory packed and protected and it shall be necessary to check whether the protection is damaged, and if damaged, the damages should be repaired. It is particularly important that the geotextile is UV and moisture protected. Geotextile, specially unwoven, when exposed to moisture absorbs it in some cases up to the rolls softening point, which makes impossible checkup of weight and placement of geotextile under low temperatures. It is also necessary to keep geotextile free from mud as if otherwise their filtering features would be diminished.

If geotextile gets damaged, the damaged parts shall be removed.

Quality Assessment Criteria

Geotextile rolls shall be laid out in such a manner to facilitate their inspection and samples taken for laboratory tests.

Each roll shall bear the following data:

- Name of manufacturer;
- Commercial name;
- Method of production;
- Raw-materials composition;
- Mass per area unit;
- Nominal thickness;
- Product size and weight in roll.

Besides general inspection, the mass per area unit is inspected in the field with the precision up to 10 g/m².

All other tests are performed in the laboratory and shall fulfill the following norms:

- normal thickness;
- pore size;
- filtering capacities;
- CBR penetration;
- Tensile strength;
- Sliding in soil.

The samples are taken from each particular roll and all tests shall be made in accordance with IGS norms.

All tests shall be completed to the full satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

Execution of Works

Geotextile rolls have weight that mainly varies from 75 to 150 kg. Light weight rolls shall be placed manually, while the heavier rolls shall be placed by machine.

Measuring and Payment

These works are measured per square meter of geotextile approved by the Engineer.

The works are paid per unit price per square meter of actually performed works.

11.1.7 Execution of Bored Piles with Large Diameters**Item description**

Bored piles shall be applied with deep founded supporting structures when the slip layer is at 5-6 m¹ from the terrain surface. It is then that they achieve their full effectiveness. Retaining structures of bored piles receive soil horizontal soil pressure and transfer them in the depth beneath the slide layer into the unmoved parts of the terrain. In order to properly execute the structure of bored piles, the Contractor shall strictly adhere to the Design and below listed special technical conditions subject to the approval of the Engineer.

Method of Piles Execution

Prior to execution of bored piles, it shall be necessary to execute the following preliminary works: execution of access road and plateau for work, for the needs of delivering, installing and operating of drilling equipment, placing of reinforcement cages and for the access when concreting. The plateau shall have the width of 5-7 m¹, and the road 3-5 m¹. Longitudinal elevation of the finished road level shall not exceed 15%. The pavement on the road and plateau shall be executed of high quality materials like gravel, broken stone, stone, etc.

Bored piles of design given diameter shall be executed per Design plans both horizontally at the designed distance and vertically per the levels specified in the Design.

Pile diameter shall be defined by outer pipe diameter. Possible diameter increase that might occur when concrete is poured shall not be taken into consideration for the payment of executed works.

The execution of piles both during the excavation and execution of concrete works should be followed by casing, which might be partial or complete or may not exist when working in stones. Complete casing prevents sliding of small and big soil particles from the drill hole walls or eliminates larger scale movement of land which could further cause closing of drill hole. Partial casing is feasible with bored holes executed of hard consistency clay, soft rocks (marlstone, cement rock, shale, flysch, etc.). With hard rock masses (sandstone, limestone, dolomite, etc.), it is possible to execute bored hole without casing.

The technology of execution of bored piles shall consist of three main phases: excavation of bored hole (boring); execution and placement of reinforcement cage and production and placement of concrete, i.e. pile concreting.

In practice, bored piles can be executed either with extended or non-extended base. Generally, there is no need to widen the pile base for retaining structures, with dominant effects of horizontal forces, because there is no static need and widening itself is technologically hard to execute. This is only possible in clay soil. Widening of pile base, when executed, is generally done up to the double pile diameter.

Pile excavation, for bored piles for retaining structures, as we have already mentioned, can be with partial or complete casing. Complete casing is more frequently applied. The order of execution of works, firstly an excavator (drill) and hydraulic pipe oscillators are brought to the spot of pile execution. Tolerances for deviation from the designed coordinates, vertical pile axis, shall be within the limit of 1-2 cm.



Together with placing the plant on the pile location, it shall be necessary to check up and ratify the verticality of wagon (drill) and telescopic rotary drilling device. Vertical tolerance allows for 1-2%.

As to commence drilling, it is required driving home of auxiliary pipe (guide frame) in the length of 2-4 m¹, which serves to secure pile position and direction. It is from the driven home guide frame (auxiliary pipe), that the excavation and transportation of excavated soil is performed. A protection steel pipe is placed in thus prepared borehole, which serves to secure further excavation. Simultaneously with progressing of excavation (drilling), protection pipe is sunk by torsion oscillation alternately to the left and to the right, by hydraulic pipe oscillator. The pipes are added during drilling up to the bottom of the drill hole in accordance with progressing of drilling process. Drilling and removing of material from the bore hole is performed through the pipe.

Drilling and removing of material is performed by spirals for soils of constitution (dust and clay) and by buckets (scoops) for loose soils (sand, gravel) and slurries. The bottom of pipe casings should progress faster than drilling, particularly if performed in slurry and loose soils. Thus the break through of soil underneath the bottom of pipe casings is prevented. Drilling is executed when the designed bottom is reached, which is checked with two to three successive measuring tests of bore hole height by volume tape. The precision of measuring is 1 cm.

Equipment

Machinery and equipment for high quality and effective execution of works on bored piles shall include: excavator with adequate tools, protection pipes, hydraulic pipe oscillator for rotary oscillating of protection pipes to ease their sinking in the ground, crane for extracting protection pipe and lifting and placing reinforcement cage, as well as equipment for contractors concreting.

Excavators or dredgers for drilling (excavation) of bore holes are the basic machines that are used for the execution of bored piles. The excavators serve for excavation in protection pipe. Excavators should be equipped with adequate tools, like spirals or buckets, extenders, chisels, etc. These tools are mounted on the telescopic rotary systems of the basic excavator and constitute a technological unity for pile excavation (drilling).

For temporary placing of protection pipes, i.e. bore hole casing, steel pipes are used that oscillate by means of hydraulic oscillator, as the separate plant complete with standardized pipes and couplings. The length of protection pipe should be equal to pile length. The maximal pipe length is 20 m¹. If the pipe length exceeds 20 m¹, the pipe shall be extended. The pipes are extended by special mechanic couplings that provide axial and torsion hardness, as well as water-tightness at the spot of extension.

Contractors concreting is performed by means of contractor pipe with the diameter of 200 mm, complete with extensions and couplings. Preparing and transporting of concrete is done by traditional equipment.

Piles are concreted by contractors procedure. Concreting shall commence by lowering of contractors pipe at the height of 20 cm from the bore hole bottom. During concreting, contractors pipe is being withdrawn per the pace of increasing the level of concrete in the pile. Contractors pipe shall be sunk in concrete at least 2-3 m¹ during pile concreting. The diameter of contractors pipe is most frequently 200 mm. The contractors pipe is made of extensions each of 1-3 m¹ in length. The extensions are connected by couplings or threads. Tremie is placed at the top of the contractors pipe to facilitate better receiving and feeding of concrete mass. The tremie is fixed at the beginning of the bore hole and has the volume of 100 liters.

Concreting procedure of contractors type with bore hole casing shall be performed in synchronized manner so that withdrawal of protective casing corresponds to the increase in concrete level provided that a concrete column of 1-2 m¹ remains in the pipes.

The pipes are removed from the ground in the following manner:

- airtight lid is placed at the upper end of the protection pipe;
- air under 2 atmospheres pressure is let into the put and it activates the device for rotary oscillation;
- the pipe is lifted by crane;

Thus allowing for relatively fast removal of protection pipes from the ground. Long protection pipes are removed in parts depending on the number of couplings. Shorter protection pipes are removed upon completion of pile concreting.

Inlet of pressurized air in the protection pipe has multiply beneficial:

- makes easier removal of protection pipes from the ground;
- the holes made by removal of protection pipe are filled in thus realizing the full contact between concrete and surrounding land;
- Concrete is poured under pressure which increases its compactness.

Materials

Concrete components like mineral aggregate, cement, water and agents shall fulfill the conditions of a world wide recognized norms for making high quality concrete for this type of work, in full compliance with the requirements of the Design and these Technical Specifications and subject to the approval of the Engineer.

Each component material used for making concrete shall be attested before use and later during execution works checked up in the manner as prescribed by the adopted norm. The Contractor shall propose the norm that component materials for concrete are to fulfill both for the test prior to commencement of works and for the control check up. The Contractor's proposal shall be subject to the approval of the Designer and the Engineer.

Concrete used for bored pile shall be of the class (MB) as stipulated by the Design. Concrete quality is determined per one of the world wide recognized norms which will be adopted prior to commencement of works. The Contractor shall propose a norm to be used for making and building-in of concrete, as well as for quality control of concrete. The Contractor's proposal shall be subject to the approval of the Designer and the Engineer. The piles are concreted by plastic concrete which quality shall correspond to the adopted norm.

Round (GA 240/360) bars and ribbed bars (RA 400/500) shall be used for the reinforcement of bored piles. The reinforcement works shall be done per plan from the Design. Main reinforcement shall be of ribbed bars, while stirrups and other structural or bonding reinforcement may be of round bars.

Reinforcement cages for bored piles shall have the following features:

Internal rings which are placed at 1 - 1,5 m¹ of the pile height and serve as structural supports of vertical steel bars (pile main reinforcement). Vertical bars are welded to internal ring minimum on 50% of joints.

The main vertical reinforcement calculation is static calculation of pile bearing capacity, taking into account the loading acting on the pile. The length of vertical reinforcement shall be equal to pile length and increased for the height of pile cap (beam), if such beam exists in the supporting structure.

Beam hanger/stirrups on drilled piles are spiral and are welded to minimum 50% of joints. They are of reinforcement steel with diameter per Design normally 8 or 10 mm. Beam hanger/stirrups travel is provided by the Design and should be observed.

Centralizers or fenders serve to center pile reinforced cage. They are steel metal sheet or steel reinforcement. They are welded to main vertical reinforcement at adequate spacing and per adequate sequence. Centralizers exceed the size of reinforced cage for the thickness of protection layer of concrete in compliance with accepted norm for reinforced concrete.

Reinforced cage shall be placed, centered and fixed into drilled hole, protected by steel pipes, upon the completion of drilling and clearing of bore hole, directly before pile concreting. Placing of reinforced cage shall be performed by cranes. Reinforced cage may be executed in full or partially, if extended, by overlapping per regulations of the accepted norm for reinforced concrete.

Work Log

During the execution of piles, each pile shall be described in the minutes: the type of soil to be drilled shall be stated as well as appearance and the level of underground water, other obstacles, if any. Besides the afore-mentioned, the log should also record the time of commencement and completion of works on piles, lower pipe height level, reinforcement level, commencement and completion of concreting, the quantity of built-in concrete, etc.

The Contractor shall be obliged to keep complete documentation on execution of each particular pile.

All works and all documentation shall be subject to the approval of the Engineer.

Measuring

Measuring of the quantity of actually executed piles shall be made in linear meters (m^l). The designed pile length may be changed subject to approval of the Engineer and Designer.

Payment

The Contractor shall be paid for the quantity of actually performed works, i.e. completely built-in piles per the Design per m^l. The price shall include compensation for supply of all materials, plant and equipment, necessary labor for the execution of bored piles per the Design.

Testing of pile bearing capacity shall be paid in accordance with the Contract signed by and between the Employer and the Contractor and subject to the approval of the Engineer.

11.1.8 Execution of Pile Cap (Beam)

Pile Cap (beam) shall be executed in high quality reinforced concrete (RC). Pile Cap (beam) has the function to connect piles of retaining structure into a whole. Uneven soil pressure alongside retaining structure is more evenly distributed on the piles by means of pile cap (beam). Thus the structure is not exposed to concentric loading which adds to her integrity.

Method of Pile Cap Execution

Pile Cap (beam) is to be executed over bored piles. The concrete used for execution of pile cap (beam) shall be of high quality. Concrete class (CC) is determined by the Design and shall be observed. Formworks for pile cap (beam) shall be made before concreting, in accordance with the sizes provided for in the Design. Formworks shall be made of hard timber or metal structure, properly fixed, as to avoid its being deformed due to weight of concrete.

It is possible to execute pile cap (beam) reinforcement either on the spot or in reinforcement workshops and then transport it and place on the site. The reinforcement shall be placed in all respects per the Design. Reinforcement RA 400/500 or GA 400/500 shall be used as determined by the Design. Stirrups and other structural reinforcement may be of GA. The reinforcement of pile cap (beam) shall be connected to pile reinforcement on each contact point.

Static wise, the pile cap (beam) is continuous girder, therefore during the execution of works attention should be paid that work breaks are made at favorable spots (approximate on the spots where bending moments equal zero).

Concreting shall be done in layers of maximal thickness of 40 cm. Concrete shall be compacted by adequate vibrating devices which are to be subject to the approval by the Engineer.

It is possible to remove vertical formworks in 4-5 days upon the completion of concrete works, while the horizontal is to be removed in three weeks upon the completion of concrete works. Preferably, the concrete shall be cured upon formworks removal, up to 28 days from the date of concreting.

Expansion joints shall be placed on the spots as determined by the Design. They shall be executed in the manner as determined by the Design.

Concreting shall be executed in the manner anticipated by one of world-wide recognized norms and in full compliance with the requirements of the Design and these Technical Specifications. Norms are proposed by the Contractor and are subject to Engineer's and Designer's approval.

Equipment

Concrete shall be made in concrete plants equipped with weight-feeders of component materials (mineral aggregate, cement, water, agents). Mixing time shall be sufficient as to allow for production of uniform concrete. Transportation of concrete from the plant to the building-in spot on site shall be done by mixer-trucks and shall not exceed 60 minutes.

Concrete shall be compacted during placing by adequate vibrating devices of sufficient power, as to achieve compacted built-in concrete. This is achieved by selecting among vibrating devices (like pervibrators, platvibrators, etc) on the site subject to Engineer's approval.

Materials

Componential materials for concrete like mineral aggregate, cement, water and agents shall fulfill the conditions of a world wide recognized norm for mixing high quality concrete for this type of works. Each componential material that is used for concrete production shall be previously attested and, at later stage during the execution of works, check-up tested in the manner determined by the adopted norm. The Contractor shall propose the norm for the componential materials for concrete mixing which is to be observed both in the prior testing and control testing during the execution of works. The norm proposed by the Contractor shall be subject to both the Engineer's and the Designer's approval.

The concrete of which the pile cap (beam) is made shall be of the class stipulated by the Design. Concrete quality is determined in accordance with one of the world-wide recognized norms, which is to be adopted prior to commencement of works. The Contractor shall propose the norm to be adhered to when mixing and pouring concrete, as well as when controlling the concrete quality for the approval of the Engineer and the Designer.

The reinforcement of pile cap (beam) shall be of round bars (GA 240/360) and ribbed reinforcement (RA 400/500). Reinforcement works shall be done per schedule provided by the Design. Main reinforcement shall be of ribbed bars while stirrups and other structural or bonding reinforcement shall be of round bars.

Measuring

Measuring the quantity of built-in pile cap (beam) shall be done in cubic meters (m³) of works actually performed and approved by the Engineer.

Payment

The quantity of actually executed works i.e. completed pile caps (beams) together with formworks per the Design shall be paid per contracted price for 1 m³ to the Contractor. The price shall represent the compensation for supply of all materials, plant and equipment, the price of labor required for the execution of pile cap per the Design.

11.2 Drainage Slabs of Single-Grain Concrete 4-8 mm**11.2.1 Description**

These slabs are made of high quality single-grain gravel as to ensure satisfactory water-tightness (k=10 to 10m/s).

11.2.2 Quality of Basic Materials

The requirements of Technical Specifications Sub-Section 8.2 shall apply.

11.2.3 Execution of Slabs

The mix of 250 kg of cement per cubic meter of concrete with w/c factor in the interval 0.50 to 0.60 shall be used for the execution of slabs. Compacting shall be done manually in moulds and attention shall be by all means paid to avoid the decrease of slab' water-tightness.

11.2.4 Measurement and Payment

The calculation shall be made per cubic meter of concrete approved by the Engineer and the price shall include all materials, execution and erection within the structure.

11.3 Smaller Size Structures – Pipe and Box Culverts**11.3.1 Description**

This item includes execution of smaller-size structure of the opening up to 5,00 m² and they are:

- Pipe culverts opening of 1-2 m. of prefabricated pipes to be concreted on the site in all respects per the details of the Design, with;
- Box culverts with the opening of 1 – 5 m² by concreting on the site.

The execution shall include all excavation works, strutting, execution of formworks, mounting and placing, i.e. filter execution together with overall supply of materials and prefabricated elements, as well as all other necessary for the execution of works. All works shall be done in accordance with the Design and these Technical Specifications and subject to the approval of the Engineer.

Frame culverts are identical by form and structure to smaller-size beam system bridges.

11.3.2 Materials

Concrete shall comply with the requirements of Technical Specifications Section 8 on concrete quality

The reinforcement also shall be complied with conditions of the reinforcement regulations hereof.

The formworks for prefabricated elements shall be executed as to avoid deterioration from the sizes of prefabricated elements in serial production, as well as to secure smooth surfaces upon the removal of formworks.

If anticipated by the Design, filter materials like stone, wedges by the structures and insulations, shall fulfill the conditions hereof

11.3.3 Execution of Works

Excavations shall be performed in accordance with the Design and the Contractor's instructions and subject to the approval of the Engineer. The form of excavation shall be adjusted to the detailed drawing from the Design and the terrain conditions. Excavation category shall be determined per types of earth material (G.N.200).

Excavations shall include all additional works like strutting, transporting of excavated material, water pumping.

Prior to placing base courses of concrete, gravel or sand, the height levels should be re-determined.

Concrete is reinforced by reinforcement per the Design and Rules Book on concrete and reinforced concrete. Attention should be paid when placing concrete that all reinforcement is covered by concrete at all sides and that the Design anticipated thickness of protection layer is achieved.

An extensive cure and protection should be performed in accordance with the conditions hereof, for the first 7 days from concrete pouring.

Concrete quality is determined by concrete class in accordance with the Technical Specifications Section 8.

Placing of concrete pipes for culverts (concrete class 20), i.e. placing of individual pipe parts on fresh concrete base class 15 shall commence on the downstream side with cast culvert end on previously prepared base. Cracked pipes and damaged elements shall not be used. When the pipes, which have been previously cleaned and sprayed with water, are placed they shall be lined by concrete class 20 if so anticipated by the Design. Concreting of foundation and culvert's end is executed in compliance with the requirements on concrete works, as well as concreting of culvert inlet and outlet.

11.3.4 Measuring

The excavation is measured as wide excavation by m^3 of actually executed works in original natural soil per sizes from the Design up to the subsoil height level, and as foundation excavation if below the above mentioned height level, and as approved by the Engineer.

The culverts are measured per actual length in meters alongside the bottom of the pipe and as approved by the Engineer. These lengths include inlets and culvert ends.

Frame culverts are measured per actual length in meters as approved by the Engineer.

11.3.5 Payment

All works are calculated per contracted unit prices. Unit price shall cover complete culvert execution.

11.4 Retaining Structures of Soil and Plastics – Lining Free

11.4.1 Item Description

The retaining structures of soil and plastics are structures both fine-grained and coarse-grained soil and of geo-synthetics (woven geotextile or geo-net).

Bearing function of this structure is overtaken by interaction between the soil and reinforcement, meaning that the friction that appears in reactive zone of the structure, between the reinforcement of plastic material and soil, keeps the structure in stable condition.

Retaining structure of soil and plastic should satisfy the conditions of external stability (stability to the rotary and translational movement, allowed stress at the contact of soil and foundation, setting of structure and plinth sliding). The retaining structure shall also fulfill interior stability conditions (soil compressive force shall be for 1,5 times lower than compressive force between the soil and geo-synthetic, both globally and on vertical segments).

11.4.2 Work Technology

Retaining structures of soil and plastic are constructed over already prepared subsoil in accordance with the conditions for execution of roads' subsoil. Prepared subsoil is covered by the "clean" layer of sand-gravel soil or crushed stone 0-30 cm, which is 10-30 cm thick. Then the first layer of geotextile is applied over which a layer of soil (fine-grained and coarse-grained) is spread, leveled and compacted. When the first layer is compacted according to the regulations, then it is covered by geotextile, minimal 1.00 m².

Then the second layer is executed, i.e. geotextile is laid first which over another layer of soil is spread, leveled and compacted. This schedule of works shall be adhered to, starting from the bottom and progressing to the top of the structure, i.e. schedule of successive placing geotextile (reinforcement) and execution of embankment layers. Embankment shall be constructed per technical conditions for road embankments.

11.4.3 Materials

The reinforcement used with these types of structures is woven geotextile, or geo-net of polyvinyl alcohol (PVA), polyester (PES), polypropylene (PP) or polyethylene (PE).

Orientation values of main mechanical characteristics of tensile strength (β_L) and maximum dilatation (ϵ) of geosynthetic for these types of structures are: woven geotextile and geo-net of polyester, polypropylene or polyethylene:

$\beta_L = 40 - 300 \text{ kN/m}^2$, and the dilatation at the top tensile strength is $\epsilon < 15\%$. Geosynthetic that is applied on retaining structures of soil and plastic shall be resistant to ultra-violet rays (UV). If geosynthetic fails to be resistant to UV rays, the slope of the embankment shall be protected by topsoil. For top soil stability, it shall be necessary to use plastic subgrade of high-density polyethylene (HDPE) 16-18 mm thick which receives tensile force of minimum 3,00-3,50 kN/m^2 . Plastic subgrade shall be fixed to the road embankment by plastic wedges of HDPE of 70 cm in length that are laid in <check-mat> pattern at the distance of 70-100 cm. A layer of topsoil mixed with grass seeds is placed between the embankment slope of geosynthetic and plastic subgrade.

The soil used for the structure shall possess the following geo-mechanical characteristics:

$\gamma > 18 \text{ kN/m}^3$, $\phi > 25^\circ$; and that the soil is not polluted by chemically aggressive agents to geotextile as well as that the presence of slurry particles is less than 4%.

11.4.4 Quality Control

The quality of treated subsoil shall be checked by one of world-wide acknowledged norms for:

- Determining soil moisture,
- Determining soil bulk density;
- Determining modulus of soil volume change.

Subsoil compaction shall be determined per standard Proctor compaction test:

- Natural original fine-grained and coarse-grained soils with the embankment height not exceeding 2 m1 in height, 100%.
- Natural original fine-grained and coarse-grained soils with the embankment height exceeding 2 m1 in height, 95%.
- Tests shall be made at each 50 m1 of treated subsoil.

The quality of executed embankment layer shall be checked by one of world-wide acknowledged norms for:

- Determining soil moisture
- Determining soil bulk density
- Determining modulus of soil volume change.

Fine-grained material like clay, dust shall fulfill the compaction condition per standard Proctor procedure $E = 600 \text{ MN/m}^2$:

- For the embankment layers of below $2,00 \text{ m}^1$ from the finished height level 95%.
- For the embankment layers up to $2,00 \text{ m}^1$ below the finished height level 100%.
- For coarse-grained soils like sand, gravel, the modulus of soil volume change $M_c = 600 \text{ kPa}$.

The compaction of embankment layers shall be tested at each 50 m^1 by two tests from close locations that will give the same results:

The quality of geotextile shall be proved by testing tensile strength and elongation (dilatation) at peak strength as well as resistance to UV rays with one of registered institutions for this type of jobs.

All tests shall be completed to the full satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

11.4.5 Measuring

The quantity of executed retaining structure of soil and plastic approved by the Engineer shall be measured in two ways:

- in m^3 of actually executed embankment, and
- in m^2 of placed geotextile.

11.4.6 Payment

The payment for retaining structure of soil and plastic shall be made per actually executed quantities for the embankment as well as for supplying and placing geosynthetic per unit price stated by the contracted bill of Quantities.

11.5 Geotechnical Prestressed Ties

11.5.1 Description and Scope of Works

The works included hereof consist of supply of materials, labor, plant, equipment and the execution of all necessary operations. All specific preliminary works like scaffolding, water-supply, electricity supply, etc., shall be also included. All works shall be in full compliance with the Design, these Technical Specifications and subject to the approval of the Engineer.

11.5.2 Execution of Works

Execution of Borehole

Bore holes for ties are executed with casing in the slope anticipated by the Design. Drilling method shall be harmonized with geotechnical conditions of the terrain, which have been defined by prior examination works. All materials through which the bore hole passes through are identified and recorded in the Work Log. On the basis of the established profile, the length of tie or road-stead zone will be possibly corrected. Corrections in respect of the Design shall be exclusively made by the Designer or Engineer. The position and slope of bore holes shall be in strict compliance with the Design. Finally, the bore hole is water flushed upon completion. Drilling mud usage shall not be allowed when executing bore holes for geotechnical works.

Building in of Anchors

Already prepared tie, whose structure and bearing capacity is complied with the Design, is upon water flushing inserted in the bore hole. Any changes on the tie could be only made with Designer's consent. After the tie is inserted into the bore hole, protection pipes are removed. Injecting of tie, road stead zone, shall be made by cement-water mix with addition of contents that increase the volume. The composition of injection mass/compound is determined by the Design depending on rock mass and force in the tie and shall not be changed without prior consent of the Designer.

Injecting shall be performed under small pressure and shall last until injecting mass reaches bore hole outlet. The part of tie exposed to elongation-prestressing is protected by special structure. When mass hardens, which is determined by laboratory tests, then it shall be proceeded to tie prestressing. Prestressing is performed in several cycles, which are precisely detailed by the Design. The tie is found correct, if deformation-free during straining. After prestressing, tie-head is fixed and subjected to protection against corrosion. Part of tie whereon elastic deformation is applied is injected and tie-head is covered by concrete per the detail of the Design.

Protection against corrosion completes the works on tie execution.

The data on method of execution of works and used materials is recorded in the Work Log, which shall be maintained by the Contractor and the Engineer for eventual submission to remain with the Employer.

Attests for all used materials shall be handed-over to the Employer through Work Log.

Measuring

In principle, the tie length shall be determined by the Design on the basis of examination works and Design requirements. However, under complex engineering-geological conditions, the tie length is determined after the bore holes have been executed. Therefore, the quantities to be paid for are determined on the basis of actually executed works approved by the Engineer.

Payment

The payment shall be made per contracted unit price for linear meter of tie. The price shall cover all material, usage of plant and equipment, all work operations until the tie completion. Testing of tie bearing capacity, if anticipated by the Design, shall be paid separately and shall also include all labor, material and equipment.

11.6 Gabion retaining structure

Gabions are retaining or lining structures for receipt of soil pressure, made of wire or plastic cages of different sizes and filled with broken stone.

Method of Gabions' Execution

Gabions shall be placed on the leveled earth base cleared from weeds, stumps and other elements that might damage the net with 5% incline to the slope of the terrain. A layer of broken stone or gravel 5-10 cm thick is placed over this leveled earth base, which serves as cleaning layer. Instead of clean layer of mineral soils, it is possible to place non-woven textile, which in this particular case has separation function, meaning it protects gabion from penetration of fine-grained soil (dust, clay) into its mass.

Wire or plastic cages (boxes) where broken stone is placed, shall be of sizes as stipulated by the Design, normally 1,00x0,50x2,00. It is necessary to execute a diaphragm (partition) in the cage center, if the cage length is 2,00 m¹. The cages are made of hexagonal or square steel net with double thread of steel wires with tensile strength of 550 N/mm²; dilatation at elongation is 10%. The wires have diameter of 2,4, 2,7 and 3,0 mm and they are galvanized by 275 - 290 g zinc per m², or steel wires galvanized by Galfan alloy of 95% zinc, 5% aluminium and "Mischmetall" (mixed metal) alloy. If so required, both wire types may be PVC coated as additional protection against chemical effects, if exposed to polluted or aggressive environment. The edges of gabion cages are reinforced by galvanized steel wire with diameter that is higher than the diameter of gabion net wire. Stainless steel or galvanized steel rings are used to horizontally or vertically connect gabions as well as the sides of gabion cages. Ring diameter is 3,05 mm and it is galvanized by 280 g/m² zinc. The rings are placed either at horizontal or vertical distance of 20 cm by manual or hydraulic device, specially manufactured for this type of job.

Gabions are anchored per schedule provide by the Design detail. Anchors are made of the same steel net, which quality is described in this item on gabion cages.

The filler used for gabions shall be crushed stone whose minimal grain size should exceed the size of cage wire mesh. The density of crushed stone filler for gabion shall be min. 60%. Crushed stone used for gabion filler shall fulfill physical and mechanical conditions anticipated hereof. Final/top gabion filler shall be fine grained stone as to provide as smooth as possible upper gabion surface. Also, the top gabions filler shall be placed 50 to 75 mm above the top of the net as to facilitate setting due to gabion own weight. Filled cage/cage shall be closed and the lid shall be tied by wire or steel rings. If the cage is made of plastic, ties shall be made by plastic thread. Gabions are to be made on site.

Specially, if thus required by the Design, gabions shall be cross or longitudinally tied/connected by reinforcement of 6 mm in diameter. Horizontally, the reinforcement shall be placed at each linear meter of gabion width, and vertically at each two meters of gabion length.

Horizontal wise, gabions shall be placed in such a manner as to avoid overlapping of vertical joints of the layers, i.e. vertical joints of one layer shall be at the center of the gabion of the other layer. Gabion cavities should be filled with natural materials like clay and dust which would further facilitate seeding of grass or bushes that would stabilize gabion structure. The space between gabions and embankment slope shall be filled with earth and broken stone compound, diameter 1-6 cm, in the ratio of 1:10 as allow for plants to take better root.

Equipment

Hand tools for cutting of galvanized steel wire, or sheradized steel wire shall be needed to make cages for gabions, as well as a device to connect sides of gabion cages, or to connect gabions. The tools to be used to make plastic gabion cages are tongs, ruler, needles, etc.

Cages are to be filled both by loader and manually.

Materials

The following materials shall be needed for gabion production:

The net of hexagonal steel wire, double folded, with ultimate strength 550 N/mm², at the elongation of 10%, galvanized with 275-290 g zinc per m² or steel wire galvanized by Galfan alloy of 95% zinc, 5% aluminium and "Mischmetall" (mixed metal) alloy. Both nets, if required by the Design, may have PVC coat 1,00 mm thick. The edges of gabion cages and diaphragm shall be reinforced by galvanized steel wire of the same quality as for net wire, but with higher diameter 3,20 mm. The sides of gabion cages shall be connected, as well as internal ties, by steel rings with diameter of 3,05 mm, galvanized by 280 g/m² zinc or by wire of the same quality which of the cage net is made of. Instead of steel nets, Plastic polyethylene (PE) nets of high density (HDPE) may be used instead of steel wire nets, with square wire mesh size 8-10 cm or hexagonal wire mesh size 10-12 cm. The sides of plastic cages and internal cross connections shall be connected by plastic thread, 3x0,6 mm thick.

Crushed stone grain size 10-25 cm, for cage filler, shall fulfill the following conditions:

- volume mass with cavities 22 kN/m³;
- water absorption min. 1%;
- compressive strength in water-saturated condition min. 100 MPa;
- Resistance to moisture and frost M-50, per one of world-wide acknowledged norms.

Reinforcement shall be of geosynthetic polyester (PET) net or polyvinyl alcohol (PVA), which shall possess basic physical-mechanical characteristics:

- ultimate strength $\beta_T = 50 - 300 \text{ kN/m}^2$;
- dilatation at peak strength: $\epsilon = 6-12 \%$

In concrete case, geosynthetic net per the Design shall be used.

Connecting reinforcement to lining concrete blocks may be executed in two different ways:

- direct connecting;
- indirect connecting.

Direct connecting understands placing of reinforcement directly into concrete block. This is possible, if geosynthetic net of polyvinyl alcohol (PVA) is used as reinforcement. This net is resistant to pH values, 9 for concrete, and therefore it is possible to directly anchor the net onto the concrete block, as provided for by the Design.

Indirect connecting shall be necessary if geosynthetic polyester (PET) net is used which is not resistant to pH values of concrete and therefore indirect connecting shall be used as provided for as a variant by the Design.

The Contractor shall select one of the two proposed ways of connecting reinforcement to concrete block and submit his proposals for the approval of the Designer and the Engineer.

Measuring

Measuring the quantity of executed gabions shall be made in cubic meters (m^3) of actually performed works approved by the Engineer.

Reinforcement of geosynthetic net which is actually placed shall be measured separately in m^2 .

Payment

The Contractor shall be paid for the quantity of actually executed works, i.e. completed gabions per the Design, per contracted price for $1 m^3$. The price shall represent the compensation for supply of all materials (net of galvanized wire or plastic, crushed stone, broken stone, etc.) and the price of labor needed for execution of gabions per the Design.

11.7 Water flows control

11.7.1 Excavation

11.7.1.1 General provisions

Excavation includes excavation, loading and transport to the disposal area or place determined by the Engineer, unloading and arrangement of disposal areas.

Excavation shall be carried out to the lines, slopes and dimensions given in the Final Design or to the lines, slopes and dimensions approved or instructed by the Engineer. Overbreak beyond these lines shall not be considered for the payment except the overbreak or additional excavation that may be approved by the Engineer.

All operations that the Contractor plans to carry out on the excavations must be stated in the programme for these works which is to be submitted to the Engineer for the approval, at least 30 days before the commencement of the works. Material, equipment and labour for the stated operations shall be subject to the approval of the Engineer. The Engineer has the right to deepen and enlarge anticipated excavations, to change slopes of excavation and to make all necessary changes in order to ensure the required quality of the excavation or construction material. All excavations that the Contractor carries out beyond the approved dimensions and levels defined in the design or not approved in written by the Engineer shall not be accepted for payment, and the costs of filling works, which are to be carried out according to the filling specifications, are to be paid by the Contractor.

Within 10 days from the reception of the excavation plan, the Engineer shall issue written approval or rejection, partly or completely, of the Contractor's proposal. In case of rejection, the Contractor shall submit a new excavation plan.

No excavation should start without the previous approval and signing of the mentioned plan by the Engineer. The payment for excavation shall be done according to the unit rates for $1 m^3$ stated in the Bill of Quantities.

During excavation works, working areas are to be kept dry and the measures and method that the Contractor takes in order to fulfill this condition must be fully in accordance with the design and approved by the Engineer and they must have no negative effect on the surrounding area.

11.7.1.2 Approved overbreak

Approved overbreak is overbreak which, according to the Engineer's opinion, is an inevitable result of bad material, and is not caused by negligence or carelessness of the Contractor. Additional measuring shall be carried out for the approved overbreak and it shall include unstable material which did not fell off by itself, but needed to be removed mechanically or manually during the cleaning.

For those quantities which are beyond theoretic excavation lines defined by the drawings or beyond excavation lines determined by the Engineer, the Contractor has right to request payment as per same prices stated in the Bill of Quantities. These prices include costs of loading, transport and disposal of material. The Contractor shall immediately submit applications for payment of costs for overbreak caused by inevitable break and sliding of material to the Engineer who will establish causes of overbreak and decide whether the overbreak may be considered as approved or not. Only the Engineer is competent to decide on causes of overbreak.

11.7.1.3 Disposal areas

Material not suitable for construction or left after excavation shall be disposed. Disposal of excavation material shall be carried out in the areas proposed by the Contractor subject to approval by the Engineer, in principle in the areas of the existing depressions. In case of necessity, the Contractor may carry out temporary disposal of excavation material, in other places subject to approval by the Engineer, which are usually in already expropriated areas. On completion of works, when there is no more need for temporary disposal of excavation material, the Contractor is obliged to transport all of the remaining material to the permanent disposal areas and bring temporary disposal area into the previous state arranging it in a way to be agreed with the Engineer. Material disposal shall be carried out in such way that disposal areas are always drained and planned. Slopes of disposal areas, as well as disposal areas by themselves, must be stable. Arrangement of temporary disposal areas shall not be paid separately but included in unit rates for excavation.

11.7.1.4 Excavation of channels and river beds

Unlined part of the profile

Unlined part of the profile shall be excavated fully in accordance with dimensions and slopes defined in drawings. If stability conditions, or some other conditions require that, the Contractor may propose to finish the excavation to the different dimensions and slopes and request the approval of the Engineer. Surpluses or shortages in quantities resulting from these changes may not have effect on offered unit rates for channel excavation.

Lined part of the profile

Special attention shall be paid to prevent overbreak of material on the bottom and slopes over which channel lining will be placed. In places where natural terrain line is beneath the channel bed, channel bed is to be filled up to the lining base in the same way as it is specified for filling and compaction of the channel embankment.

In case of ordinary excavation, channel excavation is to be carried out from the lining foundation, as it is shown in drawings or as it is specified, in order to provide required lining thickness.

On those sections where underground water is present, which is to be established by the Contractor, part of the profile that is to be lined shall be excavated so that the space is left between the excavation surface and lower side of the lining. This additional excavation of channel lining is to be filled with drainage material selected in accordance with the Design and subject to the approval of the Engineer.

Overbreaks of excavation surfaces resulting from bad structure of material in which excavation is carried out, shall be filled with the selected material as directed by the Engineer.

Measuring and payment

Measuring and payment for channel excavation shall be made to the excavation borders given in the drawings, borders defined by these specifications or borders approved by the Engineer.

On those sections where ordinary excavation of profile which is to be lined is carried out, measuring of excavation, except the one anticipated in this item, shall be made to the line of the lower side of lining.

In those places where additional excavation for placing drainage material is required, measuring of excavation shall be made to the line parallel with the lining, 0.10 m under the lower side of the lining. Costs of filling this lining excavation shall be included in unit rate for one square meter, given in the Bill of Quantities for lining base preparation in the areas with high level of underground water.

Measuring for payment of excavation of unlined part of the channel profile shall be made to the excavation borders and slopes shown in drawings and as approved by the Engineer, taking into consideration the following:

If excavation is carried out in material that can be excavated exactly to the defined borders and slopes, excavation is to be done exactly to the mentioned borders and slopes up to which measuring for payment shall be made. Any overbreak beyond these borders shall not be accepted.

If excavation is carried out in material that contains large boulders or large pieces of debris, excavation is to be done to the excavation borders and slopes shown in drawings or those approved by the Engineer.

Measuring for payment shall be made to the anticipated borders and slopes, and in cases of overbreak caused by bad structure of material which is subject of the Engineer's decision, measuring for payment shall be made to the excavation lines.

Payment for channel excavation shall be made per unit rates for one cubic meter, given in the Bill of Quantities for ordinary excavation and excavation of channel in rock. Unit rates shall include work of machines and labour, transport of excavated material to the embankment or disposal area not more than 150 m away from the excavation place, water pumping or drainage as well as any other work required for keeping excavation in good condition during construction works.

11.7.1.5 Excavation from the borrow pits

General provisions

If the excavation does not provide sufficient quantity of necessary material for filling, the Contractor shall establish place from which additional material is to be procured and request the approval of the Engineer. Material is to be taken in such way that the smallest possible agricultural area is destroyed. Surface of borrow pits is to be left reasonably even, and subject to approval by the Engineer.

Where it is necessary, in order to prevent accumulation of standing water, borrow pit holes are to be drained by open channels to the full satisfaction of the Engineer.

Measuring and payment

Measuring for payment of material taken from the borrow pit shall be made in the excavation place. Measuring for payment of borrow pit excavation shall be made only in those quantities that are necessary and as approved by the Engineer. Paying for the excavation material from the borrow pit shall be made per unit rates given in the Bill of Quantities for borrow pit excavations. Besides excavation costs, unit rate shall include costs of borrow pit drainage.

11.7.1.6 Excavation for structures

Excavation for structures is to be carried out to the excavation borders and slopes shown in drawings or as approved by the Engineer.

Notwithstanding excavated quantity, measuring for payment of excavation shall be made only to the above described borders and subject to the approval of the Engineer.

Excavation for abutments of bridge or other structures lying out of the channel profile, if it has not been required from the Contractor to carry out these excavations before the channel excavation, are to be considered as excavations for structures, but they shall include only necessary excavation out of the normal channel profile and they will be measured to the borders described within this item.

If it has been required from the Contractor to carry out these excavations before the channel-bed excavation, all required excavations shall be considered as excavations for structures and shall be measured to the designed, required borders. This applies in cases of deck bridges construction, before excavation of channel, which is obligatory on flat and unoccupied areas (costs of scaffolding shall not be charged).

Excavation for culverts and other structures below channel-bed: if this excavation is done before excavation of channel, all necessary excavations below terrain surface between vertical surfaces at the beginning and at the end of the structure, including all necessary excavations upstream and downstream from the structure, shall be considered as excavation for structures.

If waste material is found in foundations of structure it shall be excavated to the depth that shall be approved by the Engineer in order to enable filling of material suitable for base, and measuring shall be in accordance with this item.

If this excavation is carried out after channel excavation, excavation out of required normal profile shall be considered as excavation for structures, and it shall be measured to the borders of the channel.

Excavation for foundations of structure shall be carried out to the level shown in drawings, or those approved by the Engineer. The Contractor shall prepare structure's foundations providing firm base for concrete structures. Bed and slopes of ordinary excavation on which concrete is to be placed are to be manually dug to the specified dimensions, and in that way prepared surfaces shall be, if necessary, watered and compacted with appropriate tool in order to get firm base for concrete.

If in any place of ordinary excavation overbreak is done below the specified founding level, it shall be filled with adequate material compacted fully in accordance with these specifications.

If this overbreak is done by the Contractor's mistake, or by any other reason, except if it was instructed by the Engineer, the overbreak shall be filled, as stated above, and at the expense of the Contractor.

If the Engineer instructs additional excavation, and in order to remove bad founding material, measuring for payment shall be made to the ordered depth and dimensions, and payment for filling and compacting shall be made in accordance with the provisions of these Technical specifications.

If overbreak is result of the Contractor's mistake, or any other reason, except if it was instructed by the Engineer, the overbreak shall be fully filled up to the required level with concrete of same quality as anticipated concrete structure, and at the expense of the Contractor, including costs of his work and material.

If it is necessary, material provided from excavation for structures shall be used for filling around the structure or for construction of the embankment. Otherwise, it shall be used for filling of connecting beds and depressions or distributed, subject to approval by the Engineer.

Payment for excavation for structures in ordinary excavation or in rock shall be made according to the unit rates given in the Bill of Quantities. Offered unit rates for excavation for structures in ordinary excavation shall include all the costs of work and material, water pumping and drainage, and any other works necessary to keep excavation in a good condition during construction, as well as transport of the excavated material to the distance of 150 m.

11.7.1.7 Transport

One kilometer cubic meter (km/m³) of transport is defined as one cubic meter of excavated material transported 1 km out of the borders within which transport is not being paid, since it is already included in the unit rates. That border shall be 150 meters.

Payment for transport shall be made only for the excavated materials that are necessary for forming bed-channel and other embankments for filling of old beds and other depressions, as well as for excavated and disposed waste materials which is decided to be transported beyond the border of 150 m.

If it is not anticipated otherwise, payment of transport of material for filling around the structures shall not be made.

Measuring and payment of transport shall be made as it is described here, notwithstanding the method and type of equipment used for excavation and transport.

If the material is taken from excavation of bed or channel and used for filling or disposed to the disposal area within border of 75 m, including the area left and right from the channel centre line, transport length is to be measured along the channel centre line from the center of material bulk in excavation to the center of material bulk in place of filling or disposal.

If the material is taken from the borrow pits located within 75 m, including the area left and right from the channel centre line, transport length is to be measured along the channel centre line from the center of material bulk in excavation to the center of material bulk in place of filling.

Notwithstanding the actual length of transport, the upper length of transport shall be distance measured along the channel centre line between the normal projection on the channel centre line of center of material volume in excavation and normal projection on the channel centre line of material volume in place of filling.

If the material is taken from the borrow pits located more than 75 m away from the channel centre line, transport length is to be measured along the shortest possible route, which is to be determined by the Engineer, and that is from the center of material bulk in excavation to the center of material bulk in place of filling.

If the material is to be transported to the disposal area located more than 75 m away from the channel centre line, transport length is to be measured along the shortest possible route, which is to be determined by the Engineer, and that is from the center of material bulk in excavation to the center of material bulk in place of disposal.

In measuring of quantities of material for the purposes of transport payment, volume of material for transportation is to be measured in excavation and as approved by the Engineer.

Transport length shall be measured in units of 50 m.

Payment of transport shall be made according to the unit rate per kilometer given in the Bill of Quantities.

11.7.1.8 Tolerances and quality of finishing works

The Contractor is required to perform works on excavation so that he immediately continues with work after excavation, which means to synchronize works in order to prevent moistening, sliding, ditching, loosening or any other degradation of quality of surfaces on which excavation is completed and filling did not yet started.

The Engineer shall instruct, at the expense of the Contractor, removal of damaged parts of completed excavation and filling of those parts with filling material.

Approval by the Engineer for the excavation is to be made after definite preparation of excavation surface, in naturally damp, fresh, compact state, after removal of any loose material. Approval for the excavation is to be carried out parallel with surveying of surfaces of the completed excavation, and the Contractor is not allowed to continue with further work until he receives written approval for the excavations.

The Engineer shall instruct additional deepening or widening of excavation in parts where specified dimensions were not achieved before issuing any final approval.

11.7.2 Filling

11.7.2.1 General provisions

Dimensions and tolerances

The Engineer shall instruct all necessary corrections of excavation or embankment or any other modifications during construction works in order to adjust the structure to the real conditions.

The tolerance for filling, in respect to the levels given in the Design and obligatory for the Contractor, shall be 0.05 m, or as otherwise directed by the Engineer.

If deviation from the mentioned tolerances is found, the Contractor is obliged, at his own expense, to make necessary corrections, remove incorrectly executed filling and bring inadequate parts into the right condition as determined by the Engineer.

Maintenance of embankment

The Contractor has obligation to maintain outer surfaces of fill in the same condition as on completion of works and all until works are finally accepted by the Engineer. All changes that occur during the mentioned period, including the damages, the Contractor is obliged to fix and bring filled areas into the previous state at his own expense.

Method of execution

The Contractor shall submit for the approval of the Engineer, at least one month before the commencement of works, his programme of works where he proposes phases in embankment construction, method of construction for each phase and equipment for construction.

Transportation and build-in equipment must be submitted for approval by the Engineer.

Build-in may start only after the Engineer issues approval for the surfaces prepared for filling of the next layer.

In construction of the embankment with section in cut and fill, it is necessary first to remove topsoil on the entire surface of excavation and embankment, and then follows excavation, embankment construction, trimming of the entire slope of the section, top-soiling and grass seeding.

Topsoiling of visible surfaces of the embankment shall be done by using topsoil material disposed along the embankment.

Slopes and crowns of the embankment shall be covered with topsoil material in layer of 10 cm. Topsoil that remains shall be distributed over both sides of the embankment.

Topsoiled areas are to be grassed with a mixture of selected shrubby grasses so that the grass cover undertakes function to protect surface layer from erosion.

Grassing shall be performed in accordance with the agro-technical measures and by adding fertilizer in quantity of 200kg/ha.

Calculation shall be made per 1 m² of topsoiled and grassed surface.

Temporary access roads

Final works on access road shall be performed in accordance with description given in the Design and subject to the approval of the Engineer.

Subject to the approval of Engineer, the Contractor may use existing roads or cut temporary roads.

On completion of works, Contractor shall:

- a) bring the existing roads into the previous state or better
- b) level and plough temporary roads in order to bring area to its previous purpose

All such reinstatement works shall be completed to the satisfaction and approval of the Engineer.

Costs of the work on roads are included in prices for permanent works (excavation, filling, concrete...)

Testing and control

All testing and control shall be completed in accordance with Section 1 of these Technical Specifications and as directed by the Engineer.

Compacting equipment

Considering used material, Contractor shall choose most appropriate equipment for compacting, such as, for example, manual vibrating rammers.

The manual vibrating rammers are to be used where there is no access for the machines and they must have vibrating deck weighing at least 30 kg. Type and number of these rammers is to be submitted for approval by the Engineer.

The Contractor is obliged to timely submit his proposal for type of compacting equipment to the Engineer.

11.7.2.2 Execution of filling and protection around structures

General

Details of specifications for material incorporation are as defined in the Design, these Technical Specifications and as determined by the Engineer.

Measuring for payment shall be made per m³ of the material incorporated (compacted) in filling and as approved by the Engineer, where unit rate includes all works on excavation, transport within 150 m, placing in layers, moistening and compacting.

The Contractor is not entitled to ask for any reimbursement of costs above the offered unit rate for any work related to the drying of material, such as spreading and turning over in order to speed the process of drying, nor he is entitled to ask for reimbursement of costs resulted from delay caused by need to dry the material.

Preparation of surface for filling

The surface of terrain under all fillings shall be ploughed forming open rills of depth not smaller than 0.20 m from the natural level of terrain surface, and distance between them shall not be greater than 1.00 m. In places where terrain is inclined, berms shall be constructed as it is shown in cross sections.

Prior to placing of the first embankment layer, it shall be necessary to rough the base in depth of 5 cm, moisten it to the optimal moisture, and if it is too wet it shall be dried to the specified moisture as described in the following item.

In places where soil composition under embankment is not suitable for foundations, as determined by the Engineer, the Contractor shall remove that material to the depths and border established by the Engineer. The removed material shall be disposed as described in this item.

Measuring for payment of costs caused by removal of material not suitable for foundations base shall be made only to the depths and border approved by the Engineer, and payment shall be made according to the unit rates given for the ordinary ditch excavation in the Bill of Quantities.

Except costs of removal of material not suitable for foundations base (m²), costs of all other works described in this paragraph shall be included in the unit rates given in the Bill of Quantities for the ordinary ditch excavation (m³).

Moisture of material and compacting

During incorporation, material shall have uniform moisture adequate for compacting. During construction, in case of non-cohesive materials or poorly cohesive materials, the Contractor shall provide systematic watering in order to achieve better compacting results. In case of batches with higher percentage of fine fractions (semi-cohesive material), moisture of fine fractions shall be near to the optimal, from -1% to +3% of water content according to the standard Proctor. Density of material filled shall be at least 95% of dry volume weight obtained by standard Proctor's test. Incorporation of material with compacting shall be done in layers of 25 cm.

All works shall be subject to the approval of the Engineer.

Filling around structure

The Contractor shall execute filling around all structures, to the lines shown in drawings or as determined by the Engineer. From case to case, the Contractor shall establish type of material to be used for filling and method of filling and submit his proposals for approval by the Engineer. Filling material shall be taken from excavation for structures, channel excavation or from borrow pit.

Limit for filling amount depends on sequence of works execution.

In the place where structure was built before excavation of adjacent channel sections, The Engineer shall determine the limit for the amount of filling around structure above the terrain level to the minimum required for protection of structure, performed with or without compacting.

In the place where structure, except for the culvert and other structures above channel, was built after excavation of adjacent channel sections, filling around structure, including parts of normal channel fill within filling borders around structure, shall be carried out as filling around structure with compacting, and it shall be measured for payment in accordance with the provisions of this item and subject to the approval of the Engineer.

Measuring for payment of filling around structures shall be made to the approved borders of executed excavation for structure, and only those quantities that are really incorporated within borders established for payment shall be calculated as approved by the Engineer.

Except for already anticipated, measuring of filling around structure above terrain level shall be made to the dimensions and slopes shown in drawings or those determined by the Engineer.

Filling of unapproved overbreak arised during excavation for structure shall be performed at the cost of the Contractor, in accordance with the provisions of this item, and without any right to request reimbursement.

If it is not shown different in drawings or decided otherwise by the Engineer, filling shall be carried out in a way described in this item. Filling and compacting around and above the mentioned structures shall be performed in accordance with the following:

- o Filling and compacting around and above pipes of these structures shall be done to the surface of terrain or to the level of 0.8 m above the top of the pipe. Under terrain surface filling and compacting shall be done to the full width of ditch. Filling and compacting around watertight rings shall be done up to the level of 0.80 m above the top of the rings, at width of 0.60 m on each side and to the slope of 1:1.
- o Where position of sloped concrete walls or decks is such that they are partly above the terrain surface, and if it is necessary, as determined by the Engineer, to place concrete wall or deck directly on ground base without use of double sided formwork, the Contractor shall construct compacted embankment whose shape and dimensions present suitable base for the sloped concrete wall or deck.
- o Measuring for payment of filling around structure with compacting shall be made to the borders shown in drawings, described in this item or determined by the Engineer. Payment for compacting shall be made per unit rate given in the Bill of Quantities. This price includes only compacting work described in item 4.2.7.3 and it shall be added to the unit rate for filling around structure without compacting, given in the Bill of Quantities. Payment for filling around structure with compacting shall be made per unit rate which presents sum of two above mentioned unit rates.

11.7.2.3 Subsoil preparation

This work refers to the natural original soil on which construction of embankment is performed.

The work includes compacting, and possibly digging up for the purposes of drying or moistening of natural soil in thickness defined in design, approximately 30 cm.

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In case that the composition of soil – subsoil of embankment is such that it is not possible to carry out direct construction of embankment on it (saturated soils, muddy soils, soils of organic origin and similar), it shall be necessary to prepare the subsoil before construction of the embankment, that is to take remedial measures in a way defined in design or in any other way determined by the Engineer.

Prior to filling, cleared and leveled base soil – subsoil shall be compacted in accordance with the following conditions:

Description	Minimal required degree of density according to the standard Proctor's test
a) Natural original soils of cohesive materials, designed embankment is not higher than 2.00 m	100%
b) Natural original soils of cohesive materials, designed embankment is higher than 2.00 m	95%
c) Natural original soils of non-cohesive materials, designed embankment is not higher than 2.00 m	100%
d) Natural original soils of non-cohesive materials, designed embankment is higher than 2.00 m	95%
e) If density test on non-cohesive materials is done with a test plate, same condition shall be applied as for embankments of corresponding height: -for mixed materials with 20-30% of stone materials - for mixed materials with 30-50% of stone materials - for mixed materials with more than 50% of stone materials at optimal or near moisture	 M _c = 25-30 MH/m ² M _c = 30-35 MH/m ² M _c = 25-30 MH/m ²

For coarse-grained crushed stone materials (grain size over 150 mm) and mixed materials, density test may also be performed by using volume methods if necessary and subject to the approval of the Engineer.

Embankment height is height from level of prepared subsoil – base soil to the level of roadbed formation (subgrade), at the lowest part, or to the level of embankment crown (dam).

Tests shall be done at every 1000 m² of prepared subsoil, or as otherwise determined by the Engineer.

11.7.2.4 Structural embankment "SE"

If the material in construction place does not meet stated requirements, material for this embankment shall be provided from the borrow pit subject to approval by the Engineer.

Grain size curve shall be between limit lines shown in the appended diagram.

Organic content shall not exceed 5%

Cohesive or non-cohesive material may be used in construction of this embankment.

Compacting shall be carried out by machines in layers up to 25 cm, in compacted condition, while compacting around concrete structures shall be carried out manually in layers up to 15 cm.

Spreading in layers shall be manual or by bulldozer, depending on available working area. Compacting shall be carried out by vibrators, rollers or manual rammers. Hydraulic compacting may be carried out in case of non-cohesive materials (sands).

For cohesive materials, density in place should be 95% of standard Proctor's test with variation of moisture compared to the optimal from -1% to +3%. Moisture of incorporated material should be uniform. Surface of previous layer shall be rough up to depth of 5 cm and moisten before placing next layer.

In case of non-cohesive materials, minimal achieved density should be 70% of relative density.

In the areas where design anticipates compacting only by machine passing, this may be achieved with 4 passes of bulldozer in layers up to 0.5 m.

All works shall be completed to the full satisfaction and approval of the Engineer.

11.7.2.5 Waterproof embankment "WPE"

If the material in construction place does not meet stated requirements, material for this embankment shall be provided from the borrow pit subject to the approval of the Engineer.

Grain size curve shall be between limit lines shown in diagram of definition of grading of embankment.

"Atterberg's" limits-

Flow limits: $25 \leq LL \leq 45$

Plasticity index: $5 \leq IP \leq 20$

"Darcy's" coefficient of water permeability should be $\max K = 10^{-5}$ cm/sec.

Organic content shall not exceed 3%.



Minimal density should be 95% of standard Proctor's test with variation of optimal moisture from -1% to +3%. Moisture of incorporated material should be uniform. Test shall be performed on quantities of 200 m³ of incorporated material and not less than two tests per structure shall be done.

Compacting shall be carried out by machines in layers up to 35 cm, while compacting around concrete structures shall be carried out manually in layers up to 15 cm. Surface of previous layer shall be rough up to depth of 5 cm and moisten before placing next layer.

The embankment is constructed in layers of thickness of 0.20 m to 0.35 m. Thickness of layers depends on type of machine used for compacting. Optimal thickness of layers shall be established by test compacting on trial section. Each layer shall be compacted to the required density. Density test is performed over modulus of compressibility defined for this embankment $M_s = 50,000 \text{ KN/m}^2$ which is controlled after compacting of each layer by test plate at every 50 m of constructed embankment.

All works and materials shall be tested for full compliance with these Technical Specifications and to the full satisfaction and approval of the Engineer.

Transport of material is to be made over already constructed and compacted part of embankment. During excessive rainfalls moving across constructed embankment shall not be allowed.

Compacting of end lines of embankment shall be carried out by using light rollers or manual equipment. During execution of works, it shall be necessary to prevent sliding of material on already constructed parts of embankment and slopes must be protected from erosion caused by rainfalls. Damaged parts of slope shall be repaired and material shall be incorporated in a same way as in permanent works. It is necessary to achieve required density of $M_s=50,000 \text{ KN/m}^2$. Compacting shall be performed equally over the entire width and length of the embankment. Compactness of material must ensure required water permeability.

Results of circular deck test shall not depart more than 5% from allowed. All control tests and test results shall be submitted for the approval of the Engineer.

Embankment slopes shall be compacted upon removal of all remaining material located out of the embankment section.

11.7.3 Stonework

11.7.3.1 General provisions for stonework

Stone used for regulation works shall be provided from the quarry and shall fulfill following conditions:

- o Size of stone material depending on type of works shall be in limits defined by design curve of stone grading
- o stone shall be resistant on abrasion and frost, with pressure resistance not smaller than 100 N/mm^2
- o to have certificate for this type of works. According to the certificate it shall have 35% of weight loss after 5500 revolutions, and frost resistance shall be satisfactory (according to JUS B.88. 1).

For construction of lining larger stone shall be selected having dimensions defined by design which is to be corrected by hammer corrections on site. Each stone shall have required thickness. Corrections shall not be larger than 2 cm.

11.7.3.2 Sand and gravel base for stone lining

For sand and gravel base, filter layer, for stone lining natural sand-gravel material shall be used. Material for stone lining base shall fulfill condition that grain size does not exceed 50 mm and that is within limit curves shown in design diagram for limit curves. Spreading is carried out in layers in accordance with the design dimensions.

Measuring for payment is made per number of m³ of material incorporated in base and as approved by the Engineer. Payment shall be made per unit rates given in Bill of Quantities. Price includes excavation works, transport, unloading, construction, compacting, base preparation and other.

11.7.3.3 Protection of bank and bed by stone mound

For protection of slope and bed of regulated channel by stone mound only solid and compact stone shall be used, persistent on frost and in water, and in accordance with size shown in design diagram for stone mound.

After transport to incorporation place, stone shall be unloaded, rough calibration (manual and mechanical) shall be done in order to form constant inclination of slope and finish grade of regulated channel bed.

Measuring for payment shall be made per m³ of calibrated stone and as approved by the Engineer.

Payment shall be made per unit rate given in Bill of Quantities.

11.7.3.4 Crushed stone lining in cement rendering

Securing shall be carried out by using stone with measures and dimensions shown in drawings. For securing construction, stone resistant on atmospheric conditions and frost shall be used, which is defined by JUS B.B.8 044, JUS B.B.8 001 and JUS B.B.8 013 standards. Minimal pressure resistance of stone shall be 100 MN/m^2 . Measuring shall be made per m³ of incorporated material.

For protection of beds, minimal diameter of stone shall be 25 cm

After unload from transport mean, stone shall be manually calibrated and incorporated.

Stone lining in cement rendering, ratio 1.3, by cyclopean method of construction, shall be constructed from calibrated crushed stone of polygonal calibration, and stone calibration shall be made in a way that three connections are connected approximately in one point. Each part shall be placed in bedding of rendering and all contact surfaces shall be filled with rendering. Construction stone shall be compact, non-hydroscopic and resistant on hammer impact, without lode, abrasion and frost resistant. The Contractors proves quality of stone by certificate issued from the authorized organization. Separate parts shall have approximately same size with minimal rest edge $1/3 - 1/2$ of thickness in the upper part. Joints shall not be wider of 2 cm, which is to be achieved by using hammer and awl. Visible surface shall be separately treated and may have roughness up to $\pm 3 \text{ cm}$ which is tolerable.

Paving of lining shall be carried out in lines, and joints of longer sides shall be placed vertical to water flow.

11.7.3.5 Construction and securing of thresholds

Fixed thresholds shall be constructed from crushed stone on base in accordance with 6.2, if otherwise is not stated in the Bill of Quantities.

Stone used in construction shall fully comply with the specifications for regulation works.

Thresholds securing shall be also carried out by using crushed stone for hydro technical works. Work shall be done by machine, except for the final part which is performed by hand. Work shall be performed in dry conditions. Lining thickness is as shown in drawings.

11.7.3.6 Variations, tolerances and quality of executed works

Finished surfaces shall be in accordance with the designed ones. Allowed variations from designed dimensions for machine work are +/- 10 cm, and for fine planning +/- 3 cm.

11.7.3.7 Gabion structures

Construction of stabilization thresholds and reno mattress linings

Construction of these thresholds and mattresses shall be performed on locations anticipated by design along regulation sector and from crushed stone of dimensions from specifications given in the item that follows. Stone shall be placed manually into the prepared gabion boxes without processing or treatment, and according to dimensions given in design.

Parallel gabion structures and reno mattresses

Wire cases - gabions shall be delivered in joints and transported to the construction place in accordance with manufacture's recommendations. Cases shall be formed in construction place and bonded in horizontal layers. Cases of each following layer shall be bonded mutually and with cases in previous layer in order to have homogeneous unit which tolerates all anticipated loadings and deformations. All connections shall be executed according to details for edge reinforcement and bonding of sides recommended by the manufacturer, and which, prior to construction, Contractor shall submit for the Engineer's approval.

Filling of gabion cases shall be done by material that allows maximal filling of perfect volume of case in layers of 30 cm. Constant control of filling shall be carried out in order to avoid pinholes (voids). Filling stone shall have minimal dimensions of 120 mm, average grain size of 190 mm and maximal pieces that allow proper filling of cases. Reno mattresses shall be filled with stone of dimensions from 100 mm to 170 mm and average grain size of 140 mm. Filling stone shall fulfill requirements stated in the previous item - construction stone for bed lining in respect of required parameter values. Stone shall not be fragile, rotten, easily breakable or porous which means that it must fulfill durability requirements in the existing use conditions.

Only certified products which comply with standards UNI 3598, BS 1052/1980, US Federal Specification QQ-W-461 H, or equivalent, for wire characteristics and corresponding ones for galvanizing, shall be used for gabion cases. Prior to delivery to the Site, the Contractor shall submit certificates for the approval of Engineer. For cases, type of net 8x10 may be used with wire thickness of 3 mm or equivalent with characteristics that provide same or better behavior of filled cases under loading. All cases longer than 1.5 m shall be reinforced by diaphragms in accordance with manufacturer's recommendations, as well as with wire reinforcements sidelong in angles of shorter sides. For reno mattresses, net shall be used in accordance with the same standards for galvanized wire, and type of net 6x8 or equivalent with thickness of 2.2 mm. As alternative to reno mattresses, the Contractor may use gabion boxes, but previously he shall submit request for approval of the Engineer in order to confirm stability and durability of structure in changed conditions.

11.7.4 Construction of filter for gabions and reno mattresses

It is possible to use natural filter material or geotextile in function of filter.

11.7.4.1 Geotextile shall have following characteristics:

1. $d_{90} = 0.3 \text{ mm}$ $U_2 = (d_{100} / d_0)^{1/2}$ (according to I-N ISO 12 956)
- $d_{100} = 0.2 \text{ mm}$
- $d_0 = 0.005 \text{ m}$
- $U = 6.32$
- $O_{90}/d_{50} = 5.4$
- $d_{50} = 0.035 \text{ mm}$

2. Coefficient of vertical water permeability $K \geq 1 \times 10^{-1} \text{ cm/s}$
3. Friction coefficient - greater than limit of sliding surface creation
4. Tensile strength according to ASTM D4632 minimum 450 N
5. Splitting strength according to ASTM D4533 minimum 180 N
6. Breaking strength according to ASTM D3787 minimum 180 N
7. Min. rupture ductility 50% according to ASTM D4632
8. Cracking strength according to ASTM D4632 minimum 1300 kN/m^2 (190 PSI)

Prior to delivery to the Site, the Contractor shall submit certificates for the approval of Designer and the Engineer.

11.7.4.2 Natural filters

Natural filter layers are defined by filter analysis for corresponding parts of structures and they are shown in a separate diagram in the Design

Section 12 Traffic Markings and Traffic Equipment

Contents

- 12.1. General
- 12.2 Standard traffic signs
- 12.3 Direction Boards
- 12.4 Supports
- 12.5 Road markings
- 12.6 Traffic equipment

12.1. General

- A. Technical conditions for production, supply and erection of certain marking elements are described through individual items of these works.
- B. Ordering of marking elements shall be based on specifications provided for in the Design and in accordance with these Technical Specifications.
- C. Execution of individual elements shall be based on SRP norms and detailed drawings from the Design respectively and in accordance with these Technical Specifications.
- D. Positioning and executing of individual marking elements respectively shall be based on the layout plans, cross sections and other drawings in the Design, as well as on the Work Rules on Traffic Signs and Yugoslav norms and in accordance with these Technical Specifications.

12.2 Standard traffic signs

1.1 Size 1: Triangular 120 cm, round 90 cm, additional boards 120 x 35

1.2 Size 2: Triangular 90 cm, round 60 cm, supplementary boards size 60 x 35

- a) Standard traffic signs are in all respects executed per the detailed drawings provided for by SRP norms, under the name, code and appearance per the Work Rules on Traffic Signs SRPS.Z.S.2 from no.301 through 309 "Official Gazette of the RS" no. 15/04.
- b) Traffic sign background shall be white per the Work Rules on Road Traffic Signs ("Official Gazette of the RS", no. 3/2002 dated 01.2004).
- c) Material for the traffic sign base/background shall have retro-reflecting features, class HI (high intensity) for the principal/country roads R-251 and for the trunk roads M-22 shall be of class III (diamond grade).
- d) Traffic sign back side including possible reinforcements and all fixing elements shall be protected by artificial resins-based paint in dark-gray shade. Back side of the traffic sign, as well as its supporting documents shall be adequately marked per SRPSZ.S2.300 item 7 and protected by weather-proofing agent/coat.
- e) Traffic signs shall be protected against damage during transportation. Prior to their erection/building-in on the spot, the Engineer shall confirm that they are in order. The traffic signs have to fulfill requirements in respect of their resistance to mechanical effects and show no signs of destruction or self-separation of fixed parts, after having been exposed to mechanical effects.
- f) Positioned traffic signs shall be secured from turning and shearing.
- g) Traffic signs are erected in a manner that allows for deviation of their plane for 3 to 5° to the field from the normal to the road axis.
- h) The position of the traffic sign in the cross section is determined by the Design. If during the execution of works on some micro-location a need arises to change sign position, it shall be specially recorded in the design documentation (as built drawings). The conditions for the erection of traffic sign – position of traffic sign in the cross section are provided for in the Detail enclosure.
- i) The manufacturer shall warrantee for sign unchanged quality for at least 5 years from the date of erection, as to avoid extensive reflection and reduction of contrast between the sign symbol and the illuminated background.
- j) The price of standard traffic sign shall include delivery and transportation to the place of sign erection, all fixing elements for the support (reinforcement, bolts, packings and other), as well as sign mounting to the built-in post.
- k) Quality control: manufacturer shall possess attest for all materials used for manufacturing of standard traffic signs. Quality control shall be performed in accordance with the norm SRPS.Z.C2.300, and subject to the approval of the Engineer.
- l) The manufacturer shall be obliged to put the code on the back side of the traffic sign, according to the Work Rules on Traffic Signs, together with the contents either numerical or textual in brackets, if the sign is packed in non-transparent wrapping, than the same shall be applied also to the wrapping.
- m) Number of erected traffic signs shall be recorded through Measurement Book per offered specification. The payment shall be made per piece of erected traffic sign in accordance with the specification from the Measurement Book and as approved by the Engineer and offered unit price.

Other norms that are used for traffic signs:

SRPS.Z.S2.300 Road traffic signs – Technical conditions

SRPS.Z.S2.300 Cyrillic alphabet of normal width for traffic signs - Form and size

All tests shall be completed to the full satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

12.3 Direction Boards

12.3.1 Direction signs and special signs

- a) Direction signs and special traffic signs are executed per the drawings from the Design.
- b) Direction signs and special traffic signs are manufactured of the materials and in the manner as stipulated by SRPS.Z.C2.300 (Technical Conditions – general conditions for execution and examination/testing).
- c) Sign boards of larger sizes shall have adequate reinforcements (stiffener plate).
- d) These signs are placed on supports, which consist of a single or several parallel vertical supports, or on special structures.
- e) Positioned traffic signs shall be secured from turning and shearing.
- f) The traffic signs boards have to fulfill requirements in respect of their resistance to mechanical effects, as stipulated by SRPS and show no sign of destruction or self-separation of fixed parts, after having been exposed to mechanical effects. The quality of materials used for sign manufacturing shall fulfill the same conditions as for standard signs. The manufacturer shall warrantee for sign unchanged quality for at least 5 years.
- g) Calculation and payment shall be made per m² of sign size, mounted and positioned on site, including execution of sign and complete structure, delivery to the spot of sign positioning, excavation of holes for foundations, execution of foundations and placement of supports into foundations, shoulder backfilling, compacting and leveling and subject to the approval of the Engineer.

The price for sign board shall include supply, delivery and transportation to the positioning spot, all fixing elements, supports (structure), as well as erection of board onto anticipated structure. The above stated price shall also include delivery to spot of placement, preliminary works on the terrain and execution of foundations, tool kits for connecting certain elements, board placing and leveling, backfilling of holes, shoulder compacting and leveling, as well as the price of rain seal, and the quality control of used materials provided that the calculation is based on the area of the traffic sign which is mounted onto this type of support. The price of directional sign or special sign shall include: price for the support, all elements to be fixed onto support, as well as delivery of both sign and support, their transportation to the spot of placement, soil treatment and execution of foundation, fixing support for the foundation and fixing the traffic sign onto support as well as quality control per SRPSZ.C2.300.



Other norms that are used for traffic signs:

- SRPS U.C4.201 Latin alphabet of normal width for traffic signs – Form and sizes
- SRPS U.C4.203 Cyrillic alphabet of normal width for traffic signs – Form and sizes
- SRPS Z.S2.313 Information signs for traffic guidance in the intersection zone
- SRPS Z.S2.314 Direction signs and direction boards-Form and sizes
- SRPS Z.S2.316 Direction confirmation – Form and sizes
- SRPS Z.S2.316/1 Direction confirmation – Form and sizes-Amendments and supplements
- SRPS Z.S2.317 Information signs – Intersection - Graphic presentation
- SRPS Z.S2.321 Information signs – Name of settlement-Graphic presentation
- SRPS Z.S2.330 Paint for traffic signs

All tests shall be completed to the full satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

12.4 Supports

12.4.1 Pedestal tubular supports

- a) Pedestal tubular supports are manufactured of steel drawn pipe of uniform section and thickness, depending on the number and type of signs to be mounted on the support, which is stated in the specifications for the supports.
- b) The calculations for supports shall be made in accordance with wind effects in the zone of the road where the sign is mounted.
- c) The supports have to be protected against corrosion by artificial resin-based paint or to be plasticized, without painting, in dark-gray shade.
- d) Upper side of the support shall be rain-protected, that is closed by plastic cork or welded.
- e) All metal parts of the traffic sign supports and support structures for the shown boards and mounting elements shall be zinc-coated under hot procedure with zinc coat 60 microns. The supports shall be protected against corrosion by artificial resins-based paint or plasticized, without painting, in dark gray shade.
- f) Single pedestal tubular support shall be secured from turning by means of staves in the foundation.
- g) Pedestals are placed into, either prefabricated or cast in-situ concrete foundations.
- h) Foundation sizes shall also be determined taking into account wind effects taking into account the size and the number of signs mounted on the support.
- i) Support length (height) shall be determined from the sign position detail in accordance with the sign size and number of signs to be mounted on it, required foundation depth and selected method of fixing signs onto support. Support's extension or shortening, due to the slope of the terrain, shall be determined by the manufacturer on the site, or by the Design.
- j) The price of the support shall include delivery to the spot of mounting, preliminary works on the terrain and execution of foundation, placement of support, as well as the price for the set for connections between support elements.

12.4.2 Braced girders/supports

- a) Braced girders are manufactured for traffic signs – direction boards with their overall area exceeding 3m².
- b) Braced girders and special structure supports (portal supports) are designed and executed specially, per sign they have mounted on and per the basic measures provided for by the traffic design. The number of vertical supports and their height are determined by calculation based on sizes of the relevant sign, but also the sign position in the cross section on the given location, per attached drawing, shall be taken into account, as well as the wind effects on the surface of the relevant sign. They are made of seamless steel pipes of constant section, inter-connected by portable elements into the braced structure. The upper side of the support shall be rain protected, that is closed by plastic cork or welded. Larger-size sign boards shall have adequate reinforcements (stiffener plates) that secure compactness of sign area (sign face). The sign is generally fastened to specially executed support by these elements. The manufacturer shall warrantee wind-resistance of overall structure. The calculation for supports shall be also based on the wind effects in the road zone where in the sign is to be erected.
- c) Braced girders are placed into concrete foundations concrete class 30, either prefabricated or cast in-situ, and secured by staves, or welded to dug-in steel horizontal slabs (footing). The sizes of foundations and steel footings respectively, as well as the dug depth, shall be determined in accordance with the type of structure and wind effects on the given sign location, taking into account the size and number of signs mounted onto support (generally, in accordance with the sign manufacturer norm). Possible extension of vertical supports and their shortening due to the slope of the terrain, or any other reason, shall be stated by the Contractor on the spot and shall ensure that corresponding change of design documentation has been made by the manufacturer of traffic signs.
- d) All structure elements shall be protected against corrosion by machine-applied coat of paint resistant to atmospheric effects in dark gray shade, without additional manual painting, or plasticized also in dark gray shade.

12.4.3 Portal supports

Portal support is specially constructed steel structure frame. Portal support structure shall be separately calculated according to the number and size of boards that are to be mounted on the structure, taking into account the wind effects. Portal support shall be placed on special foundation over anchor footings and sank-in anchor bolts. The foundation shall not sail over shoulder.

Portal supports shall be protected against corrosion by protection coat of artificial resins based paint in dark gray shade or by galvanizing/zinc coating.

The manufacturer shall possess statistic calculation for both portal and foundations, as well as attests for the materials that have been used in execution and placement of portal supports.

All tests shall be completed to the full satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

The price for portal supports shall include their delivery and transportation to the spot of placement, preliminary works on the terrain and execution of foundations, execution and building in of anchors with threads, set for connecting individual elements, placing and leveling, backfilling of holes, shoulder compacting and leveling/planning, as well as quality control of used materials. Calculation and payment of portal supports shall be made per piece of built-in structure on site, including sign mounting onto portal supports subject to the approval of the Engineer.

12.5 Road markings

Pavement markings serve to mark the part of pavement designated for traffic from the opposite directions, traffic lanes or parts of pavement reserved for the traffic of certain categories of motor vehicles, pavement edges, marking the spots on pavement reserved for stopping and parking of motor vehicles respectively on the spots where traffic participants have to observe certain orders and bans.

12.5.1 Longitudinal markings – SRPS U.S4.221 through 224

12.5.1.1 Centre line – SRPS U.S4.222

12.5.1.2 Curb marking, edge line – SRPS U.S4.222

12.5.1.3 Guiding lines – SRPS U.S4.223

12.5.2 Road markings across carriageway - SRPS U.S4.226

12.5.2.1 Sprags/stays and stop beads – SRPS U.S4.226

12.5.3 Other markings – SRPS U.S4.229 through 230

12.5.3.1 Arrows – SRPS U.S4.229

12.5.3.2 Fields for traffic direction – SRPS U.S4.230

12.5.4. Application

- a) Road marking is performed in accordance with the location plans from the design, detailed drawings from the location plans and special detailed typical drawings.
- b) Widths, colors and frequency of breaks are provided for by the drawings in the Design.
- c) The price of works on road markings is calculated per m² of marking executed on the surface and approved by the Engineer. The price shall include measuring on site, cleaning of carriageway and applying.
- d) Road markings shall be tick-layured and marked in white paint. Executed road markings shall have retro-reflection of min. 150mcd/lux/m².
- e) The quality of executed road markings on site shall be verified and confirmed on trial section subject to the approval of the Engineer. If it is found out upon completion of works that there is more than 10% of road marking surface with paint layer thickness less than minimal determined of (>2.0mm), the layer shall be re-applied as directed by the Engineer.
- f) The warranty period for permanent marking shall be two years.
- g) Changing of determined marking forms on carriageway per SRPS norms, like markings' deformations, incorrect execution of marked surfaces or inserting new elements shall not be allowed. Markings which are not in compliance with the determined form shall be permanently removed.
- h) The duration of the time period during which the traffic flow over the carriageway with applied markings shall be banned shall not exceed 45 minutes.
- i) The edges of lines and figures/forms shall be sharp and even and deviation from the designed line shall not exceed 5 mm. Allowed deviation from the measurements provided for by the design shall not exceed 5%. It shall be necessary to have confirmed on the trial section that the Contractor possesses the equipment, which can without any oscillations in operation apply the constant quantity of paint, reflecting beads and other required additives as to ensure continual application of the same quantity of paint regardless to the machine speed.
- j) The warranty period for these works shall be at least 12 months.

12.6 Traffic equipment

The elements of traffic equipment included hereof are

12.6.1 Steel guard rail

12.6.1.1 Continual stretches of steel guard rail

SRPS EN 1317-1, 1317-2, 1317-3

12.6.1.2 End elements of steel guard rail:

- Inclined ends 12 m

- a) The kind and type of steel guard rail shall be determined by the level of holding in accordance with SRPS-EN 1317-1, 1317-2, and 1317-3.
Guard rail types:
 - N2 (W4) (on loop terminals)
 - H1 (W5) (on shoulder)
 - H2 (W8) (on the green area)
 - H2 (W4) (on the structure)
- b) All guard rail elements as well as necessary elements for rail mounting shall be protected by hot galvanizing with 60 microns thick coat.
- c) The guard rail is mounted per location plan from the Design and detailed drawings, all in accordance with SRPS U.S4.110. and subject to the approval of the Engineer.
- d) Guard rail end elements shall both volume and length wise correspond to the technical conditions for guard rail mounting provided for by SRPS U.S4.110.
- e) Before the guard rail is mounted, the Contractor shall prove guard rail quality by attests presented to the Engineer for approval.
- f) The quality of built-in guard rail elements shall correspond to usual quality norms for industrial products. Control tests shall be made at each 1000 m of rail to check the quality of basic materials. The thickness of anti-corrosion layer/coat shall be tested at each 100 m of built-in rail. The elements that fail to correspond to the required quality shall be replaced.

All tests shall be completed to the full satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

- g) The rail price shall be calculated per linear meter of mounted rail as approved by the Engineer.

- h) The price of rail end elements shall be calculated per built-in piece.

Other norms used for steel guard rail are:

SRPS U.S4.100 Guard rails, steel – technical conditions for execution and delivery
SRPS U.S4.108 Guard rails, steel – Form and measures

12.6.2. Reflecting road studs (catadioptrics)

- a) Road reflecting studs are built-in to the rail duct – catadioptrics, which color and spacing is the same as with direction posts. They are installed on site, as to harmonize their frequency with the frequency of direction signs.
- b) Catadioptrics are of regular shape with galvanized sheet metal body, or with body made of plastic or any other resistant material which on reflecting foils (red, yellow and white) are laid, or of honeycomb structure with each cell having reflecting area.
- c) Road reflecting studs – catadioptrics are mounted on guard rail, tunnel walls, retaining walls, on the curb sides and other spots where direction posts could not be placed.
- d) Catadioptrics' features stated in the attest are checked by control tests. Each 1000th sample is checked.

All tests including SRPS Z.S2.235 shall be completed to the full satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

Measurement

The exact quantity of installed material are determined based on the measurement book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications.

Payment

The price includes delivery, transport and placing.

Payment is per placed piece as approved by the Engineer.

12.6.3. Guard posts

- a) The type and kind of guard posts and their supports are determined by the Designer per SRPS Z.S2.235.
- b) Guard posts shall be two-sided (they have markings on both sides which are visible to drivers) regardless whether placed on one-way or two-way lanes. Guard posts shall not be placed on the stretches with guard rails or retaining-lining walls instead catadioptrics are installed. Placement of guard posts in the soil shall be resolved in a manner that facilitates their easy replacement or re-installment, if possible by machine, and the guard post that is placed shall be secured from shearing, turning or pulling out. Guard posts shall be placed in concrete casing, concrete class MB 20, and fixed by crossed steel clips diameter 10 mm. Concrete casings are foundations in the shape of hemmed pyramid 30 cm high, with the side of bottom square of 30 cm, and the side of upper square 20 cm, dug into earth. The shoulder shall be compacted and leveled, after the guard posts have been placed. The guide posts shall allow for mounting of snow rods/boards. Possible deviations in execution from the design shall be separately determined and changes shall be entered into as built drawings subject to the approval of the Engineer.
- c) The quality of built-in elements (retro-reflecting material and support) shall correspond to standard quality norms for industrial products, and the manufacturer may refer to corresponding attestations and other proofs that verify the quality of anticipated element. Guide post support shall be made neither of concrete or metal pipes.
- d) Control checks are made at each 100 pieces of guide posts to check the quality of basic materials (support and retro-reflecting markings) and retro-reflecting markings.
All tests shall be completed to the full satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.
- e) The number of built-in guide posts shall be measured as approved by the Engineer. The payment shall be made per piece of built-in guide posts. The guide post price shall include the support and reflecting road studs, the costs of their delivery and transportation to the spot of placement, as well as the price of material and execution of foundations with adequate excavation, placement of guide posts and prism respectively, digging in and leveling of shoulder.

12.6.4. Direction sign

- is made of painted polyethylene;
- resistant to UV rays and weather-sealed;
- in green or blue color, and may be made at request as the case is in the subject Design where the base is yellow;
- With two retro-reflecting foils class II (High Intensity).

Sizes

Type 1000 - Ø 1.0m and x=1.25m

Type 2000 - Ø 2.0m and x=1.70m

May be both of open and closed type.

The subject design uses closed type of direction sign Type 1000 with yellow background as shown on the location plan of the Design.

Measurement

The exact quantity of installed material are determined based on the measurement book and the construction journal signed by the supervisor in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications.

Payment

The price includes delivery, transport and placing.

Payment is per placed piece as approved by the Engineer.

12.6.5. Plastic rail "NEW JERSEY"

Item description:

Item includes supply and erection of plastic rail "NEW JERSEY", which serves to close the loop legs that are not in function during the first phase of construction.

Technical details:

The rail is made of polyester, size 800x1250x550 mm with an opening for filling and discharging. The colors used are red and white set in turns (red, white). The rails are visible at night because of reflecting strips.

Their location is determined by the Design, and they are filled with water as to disable their easy removal.

Measurement

The exact quantity of installed material are determined based on the measurement book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications.

Payment

The price includes delivery, transport and placing.

Payment is per placed piece as approved by the Engineer.

12.6.6 Concrete rail "NEW JERSEY"

Item description:

The item includes supply and erection of concrete rail "NEW JERSEY" which has function to physically close the loop legs that are not in function.

Technical details:

The rail is made of concrete of adequate class (per regulations). The designed rail is single sided, 80 cm high, 46 cm wide and the length of an element is 6 m. Concrete "NEW JERSEY" shall have the attests required for this type of rail.

Measurement

The exact quantity of installed material are determined based on the measurement book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications.

Payment

The price includes delivery, transport and placing.

Payment is per placed piece as approved by the Engineer.

12.6.7 Linear – delineator with vertical barrier

Item description:

The item includes execution, supply and erection of delineators which serve to divide traffic lanes per traveling directions and direct the traffic and under special circumstances simultaneously facilitating that vehicles ride over them.

Delineators are placed with catadiopres and vertical barriers.

Technical details:

They consist of three segments: Central segments (directional) which connect and tie one another, while at the beginning and at the end end segments are placed (male and female). Catadiopres made of retro-reflecting material are installed on segments. Delineators are made of high density polypropylene (HDPP).

Delineators are yellow. The sizes of central segment are 988x242x80. Delineators have vertical directional barriers at the distance of three meters. Vertical barriers are double-sided in red and white color, size 155x680.

Execution and erection:

Linear - delineator is placed per location plan and detailed drawings from the Design.

Quality control:

The Contractor shall prove delineator quality, prior to its placing, by attest, which is to be presented to the Engineer for approval.

Measurement

The exact quantity of installed material are determined based on the measurement book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications.

Payment

The price includes delivery, transport and placing.

Payment is per placed piece as approved by the Engineer.

12.6.8 Protective Wire Fence

- a) Protective wire fence shall be placed in conformity with layout plans of Design along the right-of-way limits, completely as required by SRPS U.S.4.102/106/112).
- b) Type, shape and measures of the protective wire fence shall meet technical specifications of SRPS U.S.4.112.
- c) Protective wire fence elements shall meet technical requirements of SRPS U.S.4.106.
- d) Protective wire fence shall be protected against corrosion as required by SRPS U.S.4.102. Manufacturer shall guarantee unchanged quality of the wire fence for the period of 20 years (for aluminum fence) or 10 years for the wire fence of galvanized wire,
- e) Contractor shall proof fence quality by test that shall be delivered to Employer before placing
- f) Fence price shall be given by linear meter, where the price shall include supply to location, ground preparation and footings construction, placing, extending and set for connections between elements."

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Section 13 Bridges

Contents

- 13.1. General
- 13.2. Earth Works
- 13.3. Timber Constructions
- 13.4. Concrete Works
- 13.5. Metal Works
- 13.6. Expansion Joints on Structures
- 13.7. Installation of Cast Iron Gullies for Designed Bridge Deck Drainage
- 13.8. Designed Steel Barriers on Bridges
- 13.9. Bridge Bearings
- 13.10. Finishing Works on Bridges

13.1. General

13.1.1. Description

This Section contains the Technical Specifications of works for the following structures:

- Underpasses
- Overpasses
- Bridges
- Viaducts

Because of the scope and significance of concrete works in bridge construction, this work is specified in Section 8.10. STRUCTURAL CONCRETE. For the construction of these structures, the Contractor shall use the final designs provided by the Investor. Solutions (final designs) offered by the Contractor as his suggestion shall be considered as alternative solutions and are subject to the requirements from this Section of the Technical Specifications.

13.1.2. Legislation

Final designs provided by the Investor are aligned with all applicable regulations of the Republic of Serbia. Alternative solutions - final designs - offered by the Contractor, shall also be developed in compliance with applicable legislation of the Republic of Serbia. If legislation of the Republic of Serbia is unavailable for any area, or incomplete in covering any elements, relevant DIN or SIA regulations shall be applied, in conformity with the situation foreseen by the Investor in the preliminary or final designs and subject to the approval of the Investor and the Designer as confirmed by the Engineer.

13.1.3. Quality of Materials and Products

The quality of materials and products shall fully comply with requirements from this Section of Technical Specifications, and if such requirements for certain items of works are not defined specifically, provisions from other Sections of the Technical Specifications shall be applied, if the design covers such works, or otherwise as directed by the Engineer.

13.1.4. Preparation of Design

If the Contractor elaborates Final Designs as alternative solutions, or elaborates Final Designs of related structures that need to be constructed, the Contractor shall elaborate them in compliance with applicable technical regulations, pursuant to Sub-Section 13.1.2. LEGISLATION, to ensure the Investor's approval and a building permit for them. In such case, the Contractor shall undertake all Designer's and Contractor's obligations. Every design shall contain:

- All necessary detailed plans
- Structural analysis
- Structural details
- Priced Bills of Quantities
- Description of Works in line with these technical specifications.

The Priced Bill of Quantities shall include works by their type, i.e.:

- a) Preliminary works
- b) Earth works
- c) Timber structures
- d) Stone works
- e) Concrete works
- f) Metal works
- g) Finishing and other works
- h) Works not covered in the technical specifications for bridges in this section.

In case of any amendments to a design, both those provided by the Investor, and any adopted alternative designs of the Contractor, their adoption shall be decided upon by a commission that shall, mandatorily, be composed of the Designer, Engineer, and Contractor or their representatives. All amendments shall be noted in the Measurement Book and Building Journal in order to be taken into consideration for measurement and payment.

13.2. Earth Works

13.2.1. Excavation for Foundations – General Provisions

Scope and Contents of Works

The works under this item include the excavation of earth/rock material from the ground level to the base of foundation pits, or sub-base or leveling courses, as given in the design, where the edges of a foundation pit are considered to be the edges of foundations on the base plan according to the design. Transport to a dump site or fill (if material is suitable for that) shall be considered a constituent part of the works under this item. The Bill of Quantities shall make distinction by the depth of excavation, namely: 0-2 m, 2-4 m, 4-6 m, 6-8 m, and so on. The Bill of Quantities shall also distinguish by the category of soil, namely:

- Categories III and IV, as one category, and
- Categories V and VI, as another category.

For excavations within sheet pile walls, cofferdams, and caissons, Category II is defined separately when there are conditions for that. For carrying out excavations, the technology indicated in the design shall be applied, which implies a connection between the excavation and the designed foundation structure, and thus the items of excavation works shall be distinguished in the way specified in these Technical Specifications.

Measurement

For the work executed under a certain item of works and above-mentioned provisions, the Contractor shall be paid at the agreed unit price for the number of m³ of excavated original soil, measured from the mean ground level in the area of the foundation base and/or element and subject to the approval of the Engineer. Over-excavated parts by the Contractor's mistake, and caved in parts from the sides of excavation pits shall not be paid. If the Contractor, by his own fault, excavates foundations deeper than the designed level, he shall fill in the space between the excavation base level and the designed level with material specified by the Engineer. For special items of excavation works, appropriate extra requirements are specified.

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Payment

For the quantity of excavated material, determined in the above-described manner, the Contractor shall be paid at the agreed unit price that makes a full compensation for all excavation works, including material and works on the protection and strutting of the foundation pit, water pumping, and haulage of excavated material to a dump site, or to the road embankment, if the excavated material is assessed to be useable for that purpose by the Engineer. For special items of excavation works, appropriate extra requirements are specified.

13.2.2. Excavation of Foundations Out of the Zone of Perennial or Deep Surface Waters**Scope and Contents of Works**

The work under this item refers to the excavation of foundations in those cases when the excavation may be executed in an open pit without using sheet piles, cofferdams, open, box or other caissons. Strutting shall be used to protect the sides of a foundation pit.

Execution of Works

Before the commencement of excavations, the Contractor shall mark and protect the marks of the foundation pit edges in one of the typical ways. The marked foundation pit edges shall be subject to approval by the Engineer, after which the excavation works may start. Depending on the depth of excavation, according to the design and the type of material in which the excavation works are to be done, the Contractor shall select an appropriate way to shore and strut the foundation pit. The excavation works under this item shall also be executed in perennial streams provided that the water depth and influx are not such to require another method of work, i.e. provided that it is possible to make on the surface an adequate provisional protection against the penetration of surface water into the foundation pit. During excavation, water shall be drained with an adequate number of pumps of necessary capacity, as determined by the Contractor based on the influx of water and geological composition of ground. Parallel with the progress of excavation, the shoring and strutting of the foundation pit shall be strengthened. Appropriate machines and tools, including pneumatic hammers, shall be used for excavation. The decision on any blasting of rock mass shall be made before the commencement of excavation based on the types and composition of rock masses as identified in a geotechnical test pit. In case of blasting, it is necessary to prepare the design of blasting operations and protection of foundation pit and surrounding structures and already executed works, which is subject to the Engineer's approval based on the opinion of the designing company. After reaching the designed level, the foundation pit base shall be leveled to be in full compliance with the designed condition. If this is impossible, the excavation shall be somewhat deeper (by 10–30 cm) at critical points, and the obtained extra space down to the foundation base level shall be filled with MB15 concrete. If water is present, concrete shall be cast under water, applying the tremie concreting procedure. If this leveling layer of concrete is not specified in the design, an unlevelled foundation pit base shall not be levelled in this way. The excavation shall be performed so that the highest spot on the pit base is in line with the designed foundation base level, and any extra space will be filled with concrete during the concreting of footings. If a footing is reinforced in its lower part, a levelling course shall be constructed as described above. A levelling course or concrete footings shall be paid extra to the Contractor, as well as the excavation to the actual depth, all this if the foundation pit is deepened below the designed foundation level without the Contractor's fault. During the excavation it is necessary to monitor the change in soil strata, comparing them with the geological profile. In case of any variation from the geological profile given in the design documents, it is necessary to warn the Designer and ask for his opinion on further steps. In case of spatial and technical possibilities, and subject to the Engineer's approval, the Contractor may excavate the foundation pit by omitting shoring and strutting, while applying machines of higher capacity for "sloped" excavation. In that case, the excavation for the lowest parts of strip, multi-angular, or round footings shall be done within the base dimensions, according to the above-given description, and the total scope of digging accepted to the Contractor shall not include over-excavated parts, as stressed above.

Measurement

According to provisions of Sub-Section 13.2.1.

Payment

According to provisions of Sub-Section 13.2.1.

13.2.3. Excavation of Trenches and Channels Less than 1.5 m Wide and Less than 2.0 m Deep**Scope and Contents of Works**

The works under this item consist of the excavation of narrow and relatively shallow trenches and channels, such as the excavation for foundations of end slopes, including the provision of all plants, equipment, and labour, and carrying out all operations related to excavation, any water pumping, protection of the foundation pit from caving in, and haulage to a stockpile.

Execution of Works

The parts of end slopes that are to be lined shall be founded as specified in the design, i.e. trenches shall be excavated there for any other purpose related to the bridge structure. Trenching is foreseen to be done with a trencher, or manually if the ground conditions do not allow the use of machines, which shall be identified by the Contractor based on the perusal of design documents. The Contractor shall identify the need for full or partial strutting of foundation pits. Excavated material shall be hauled to a stockpile.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m³ of excavated material measured on site and approved by the Engineer.

Payment

For the amount determined in the way described above, the Contractor shall be paid at the agreed unit price that makes the full compensation for all work and material, according to the scope of works under this item, including any strutting and water pumping.

13.2.4. Backfilling of Foundations of Piers/Abutments**Scope and Content of Works**

Work under this item includes the backfilling of excavated material into the space left after the excavation and foundation and next to the parts of piers/abutments located in the ground.

Execution of Works

Material from excavation shall be hauled from the stockpile to which it was stored and backfilled into the space above and next to foundations and parts of piers/abutments located in the ground. If needed, material from borrow pits shall be used as well. The material shall be placed in layers about 30 cm thick, and tamped. The degree of compaction shall be adjusted in such a way that



after completed works on backfilling of foundations no subsequent settlement shall occur. In case of foundations constructed under the protection of open or box caissons, the space above them shall be backfilled, too. Where the presence of water makes compaction difficult, such material (rock, gravel) shall be selected that will set down optimally under its own weight and due to the ratios between sizes and shapes, subject to the approval of the Engineer. The finishing layer of compacted material shall be levelled and adjusted to the surrounding terrain. To allow for the possibility of immediate short term settlement, it may be necessary to leave the backfill about 5-10 cm higher, subject to the approval of the Engineer.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m³ of incorporated material as approved by the Engineer.

Payment

For the quantity determined in the way described above, the Contractor shall be paid at the agreed unit price that makes the full compensation for all equipment, material, loading, transport, backfilling, and compaction of earth material. If borrow pits are used, the excavation from borrow pits shall be paid extra.

13.2.5 Construction of Gravel Wedge

Scope and Content of Works

Gravel wedges shall be constructed on the rear side of bridge abutments, between wing walls, under transition slabs, in order to eliminate or reduce, to an acceptable degree, the deformations of the deck at the contact with the structure, resulting from settlements during the consolidation of subsoil and embankments. Wedges shall be constructed at the same time as approach embankments, after abutments have been constructed. There are two possible cases:

- The spanning structure is constructed. In this case there are no limitations regarding the construction of wedges.
- The spanning structure is not constructed. It is necessary to determine, in consultations with the Engineer and by perusing documents, whether abutments are calculated for such load phase.

Execution of Works

Soil embankments shall be finished at the contact with abutments, according to details from the design, and the construction of wedges shall be started afterwards. In the direction of the road (bridge) centre line, the cross section through a wedge is trapezoidal, and the trapezoid side at the end of transition slab, toward the embankment, shall be at least 50 cm high, unless a greater height is specified in the design. Material used for wedges, by its properties and granulometric composition, shall meet the requirements for sub-base courses, i.e. sub-base layers in flexible pavements. Material shall be spread in layers, up to 50 cm thick, and tamped with suitable mechanical devices until the required degree of compaction is achieved. The compaction of every layer is controlled applying a procedure specified for sub-base courses. The following degrees of compaction are required:

- Top layer: 70 MPa,
- Each next layer downward: reduced by 10 MPa.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m³ of constructed gravel wedges in compliance with the description above, and as approved by the Engineer.

Payment

For the quantity determined in the above-described way, the Contractor shall be paid at the agreed unit price that makes a full compensation for all equipment, material, and production, transport, placement and compaction of wedges made of gravel-sand material.

13.3 Timber Constructions

13.3.1 Scaffolds and Formwork

Scope and Content of Works

Work under this Sub-Section of the Technical Specifications includes the provision of all plants, equipment, materials, and labour, and execution of all operations related to fabrication, necessary foundations, erection, and removal of scaffolds and formwork needed for the execution of concrete works, and for other auxiliary works on concrete constructions in conformity with the Conditions of Contract, and in full compliance with this Sub-Section of the Technical Specifications, drawings, and Engineer's instructions.

Technical Regulations

PBAB 87	"Rules on technical norms for plain and reinforced concrete" (Off. Journal of SFRY, No. 11/87)
PPB	"Rules on technical measures and specifications for pre-stressed concrete" (Off. Journal of SFRY, No. 51/71)
SRPS U C9.400	Timber scaffolds and formwork. Technical Specifications (1984)

Scaffolds and formwork made of different materials (steel and timber, concrete and timber, etc.) shall be designed and erected according to the provisions of SRPS U C9.400, and applicable regulations for the areas of applied materials and constructions.

Scaffolds and Formwork Plans

Based on data and specifications from the structural design, and on data on foundations of the structure, and in view of traffic requirements and the surveyed condition, the Contractor shall prepare necessary documents for scaffolds and their supports, and for special formwork he intends to use. The documents, prepared according to provisions of relevant standards, shall be submitted to the Engineer for approval, but the Engineer's approval shall not relieve the Contractor from any inappropriate, yet adopted, solutions. When scaffolds are erected for parts of constructions above roads in a regular traffic regime, frames shall be erected above the road, on both sides, at appropriate distance from the scaffolds, to provide for the headway. The frames shall be constructed with the headway somewhat smaller than the one under the scaffolds. All traffic control signs and protections shall be put in place by the Contractor, at his own expense, in accordance with requirements of a competent authority whom the Contractor shall also ask for approval for traffic regime changes.

Erection of Scaffolds and Formwork

Scaffolds and formwork shall be designed and erected in such a way that they can withstand loads and impacts that occur during the works without harmful settlements and deformations, and ensure the accuracy specified in the design.

Scaffolds

Scaffolds shall be erected in such a way to ensure designed gradients of constructions shown on drawing, taking care of any necessary superelevation given in the design, or required by the Engineer, contractions, deflections of spanning elements of the scaffolds, squeezed material, and sinking of scaffolding trestles. The sinking of scaffolds shall be monitored and measured during concreting. It is necessary to take measures to ensure the correction of any unexpected settlements. Concreting may start upon the Engineer's approval, but only after the acceptance of scaffolding structures by a commission, specifically established by the Contractor, in charge of checking dimensions of erected elements, quality of workmanship, and implemented safety-at-work measures.

Formwork

Formwork for concrete elements or parts of the structure shall ensure that the shape and dimensions of elements given on drawings are kept within the limits of allowed tolerances. Formwork shall be erected of materials and in a way depending on requirements set out in the design, Serbian standards, and provisions of these Technical Specifications. The formwork construction shall be such that formwork may be removed without damaging concrete once concrete hardens. All supports and beams used to support formwork shall be particularly rigid, and their constructions shall be specified based on deflections values that shall not exceed 1/1000 of the span under full load. Formwork shall be as watertight as possible, and shall be moistened thoroughly on both sides before concreting. Only agents that do neither cause any change in the appearance and color of concrete, nor act aggressively on fresh or hardened concrete and reinforcing steel may be used to coat formwork and moulds. Unless otherwise specified in the design, corner fillets, triangular cross-section, 2 cm long legs, shall be placed along corner sides of formwork, to protect the edges of concrete elements against damage during the removal of formwork. Wires used to tie up formwork shall be inserted through plastic tubes, and their arrangement on visible surfaces shall be regular.

- **Formwork for Foundations and Inner Surfaces:**

For formwork for foundations, cushions, inner surfaces of concrete elements and the parts of constructions that are in contact with the ground, there shall be no special requirements regarding the selection of formwork type, and/or material, except for compliance with minimum requirements set out in these Technical Specifications.

- **Formwork for Visible Surfaces:**

Formwork for outer, visible surfaces of concrete elements: central piers and abutments, bearing beams and caps, spanning structures, and parts of structures, unless specifically indicated on drawings, shall be smooth with discreet joints.

- **Metal formwork:**

Formwork requirements: for construction, evenness, stiffening, direction, angle finish, removal, reuse, lubrication, and cleaning, they shall also apply for metal formwork, i.e. moulds. Metal used for formwork shall be of such thickness that formworks retain their shape. Connectors and other connecting accessories shall be designed so as to connect formwork firmly, and to ensure its removal without damaging concrete. Special attention shall be paid to protect metal formwork against rust, grease, or other external substances that could change the color of concrete.

- **Cleaning the inside of formwork:**

Where the base of formwork is inaccessible from the inside, the base panels of formwork shall be left free, so as to be removable for cleaning any undesired material immediately before placing concrete.

- **Acceptance of formwork:**

Before the commencement of concreting every element, based on a previously performed geodetic control survey and geometric control of the element to be concreted, the Engineer shall inspect, and note in a protocol, whether the erected formwork is satisfactory regarding:

- Horizontal position of elements and their vertical levels,
- Dimensions of elements as given in the design
- Fixing and tying up of formwork
- Cleanliness of formwork.

Removal of Scaffolds and Formwork

Scaffolding under the span structures, as well as parts of the structures, may be removed only after concrete class specified by the Design is achieved, not earlier than 28 days from the day of concreting. The exact time of release and removal of scaffolding shall be determined by the Engineer, and it will depend on concrete curing and average temperature on the Site, as well as on the results of test cubes taken during concreting and cured under the same conditions as the structure in the place where they were taken.

A precise number of days and permission for the release of scaffolds shall be defined by the Engineer, which will depend on the curing of concrete, the average temperature on the site after the placement of concrete, and on the results of tests performed on test cubes taken during concreting and cured under the same conditions as the structure at the place of extraction. For pre-stressed structures, notes given on drawings shall apply. Scaffolds under all spans shall be completely released, before parapets, railings, and road surfacing are placed. Formwork of concrete elements shall be removed in phases, without shocks and impacts, when concrete is of sufficient hardness. Unless otherwise specified in the structural design, the provisions of Art. 246 PBAB shall be applicable during the removal of formwork. All formwork shall be removed, whether above or under ground or water level. The inner formworks of hollow piers, girders, and other elements shall be removed if made of material susceptible to decay, or if they could have a harmful impact on the structure in any way.

Payment

The works covered in this Sub-Section of the Technical Specifications in the described scope shall be included in the price offered in the Priced Bill of Quantities for different items for payment that refer to concrete works. No extra compensation shall be paid.

13.4. Concrete Works

13.4.1. Plain Concrete

13.4.1.1. Concreting of Foundations of End Slopes – Foundations of Lining of Straight and Rounded Soil Surfaces

Scope and Content of Works

This item includes the construction of parts of foundations with plain concrete. The grade and class of concrete shall be specified in the Design.

Concrete Requirements

The requirements to be met for concrete for foundations are given in Section 8. CONCRETE and Sub-Section 8.10. STRUCTURAL CONCRETE in these Technical Specifications.

Execution of Works

Concreting may start after the excavation and preparation of foundation pits. The method of production, transport, and placement is set out in Section 8. CONCRETE. Concrete shall be placed in layers, 20-30 cm thick, and compacted. Before the commencement of concreting, the Contractor shall present the equipment for placement and compaction of concrete to the Engineer, and try it out in the Engineer's presence. The Contractor shall have at least one back-up vibrator for compaction of concrete at his disposal. The diameter of "needle" and frequency of the vibrator shall be adjusted to the thickness of compacted layer and W/C ratio of fresh concrete mass. The height to which foundations will be concreted with plain concrete shall be marked in advance on the struts of foundation pit. Concrete shall be cured in compliance with Section 8. CONCRETE of these Technical Specifications.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m³ of concrete cast into foundations in full compliance with the Specification given above, and as approved by the Engineer.

Payment

For the quantity determined in the described way, the Contractor shall be paid at the agreed unit price that makes a full compensation for all used equipment, material, and work on the production, transport, placement, and curing of concrete in foundations.

13.4.1.2. Lining of End Slopes – Lining of Straight and Rounded Soil Surfaces

Scope and Contents of Works

The work under this item includes the lining of end slopes or of 'let-through' embankments, which means provision of the plant, equipment, materials, and labour, to carry out all operations needed for the production, preparation of surface, and placement of a gravel layer on which the lining is placed.

Material

Concrete slabs of designed size shall be used for lining.

Concrete grade and class for precast concrete or "B-T" slabs will be specified in the design documents, while everything else shall be subject to provisions in Sub-Section 8.10. STRUCTURAL CONCRETE.

Execution of Works

The lining thickness and type will be specified in the design documents. The face to be lined shall have designed shape and slope. The space to be filled with lining shall be left earlier, at the time of backfilling. The surface shall be well compacted and even. The compaction degree shall equal 95% in standard Proctor's test and if the fill is made of uncohesive materials, the modulus of compressibility shall be MS=25-30 MPa. First a gravel bed, 10 cm thick, shall be spread over earlier prepared subsoil. Gravel shall be clean without organic matter and comply with the technical specifications for sub-base course.

Then concrete slabs shall be placed on top of the bed provided always that this building operation shall start at the end slope footing. Slabs shall be aligned with joints of minimum width except the "B-T" slabs on less inclined slopes and on slopes on which grass will be sown. Joints between concrete slabs shall be filled with 1:3 cement mortar mix. They shall first be wetted and the placed mortar mix shall also be intensely wetted and protected from moisture loss during setting.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m² of completely finished lining based on measurement approved by the Engineer on the site.

Payment

For the quantity determined as described above, the Contractor shall be paid at the agreed unit price that makes a full compensation for all used equipment, incorporated material, and all work on the fabrication, transport, and placement of the lining elements, including the bed and joints.

13.4.2. Piles and Sheet Piling

13.4.2.1. Large Diameter Concrete Piles Cast in Situ

Scope and Contents of Works

The works covered in this Sub-Section of the Technical Specifications include the procurement of all materials, plants, equipment, and labour, and in the execution of all operations related to the construction of concrete piles of a large diameter, in dry or in water, in conformity with the Conditions of Contract and in full compliance with this Sub-Section of the Technical Specifications and pertaining drawings.

Pile Construction Method

The Design foresees concrete piles, 900 - 1500 mm in diameter, just as indicated on respective drawings, which are to be constructed in soil, including digging through casings in full height. The diameters of piles are defined with the outer diameter of casing, and any enlargement of piles during the placement of concrete shall not be taken into consideration for the measurement or

increase of allowed bearing capacity of piles. The Contractor shall provide complete details on the pile driving system he intends to apply, including the specification of materials and pile construction method. Considering the importance of the construction of larger diameter piles, an engineer specialized for this work, appointed by the Contractor, shall be present on the site throughout the execution of these operations. If the Contractor wishes to construct piles the diameter of which is different than the diameter shown on drawings, he shall submit detailed plans and calculations for approval by the Designer and the Engineer. If the approval is issued for the construction and use of piles of a diameter that requires the extension of foundations, the costs of such extensions shall be borne only by the Contractor.

Equipment

Equipment that the Contractor wishes to use shall be in full compliance with the adopted pile construction system. It shall provide the best possible guarantee for precision in the construction of piles, with a minimum disturbance of adjacent soil, as well as continuity of piles and quality of concrete. The casing for work shall be completely straight. Any extension shall be welded to be watertight.

Materials

Concrete, cement, aggregate, water, and admixtures shall be in conformity with Sub-Section 8. CONCRETE of these Technical Specifications and with notes given in the Design. The content of cement shall not be less than 400 kg/m³ of concrete, when concreting under water. The consistency shall be such that concrete runs uniformly out of the tremie, and the end of it shall be under the concrete surface at all times.

Reinforcing steel shall be in compliance with Sub-Section 13.5.1 of these Technical Specifications and with notes and details given in the Design. A reinforcing cage is lowered in a proper position before concreting. The specified protective concrete cover for reinforcing steel shall be ensured. It is also necessary to prepare several additional bars, which project sufficiently above the water level from within the casing, in order to easily monitor the reinforcing cage during concreting.

Excavation

During the excavation and driving of the casing, it is forbidden to disturb the adjacent soil or to cause a hydraulic caving in of soil at the base of borehole. The casing shall be filled with water at all times, to the level higher than the level of ground or water on the outside, if so required by the geotechnical conditions. When digging with a clamshell bucket, it is necessary to ensure that the digging does not cause a suction effect on the bottom side, when the clamshell bucket goes up. It is not allowed to lower the casing with the assistance of water jet. The base of casing shall always be lower than the base of borehole. The base of finished boreholes shall be clean and with a horizontal surface. After cleaning the base of borehole, the Contractor shall perform at least two standard penetration tests in each borehole. The testing equipment and method shall be subject to approval by the Engineer, and the test shall be performed in his presence. If piles are constructed for retaining structures, the test is not necessary. Based on the results of standard penetration tests, the Engineer shall accept the borehole or decide that it shall be lowered to a greater depth, if needed. In the latter case, the cleaning and testing shall be repeated for the new depth of base. When the Engineer agrees that the base of borehole is at the level where the bearing capacity of soil is sufficient, and that the cleaning was performed properly, he shall accept the borehole with a written note. This approval shall not relieve the Contractor from any of his responsibilities.

Concreting

Concreting shall start as soon as possible after the acceptance of excavations and assembly of reinforcing cages. If concreting fails to start within four hours from the cleaning of the borehole base, the cleaning shall be repeated. Piles shall be concreted without any construction joints. Concreting under water shall be performed applying the tremie concreting method, in full compliance with Sub-Section 8.10.4.5 of these Technical Specifications. The level of water within the casing shall be maintained at a constant height, sufficiently above the level of ground and water outside the casing. During concreting, the casing shall be retrieved slowly, without lifting the reinforcement. The surface of concrete within the casing shall be kept at all times at a sufficient height above the casing base, so as not to reduce the diameter of pile or cause the penetration of water. When determining at what distance the concrete surface shall be kept above the casing base, it is necessary to take care that the quantity of concrete below the casing base is larger than that within the casing.

Only the Contractor shall be responsible for concreting, until the surface of placed concrete is high enough above a theoretical point of stopping, as indicated on drawings, in order to ensure that all concrete below the stopping level shall reach a specified quality. Once the foundation pit is excavated, and the concrete sub-base constructed, piles shall be finished up to the theoretical stopping level. Reinforcing bars shall not be damaged. In case of broken, fractured, or irregularly positioned piles, additional piles shall be installed at the Contractor's expense, and the Contractor shall also bear expenses for special constructions needed for the new situation. Before the construction of piles starts, the Contractor shall ensure to have on the site both the equipment and qualified personnel for pile boring in full length. The boring of cores will be necessary when concrete or irregularities that appear during the works indicate that the quality of piles varies from the specified standard. The Engineer shall decide whether and when the core boring shall be performed, and the testing of cores shall be carried out in compliance with the Engineer's instructions. The Engineer shall approve each pile in writing. Such continuation of works, on any foundation, shall not start until all piles are approved on preliminary foundations.

Tolerances

During boring, the Contractor shall check the position and incline of piles and submit the records for the approval of the Engineer. The position of pile head shall not exceed 5% of the pile diameter, and not more than 5 cm comparing to drawings. The pile incline shall not exceed 1% in the length under the ground surface.

Work Log

During the construction of piles, for every borehole the following shall be noted in the protocol: the type of soil for every stratum, observations related to the occurrence or loss of water in the borehole, and obstacles found. The Contractor shall keep and safeguard complete records on the construction of every pile, and submit them to the Engineer for approval. These records shall be handed over to the Investor at the technical acceptance of the structure. These records should show: the starting and end times for works on the pile, the base level of pipe, the level of reinforcement, and water table, if water is present, the start and end of concreting, the quantity of placed concrete, and during the extraction of pipe - the height of concrete within the pipe before and after every lifting step.

Trial Loading of Piles

Trial loading shall be performed in compliance with the "Rules on technical norms for the design and execution of works on the foundation of civil structures", "Off. Journal of SFRY" No. 34/74 and the Engineer's instructions, on every pile specifically

prepared for trial loading. A trial pile shall be constructed in the completely same way as piles for respective structures, in the place specified by the Contractor and approved by the Engineer. Equipment shall ensure 900 t load for piles of diameter 1200 mm, and 1300 t load for piles of diameter 1500 mm, unless otherwise specified by the Engineer. The Contractor shall perform trial boring in the immediate vicinity of the trial pile, and the properties of soil shall be determined in the laboratory. The trial load testing procedure and testing programme shall be prepared by the Contractor and submitted for approval by the Engineer, with the testing programme covering the data on load with respect to time, i.e. offer data on long-term behaviour and necessary measures.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m^1 of constructed piles, depending on the pile diameter, and as approved by the Engineer. Any extra concrete at the pile base, increase in the diameter of pile, or extra concrete in the pile head shall not be measured and will be considered as included in the item of pile concreting works according to the Priced Bill of Quantities.

Payment

For the quantity determined in the described way, the Contractor shall be paid at the agreed unit price that will make a full compensation for the procurement of all materials, plants, equipment, and labour needed for the execution of all operations in dry or in water regarding the construction of concrete piles according to the provisions of this Sub-Section of the Technical Specifications. Testing of piles for their load-bearing capacity shall be paid on a lump sum basis, in accordance with the appropriate BoQ item, and that payment shall make a full compensation for all equipment, materials, labour, and all other auxiliary operations.

13.4.3. Reinforced Concrete Constructions

13.4.3.1. Pad Foundations, Ground Beams, Foundation Plates, Cushions, and Pile Caps

Scope and Content of Works

The work under this item consists of the construction of reinforced-concrete foundations, or their parts, with or without formwork, if specified so in the Design.

Concrete Requirements

Requirements that concrete shall meet are given in Section 8. CONCRETE and Sub-Section 8.10 STRUCTURAL CONCRETE of these Technical Specifications.

After finishing the works that precede the construction of foundation parts according to this item in the Technical Specifications, formwork and reinforcement shall be assembled according to the Design.

Formwork

Formwork shall meet the requirements from Sub-Section 13.3.1. SCAFFOLDS AND FORMWORK, and provisions of this Sub-Section. Formwork for all structural elements shall be assembled in entirety or partially after or during the assembling of reinforcement. Formwork is usually prepared in segments (plates, fields) of smaller or larger length (surface area), and thus assembled in the foundation pit. The Contractor may prepare formwork in the pit itself. When placing formwork it is necessary to perform marking – aligning, so that, after the removal of formwork, the constructed part of foundation is in full compliance with the design regarding the position, shape, horizontal and vertical dimensions, and height levels of the top surface. If protective and release agents are used, they shall be applied to the formwork before placing reinforcement, in order to avoid any contamination of reinforcement with such agents, and formwork may be assembled only when it absorbed completely the applied chemical agent. It is necessary to leave openings for the pre-concreting removal of waste from the space enclosed with formwork at suitable places in the base of formwork.

Formwork shall be sealed well, to minimize any leakage of concrete or cement slurry. Formwork shall be fixed, in order to avoid its displacement, disintegration, deformation, or break of connections. Before the commencement of concreting, formwork shall be wet down, regardless whether it is pre-treated with release agents or not. The class – grade of formwork may be lower regarding the evenness of concrete surface to be obtained after the removal of formwork, but not regarding its rigidity, strength, and ability to withstand the pressure of fresh concrete mass and impact of vibrations during the placement of concrete without any deformations.

Reinforcing steel

Reinforcing steel shall meet the requirements from Sub-Section 13.5.1. REINFORCING STEEL, of these Technical Specifications, and this Sub-Section. The shape and dimensions of bars shall be in conformity with the Design, which shall be submitted for approval by the Engineer at the time of inspection for acceptance of reinforcing steel.

If the lengths of prepared reinforcing steel are in conformity with the Design, but the dimensions of formwork do not allow the placement with a proper protective cover, whereas the formwork, too, is in conformity with the Design, the Engineer shall instruct the extension of formwork in order to enable the application of specified protective covers. In that case, any extra costs of work and consumed materials, including concrete, shall be accepted to the Contractor according to the actual expenses and at agreed unit prices. However, if the lengths of reinforcing steel are not in conformity with the Design (and bars are longer than necessary), or formwork is of smaller dimensions than specified in the Design, required protective covers will be ensured as in the previous case, but at the Contractor's expense. The option with an insufficient protective concrete cover is not allowed. To avoid any above-mentioned inconveniences that would lead to the dismantling of formwork, the Engineer shall instruct a trial assembly of the typical reinforcing elements, and carefully measure lengths, heights, and shapes of bars before setting up formwork. Firmly tied reinforcing steel in a designed cage shall be checked by the Engineer. To avoid any subsequent strengthening of ties at the contact between bars, the Engineer shall timely check the steel fixers' method of work and instruct the elimination of defects, if needed. Designed protective covers shall be achieved by inserting plastic spacers (clips) or previously prepared concrete spacers. Pieces of reinforcing steel or wood, or aggregate grains, may not be used for this purpose and their use is strictly forbidden.

Concreting

Before the commencement of concreting of the void within formwork, formwork shall be cleaned from all scrap pieces of wood, wire, steel, or any other foreign objects, using water under pressure and compressed air. These pieces of waste shall be evacuated through openings left in formwork, and the openings shall be sealed after that. Before the concreting starts, it is necessary to check, by geodetic surveying, the position of anchor bolts in piers/abutments, which project out of foundation elements that are subject to this item of works, and to secure them against movement during concreting. The method of production, transport, and placement of concrete is specified in Section 8. CONCRETE of these Technical Specifications.

Section 13: Bridges

The measures to prevent segregation shall be taken during the placement of concrete. It is necessary to mark the height to which concreting will be performed on formwork. The definite level of concrete shall be in compliance with the designed level. Tolerances up to 1 cm are allowed, and they shall be made up on the pier/abutment. The removal of formwork shall be in accordance with Section 8. CONCRETE of these Technical Specifications and 1987 PBAB ("Off. Journal of SFRY" No. 11/87).

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m³ of concrete according to the design, except in cases when the quantity is increased to make a protective cover of specified thickness, or due to an error in the design, in which cases the actual quantity shall be paid as determined and approved by the Engineer.

Payment

For the quantity determined in the above-described way, the Contractor shall be paid at the agreed unit price that makes a full compensation for all equipment, formwork, concrete, and work on the production, transport, placement, and curing of concrete, including the removal of formwork. For any extra quantities due to an error in the Design, the Contractor shall be paid according to the actual expenses for:

- Formwork
- Any work on dismantling scaffolds or formwork, and re-assembling, at the agreed unit price,
- Concrete, as specified in the paragraph above,
- Reinforcing steel shall be paid extra.

13.4 3.2. Piers/Abutments as Supports for Various Types of Straight Spanning Structures and Supports for an Arched Structure

Scope and Contents of Works

The work under this item includes the construction of reinforced concrete piers/abutments together with such members as wing walls, parapets, cantilevers for transition slabs, covers, and bearing beams of abutments, pile caps with cantilevers on central piers. These members will be grouped in the Bill of Quantities as follows:

- Bodies of abutments
- Face walls
- Counterfort walls
- Wing walls at abutments
- Bearing beams
- Parapets
- Cantilevers
- Transition slabs
- Face covers on abutments and central piers
- Bodies of central piers of designed cross section
- Pile caps on central piers as designed.

The members will be distinguished by concrete grade and class indicated in the Bill of Quantities.

Concrete Requirements

The requirements to be met by concrete are given in Section 8. CONCRETE and Sub-Section 8.10. STRUCTURAL CONCRETE of these Technical Specifications and design documents.

Scaffolds and Formwork

Depending on the element of pier/abutment in question, there are different requirements regarding formwork, scaffolds, and dimensions of elements. Furthermore, the work technologies to be applied differ as well, particularly when speaking of vertical elements.

Scaffolds

Scaffolds and formwork shall meet the requirements set out in Sub-Section 13.3.1. SCAFFOLDS AND FORMWORK, and provision of this Sub-Section. Two types of scaffolds are distinguished: fixed and mobile. Fixed scaffolds are those that do not move after erection until the concrete hardening process has finished, i.e. until the time when they are allowed to be removed. Mobile scaffolds are related to the concept of sliding formwork. In both cases, scaffolds design for piers/abutments shall be prepared by the Contractor, unless the Design provides a solution for scaffolds. If the Contractor is to prepare the scaffolds design, it shall be submitted for approval by the Designer and the Engineer.

a) Fixed scaffolds

They shall be erected as working scaffolds and falsework for all parts where the weight of concrete is transferred over already concreted parts (bodies of vertical piers/abutments). They shall be erected as load-bearing scaffolds for all parts where the weight of fresh concrete is received directly onto scaffolds (pile caps, wing walls, etc.), and it is thus necessary to ensure the transfer to the ground of not only the weight of scaffolds, but also the weight received from concrete. For load-bearing scaffolds it is necessary to ensure temporary footings, adequate by dimensions and depth of foundation to the load, or piles under the posts of scaffolds, depending on the location of a post and load-bearing capacity of soil.

Appropriate supports shall be implemented for non-bearing scaffolds, too, since they give the stability and support for dead weight, work load, and any lateral forces to the scaffolds.

b) Mobile Scaffolds

This is a system of a working platform for which a special design is prepared. Dead weight and working load are transferred on already constructed parts of a pier/abutment. It is often accompanied with working scaffolds, usually tubular, that enables the access to the working platform at different heights.

The working platform is subject to the requirements of load-bearing capacity and stability, just as every other temporary construction. The working platform design with the sliding technology shall be submitted for approval by the Engineer.

Working scaffolds shall meet appropriate requirements given under a) above, related to scaffolds that are non-bearing in terms of this description.

Without a written approval for erected scaffolds given by the Engineer and recorded through the Building Journal, scaffolds shall not be used.

Formwork

Formwork solutions may be different. However, since this is about visible surfaces, all formwork shall be erected in such way that after its removal the concrete surface is left without any residues from the material it is made of, and traces of any fastenings (wire and similar). The requirement is to obtain a flat concrete surface that is in compliance with the design in every way evenness, uniform texture of concrete, and uniform appearance. The strength of formwork shall be ensured with appropriate stiffeners. Timber shuttering implies vertically placed boards, made of softwood, Class II, on all visible surfaces. The points of extension shall be selected so that all boards are neither joined together at the same level, nor staggered too much by height. Unstable knots shall be driven out, and the resulting holes firmly sealed with wedges made of softwood that will be cut flush on the concrete facing side. Horizontal and inclined shutters (the soffit of cantilevers of the pile caps on central piers) shall be placed in the direction of the centreline of a pier, i.e. the centreline of a wing for the shutters for wings. All other boards for visible surfaces shall be vertical, unless the overall height of an element exceeds 50 cm, provided that horizontal boards do not disturb the general appearance of the concrete surface in such case either. Timber shutters may be reused several times, if it is identified as suitable for further use after the removal and cleaning, which is to be subject to approval by the Engineer. Boards that are not suitable for visible surfaces may be used for those surfaces that are not exposed to view, provided that they are of appropriate bearing capacity. Shutters made of engineered wood boards, i.e. treated wood, may also be used without limitations on surfaces not exposed to view. For visible surfaces, it is necessary to prepare a board arrangement schedule that shall be subject to approval by the Engineer.

Reinforcing Steel

Provisions of Sub-Section 13.5.1 REINFORCING STEEL shall apply.

Execution of Works

The works shall be executed in full compliance with provisions of Sub-Section 8.10.4 EXECUTION OF CONCRETE WORKS.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m³ of concrete according to the design of piers/abutments, and/or their elements, and as approved by the Engineer. The quantity shall be determined separately for each part of a pier/abutment according to the Priced Bill of Quantities, as given with "Scope and Content of Works" for this Sub-Section of the Technical Specifications.

Payment

For quantities determined in the above-described way, the Contractor shall be paid at the agreed unit prices for each separate pier/abutment element in the Priced Bill of Quantities. The unit prices shall make a full compensation for full equipment, scaffolds, and formwork, placed concrete, and all work on the erection and removal of scaffolds and formwork, and on the production, transport, placement, and curing of concrete. Reinforcing steel shall be paid extra.

13.4.3.3. Reinforced-Concrete Spanning Structure

Scope and Content of Works

The work under this item includes the construction of all structural elements of the reinforced-concrete superstructure of the bridge, which also implies the provision of all plants, equipment, material, and labour, and the execution of all operations related to the production, transport, placement, and curing of placed concrete, as well as all works and materials for the erection and removal of scaffolds and formwork. Parts of the spanning structure covered with this item of works may be distinguished in the following types:

- Main girders of the bridge, made of reinforced-concrete
- Cross girders of the bridge, made of reinforced-concrete
- Bridge deck (upper deck with cantilevers and beams and/or lower deck), made of reinforced-concrete
- Main plate girder, made of reinforced concrete
- Cross girders, made of reinforced concrete, to link main girders made of pre-stressed concrete
- Bridge deck made of reinforced concrete over pre-fabricated girders

Parts of the spanning structure are divided in the Bill of Quantities according to the grade and class of concrete, as well, if such differences are foreseen in the Design.

Concrete Requirements

Requirements that concrete shall meet are given in Section 8. CONCRETE and Sub-Section 8.10. STRUCTURAL CONCRETE of these Technical Specifications.

Scaffolds and Formwork

Requirements for scaffolds and concrete are given in Sub-Section 13.3.1 SCAFFOLDS AND FORMWORK of these Technical Specifications, and in Sub-Section 13.4.3.2. in the part covering scaffolds and formwork. Scaffolds shall be designed for the entire load from main and cross girders and slab.

Reinforcing Steel

Provisions of Sub-Section 13.5.1. REINFORCING STEEL shall be observed in entirety.

Execution of Works

The works shall be executed entirely in compliance with provisions of Sub-Section 8.10.4. EXECUTION OF CONCRETE WORKS, with a particularly accentuated need for the preparation of and compliance with the concreting plan. Any interruptions and stages in concreting are given in the Design, and no changes in these requirements from the Design shall be allowed without the Engineer's approval. The Engineer shall not give his approval for any changes that may cause unfavourable consequences in the form of fissures and cracks, or the appearance of additional static impacts in the system due to changes in contraction and creeping values with respect to the Design.

The following is specifically pointed out:

- Main and cross girders shall be concreted at the same time, always from the lower edge of bridge deck, i.e. lower edge of cantilever. The bridge deck shall not be concreted at the same time, but only after concrete in girders has passed through the initial setting period.

- In principle, scaffolds shall be loaded symmetrically in each span, which is given in the concreting plan, and in case of its absence, this principle shall be observed by the Contractor.
- The bridge deck and cantilever surfaces shall be finished according to the design in terms of evenness, gradients and cross falls, which shall be checked with a 3 m long metal straight edge. Any variation from the straight edge shall not exceed 5 mm. The evenness checking procedure with a straight edge is performed by moving the straight edge by a half of its length with respect to its previous position. The measurement of evenness shall be carried out in at least two orthogonal directions. If there is a variation in excess of 5 mm, minor repairs shall be performed by moving the straight edge over fresh concrete, and major repairs by removing, or adding, material with appropriate compaction, all subject to the approval of the Engineer.
- The control of evenness and repairs shall be performed on fresh concrete.
- The surface of concrete shall be roughened while concrete is fresh in a proper way, so that after the work is over, the surface remains rough, after which it shall be protected against a rapid loss of water, i.e. against damage induced by precipitation (rain shower, hail, etc.) until sufficient strength is achieved.
- In places where gullies are to be installed, it is necessary to leave openings.
- In the zones foreseen for the installation of expansion joints, concreting shall be properly ended, having in mind dimensions, i.e. quantity of concrete to be cast when installing expansion joints shall be sufficient to perform a good bond.
- When dealing with the construction of reinforced-concrete slabs over precast main girders, everything specified above is of importance. In that case, special attention shall be paid to the cleanliness of anchor bolts for the bond between the precast girders and the subsequently concreted slab.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m³ of concrete according to the design of spanning constructions, and/or their elements, as approved by the Engineer. The quantity is determined separately for every part according to the Bill of Quantities.

Payment

For quantities determined in the above-described way, the Contractor shall be paid at the agreed unit prices for each separate element of the bridge spanning structure in the Priced Bill of Quantities. The unit prices shall make a full compensation for all equipment, scaffolds, and formwork, placed concrete, and all work on the erection and removal of scaffolds and formwork, and on the production, transport, placement, and curing of concrete. Reinforcing steel shall be paid extra.

13.4.3.4. Precast Cornices or Parapets on Cantilevers Supporting Pedestrian Walkways

Volume and Content of Work

The work under this item includes the casting, transport, and fixing of designed cornices which means the provision of all plants, equipment, materials, and labour to carry out all operations needed for the casting, transport, and fixing of cornices. The shapes and dimensions of cornices, and the grade and class of concrete shall be specified in the Design.

Casting Requirements

Precast cornices shall be of reinforced concrete according to Section 8 CONCRETE and Sub-Section 8.10. STRUCTURAL CONCRETE.

As a rule, precasting, fixing and edge rounding tolerances shall be considered in the Design. If this is not the case the Contractor shall make a formwork proposal that will ensure:

- Sufficient tolerances for cornice fixing,
- Easing of sharp edges,
- Proper positions of reinforcing steel and size of protective cover, which implies a minimum thickness of cornice of 8 cm.

The grade and class of concrete shall be defined in the Design. Regardless of this fact, cornices shall be precast of concrete having the characteristics in compliance with the following standards:

- MB 45 (SRPS U.M1.020)
- V-8 (SRPS U.M1.015)
- M-150 (SRPS U.M1.016, SRPS U.M1.055.)
- Frost and salt resistance (SRPS U.M1.055)

If the design specifications are stricter than the above standards, then they shall be complied with to the full satisfaction of the Engineer.

The Engineer shall consider for approval the Contractor's proposal of dimensions and tolerances, the method of sharp edges casing, and require the compliance with the requirements contained in the standards listed above.

Execution of Works – Fixing

Precast cornices will ensure the final lateral appearance of the bridge. For this reason when put in position they shall fully create the aesthetic effect required by Design.

Cornices shall be fixed as soon as concrete mix reaches its final strength and scaffolds, if any, are removed.

The Contractor shall not be allowed the use of any cornice cast of such concrete type and class that does not comply with this Sub-Section in the Technical Specifications, and any cornice with mechanical damage inflicted during casting, transport and fixing. When cornices are fixed into designed positions the Contractor shall check their positions, arrangement, and geometrical characteristics and request the approval of the Engineer. Subject to the approval of the Engineer, the Contractor shall proceed with the final fixing and concreting of that segment of the superstructure with which the cornices and the remaining part of the bridge structure will make a monolithic structure.

Any incorrect members deemed so by the Engineer on the basis of the requirements in this Sub-Section of the Technical Specifications shall be rejected and replaced with proper ones at the Contractor's expense.

Structural members bearing traces and remains of formwork coating agent may be built in, subject to the approval of the Engineer, provided always that the Contractor will submit evidence that such traces and remains will disappear within 30 days after building in, to the full satisfaction of the Engineer.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m³ of cornice of designed size, as approved by the Engineer.

Payment

The quantity measured in the above described way will be paid to the Contractor at the contract unit price which will mean a full compensation for the use of equipment, work, and materials for casting and fixing precast cornices.

13.4.3.5 Transition Slabs

Volume and Content of Work

The work under this item includes the casting of reinforced concrete slabs on top of a gravel wedge at the contact of approach fill and bridge superstructure. Slabs are to eliminate shocks when vehicles cross from the approach fill to the bridge superstructure due to different degree of settlement between them. Alternatively, the settlement at the approach fill end of transition slabs shall be reduced to zero or to the degree of settlement of the superstructure at the point where the slabs rest on it.

The length of transition slabs shall be given in the Design depending on approach fill height.

The work includes the preparation of bed – gravel wedge, the positioning of reinforcing bars and formwork wherever needed, and the placement and curing of concrete mass.

Concrete Requirements

The grade and class of concrete shall be given in the Design. Everything related to the production, transport, and placement of concrete shall be ruled by provisions of Section 8. CONCRETE, and Sub-Section 8.10. STRUCTURAL CONCRETE of these Technical Specifications.

Execution of Works

After the completion of works on the construction of abutments and cantilevers of transition slabs, and construction of gravel wedges according to provisions of Sub-Section 13.2.5. CONSTRUCTION OF GRAVEL WEDGE of these Technical Specifications, it is necessary to perform the control of evenness, gradients, and cross falls of gravel wedge surfaces on which transition slabs will be placed.

If any variation from the values specified in the Design is identified, higher parts of the constructed gravel wedge shall be removed, and depressions shall be filled with material used for the construction of wedge, and compacted in compliance with provisions of Sub-Section 13.2.5. CONSTRUCTION OF GRAVEL WEDGE of these Technical Specifications and to the full satisfaction of the Engineer.

Before placing reinforcing steel, the gravel bed shall be covered with natron paper from cement bags, with necessary 20 cm overlaps.

Reinforcing cages shall be prepared according to design details and laid on a prepared base. To achieve a required bottom cover for transition slabs, it is recommended to place concrete in thickness that corresponds to the thickness of cover immediately before installing cages.

Before concrete starts to set, reinforcing cages shall be placed and formwork prepared in advance shall be fixed at the place of joints, if joints are foreseen in the Design. At the place of joints, steel formwork is envisaged and shall be coated with appropriate concrete setting inhibitors.

Formwork shall be flat and clean.

After the reinforcing steel and formwork for joints are fixed, concrete shall be placed in the way as specified in relevant provisions of Section 8. CONCRETE and Sub-Section 8.10. STRUCTURAL CONCRETE of these Technical Specifications, with the placement of concrete performed simultaneously for all designed transition slabs next to an abutment, i.e. simultaneously for all slabs of one abutment for which the preparation of base, protective cover, and reinforcing steel is finished.

The most suitable way foreseen is to install every other slab with the use of formwork, so that the remaining slabs between already hardened ones are cast subsequently, using natron or felt paper for making joints.

If transition slabs are not to be concreted at the same time in the entire width of abutment, it is necessary to foresee concreting of the entire number of slabs, secure the position of ending separation formwork against displacement using steel wedges driven into the gravel wedge, by at least 50 cm, and place a protective cover only in the width to be concreted.

After finished casting of concrete, the surface of concrete shall be levelled with rules, manually, so that the finished surface has evenness, gradients, and cross falls according to the Design.

Any movement over fresh concrete shall be forbidden for at least 48 hours after concreting, and then only over previously laid boards, at least 5 cm thick. If the surface evenness becomes damaged due to the Contractor's negligence, such slab shall be demolished and removed at the Contractor's expense, and a new one shall be cast, in conformity with provisions of these Technical Specifications.

Separation formwork may be taken out after concrete reaches initial strength, while taking care not to break off the concrete cover. The removed formwork shall be cleaned and coated for the next use.

Reinforcing steel

Fully in accordance with the Design and provisions of Sub-Section 13.5.1. REINFORCING STEEL of these Technical Specifications.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m³ of placed concrete in dimensions as set out in the design, and as approved by the Engineer.

All slabs poorly constructed by the Contractor and removed on the Engineer's instructions shall not be taken into account.

Payment

For quantities determined in the above-described way, the Contractor shall be paid at the agreed unit price that makes a full compensation for all equipment, material, and work on the construction of transition slabs in accordance with the provisions of this Sub-Section of the Technical Specifications. Reinforcing steel shall be paid extra.

13.4.4. Pre-Stressed Bridge Structures**13.4.4.1. Precast main girders made of pre-stressed concrete****Scope and Contents of Works**

The work under this item includes the construction, transport, and installation of main girders made of pre-stressed concrete, which implies the provision of all plants, equipment, materials, and labour, and execution of all operations related to the fabrication, transport, and installation of girders.

Requirements for Materials

Requirements to be met by concrete are given in Section 8. CONCRETE and Sub-Section 8.10. STRUCTURAL CONCRETE of these Technical Specifications.

Requirements for formwork are given in Sub-Section 13.3. TIMBER CONSTRUCTIONS of these Technical Specifications.

Requirements for reinforcing steel are given in Sub-Section 13.5.1 REINFORCING STEEL FOR CONCRETE ELEMENTS AND STRUCTURES.

Requirements for pre-stressing steel and systems are given in Sub-Section 8.10.6. PRE-STRESSING OF CONCRETE CONSTRUCTIONS AND ELEMENTS

Execution of Works

Fully in accordance with provisions of Sub-Sections 8.10.5. PRECAST ELEMENTS and 8.10.6. PRE-STRESSING OF CONCRETE CONSTRUCTIONS AND ELEMENTS of these Technical Specifications. Apart from provisions from Sub-Section 8.10.5. PRECAST ELEMENTS the Contractor shall also observe the following:

- **Extension of Elements:**

If precast girders are fabricated in parts and delivered to the site as such, lengths of particular members shall be adjusted to the method of transport and installation of girders. Unless otherwise specifically stated in the Design how the elements are to be extended, the Contractor shall recommend a way to extend girders, and his proposal shall be submitted for the written approval of the Designer and the Engineer. Transported parts of girders are not pre-stressed in principle, which means that, as a rule, they cannot be exposed to dead load, which the Contractor shall have in mind when handling them. The extension by a direct contact between parts of girders is allowed only with the Designer's and Engineer's approval, as mentioned above. In that case, the Contractor shall prove the stress condition at the place of extension, with the requirement that the stress in a joint at the most unfavourable load in operation be of at least 1.5 MPa pressure, according to the related Serbian regulations.

Contact surfaces at the point of extension shall be roughened and coated with an epoxy coating immediately before tensioning, with the contact achieved before the epoxy coating sets, and the tensioning of cables to reach the full force only after the coating has reached the strength at which it receives tensile stress generated during pre-stressing in the zones in which the cross-section will be pressed in use. For applied epoxy resins, the Contractor shall procure and submit to the Engineer for approval, all necessary compliance certificates, and, among them, particularly evidence on the behaviour of resin in time.

The continuation in concreting of a part of girder is performed using concrete of the same grade and class, with produced cement and aggregate of the same type used for the fabrication of girders in the respective plant. For this purpose it is, therefore, necessary to separate cement and aggregate in the plant and transfer them to the site, with a clear designation for which girders they are to be used. In situ concreting at the place of extension may be performed only in formwork of the same kind and type as the formwork used in the plant, and coated with the same agent as it was done in the plant.

Contact surfaces shall be roughened and wetted down before concreting, and all reinforcing steel shall be properly extended according to provisions of Sub-Section 13.5.1 REINFORCING STEEL FOR CONCRETE ELEMENTS AND STRUCTURES of these Technical Specifications

Tensioning of cables shall be carried out once concrete for extension has reached a sufficient strength for pre-stressing, according to provisions of Sub-Section 8.10.6. PRE-STRESSING OF CONCRETE CONSTRUCTIONS AND ELEMENTS. In case of the extension of parts of girders on the site, the Contractor shall submit for approval by the Engineer and the Designer the relevant calculation of losses of prestress, stress, and deformations, calculated for a selected extension procedure.

- **Pre-stressing:**

Fully in accordance with provisions of Sub-Section 8.10.6. PRE-STRESSING OF CONCRETE CONSTRUCTIONS AND ELEMENTS

- **Installation of girders:**

Before the installation of girders, the Contractor shall check the position and height of bearings on which the precast girders shall lie and request the approval of the Engineer. During the installation, the girders shall be secured in terms of their designed position, and secured against getting into such position in which unfavourable stress conditions appear with respect to values foreseen in the Design.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m³ of placed concrete according to the design, and as approved by the Engineer. Concrete in the parts of extension, and epoxy coatings, shall not be measured extra.

Payment

For quantity determined in the above-described way, the Contractor shall be paid at the agreed unit price that makes a full compensation for all equipment, scaffolds and formwork placed concrete, and all other work on the erection and removal of scaffolds and formwork, and on the fabrication and transport of girders to the site, and their assembly into designed positions.

Any work on the extension of girders shall not be accepted for extra payment.

Reinforcing steel, pre-stressing cables, and grouting of cables shall be paid extra.

13.5. Metal Works**13.5.1. Reinforcing Steel for Concrete Elements and Structures****Scope and Contents of Works**

The work covered under this Sub-Section of the Technical Specifications includes the procurement of plants, equipment, materials, and labour, and the execution of all operations related to reinforcing steel in conformity with the Conditions of Contract and in full compliance with this Section of the Technical Specifications, drawings, and the Engineer's instructions.

Technical Regulations

Reinforcing steel shall be in compliance with the Rules on technical norms for plain and reinforced concrete (PBAB 87), instructions for use, and relevant standards:

SRPS C.K6.020	Hot-rolled steel. Reinforcing steel for concrete. Technical specifications (1987).
SRPS C.K6.120	Hot-rolled steel. Reinforcing steel for concrete. Shape and sizes (1986).
SRPS U.M1.091	Welded mesh reinforcement for construction industry (1986).

The standards specify shapes and sizes, as well as testing methods, for quality requirements set out in PBAB 87.

Materials

Wires and bars made of smooth steel, high-strength naturally hard ribbed steels, and mesh reinforcement made of cold-drawn smooth wire shall be used for the reinforcement of concrete constructions and elements as specified in the Design.

- Smooth reinforcing steel GA 240/360

Smooth reinforcing steel /GA/ is soft steel, grade 240/360, produced in the form of wires and bars. For reinforced concrete constructions, round, smooth reinforcing steel shall be fabricated according to an approved procedure.

- Ribbed reinforcing steel RA 400/500

Ribbed reinforcing steel /RA/ made of high-strength naturally hard steel, grade 400/500, is produced in the form of wires and bars. For reinforced concrete constructions, round, ribbed, reinforcing steel shall be fabricated according to an approved procedure.

- Welded mesh reinforcement MAG 500/560

Welded mesh reinforcement is made of cold-drawn wire made of smooth steel, grade 500/560. Mesh marks, diameter and spacing of wires, tolerances, etc. are determined in SRPS U.M1.091.

Protection of Materials

Reinforcing steel shall be protected against damage at all times. When placed into a construction, it shall be free from dust, loose flakes of slag and rust, paint, oils, or other foreign materials.

Bending

Reinforcing bars shall be carefully cut and bent by a qualified worker. They shall be bent in cold according to patterns, and shall not noticeably vary from the shape and dimensions shown on drawings. Sharp bends shall be avoided, and radii smaller than those specified in Table 24, PBAB 87, shall not be allowed.

Placement and Fixing

All reinforcing steel shall be accurately placed, bars shall be tied with wire at every crossing, so as to stay in positions shown on drawings during the placement of concrete. Spacers that prevent contact between reinforcing steel and formwork, and between rows of reinforcing steel shall be made of precast concrete cubes, or other materials of approved shape and dimensions. Concrete cubes shall be of such dimensions that it is possible to cover them with concrete. Coarse-grained gravel, crushed stone, or bricks, metal pipes, and wood shall not be used as pads. The inspection of placed reinforcing steel shall be performed macroscopically. The proper positions of placed reinforcing steel and its particular elements with respect to designed positions shall be checked by measurement and submitted for the approval of the Engineer.

Allowed variations are in the following limit ranges:

- Variations between particular bars
 - For piers/abutments and beam girders - 10 mm.
 - For slabs and walls - 15 mm.
- Variations between vertical rows of reinforcing steel, and variations in the designed dimensions of protective cover
 - For elements with the structural height over 1 m - 10 mm.
 - For beams and slabs thicker than 10 cm - 5 mm.
 - For slabs thinner than 10 cm - 3 mm.
- Deviations in stirrups with respect to horizontal or vertical values
 - For elements with the structural height over 1 m 10 mm.
 - For elements with the structural height under 1 m 5 mm.
- Axial deviations for butt-welded bars 0,10 Ø.

Extension

All reinforcing bars with overall length smaller than 12 m shall be delivered in full length as indicated on drawings. Bars longer than 12 m may be extended as shown on drawings or specified in PBAB, Section V.5, and/or Engineer's instructions. Butt joints made applying the electronic welding procedure shall be tested according to SRPS C.A4.002 and SRPS C.A4.005.

Acceptance

Before the commencement of concreting of every element or construction, it is necessary to identify and note in a protocol, prepared by the Contractor and submitted for the approval of the Engineer, whether reinforcing steel meets the requirements regarding:

- Diameter, number of bars, and designed geometry of placed steel
- Fixing of steel in formwork
- Mechanical properties: yield strength, breaking limit, quality of welded joints, and
- Cleanliness of placed steel.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of kilograms of placed reinforcing steel, as indicated on drawings and in specifications, i.e. reinforcement schedules, and as determined and approved by the Engineer. Any additions for trimming pieces, concrete cubes, pads, and spacers, as well as wire clips and fasteners to be procured by the Contractor when and as instructed by the Engineer shall not be taken into account. When making overlaps other than specified in Sub-Section V.5., PBAB, no compensation shall be given for extra steel, and for construction joints not indicated on drawings. For the calculation of weight of reinforcing steel, SRPS C.K6.120 shall be applied.

Payment

For quantity determined in the above-described way, the Contractor shall be paid at the agreed unit price that makes a full compensation for the scope and content of works given under this Sub-Section of the Technical Specifications.

13.5.2. Metal Work in Pre-Stressed Concrete**13.5.2.1. High-strength patent pre-stressing wire with all anchors, tie plates, and cable ducts****Scope and Contents of Works**

The work under this item is described in Sub-Section 8.10.6. PRE-STRESSING OF CONCRETE CONSTRUCTIONS AND ELEMENTS of these Technical Specifications.

Measurement

In full accordance with Sub-Section 8.10.6. PRE-STRESSING OF CONCRETE CONSTRUCTIONS AND ELEMENTS

Payment

In full accordance with Sub-Section 8.10.6. PRE-STRESSING OF CONCRETE CONSTRUCTIONS AND ELEMENTS

13.6. Expansion Joints on Structures**Scope and Contents of Works**

The works covered with this Sub-Section of the Technical Specifications include the provision of all plants, equipment, material, and labour, and the execution of all operations related to the fabrication, transport, and installation of all expansion joints, in accordance with the Conditions of Contract and in full compliance with this Sub-Section of the Technical Specifications, structural requirements, drawings, and the Engineer's instructions.

In accordance with structural requirements, drawings, specifications from the Design, this Sub-Section sets out the requirements for the application of materials, and the fabrication and installation of expansion joints, specifically for:

- Special expansion joints that may absorb extremely large amounts of expansion
- Reinforced elastomeric expansion joints.

Materials

Elastomer for expansion joints shall comply with the specifications for bearings for which certification has been issued by the authorised testing institute as approved by the Engineer, and shall be resistant to aging, weather conditions, and chemical impacts.

Protection against Corrosion

The Contractor shall define corrosion protection systems to be applied for particular surfaces on the bridge in accordance with the applicable technical regulations and Rules on technical measures and requirements for the protection of steel structures against corrosion (Of. Journal SFRY, No. 32/1970) and submit his proposals for the approval of the Designer and the Engineer. Alkyd-based corrosion protection systems shall not be accepted. The sequence, type, and technology of application and method of control of coats of the corrosion protection systems specified in the Contractor's proposal shall be defined in appropriate reports. As a rule, surfaces shall be prepared by abrasive jet cleaning. The degree of reached cleanliness of surface shall be determined in accordance with SIS 053900. After cleaning and dedusting, surfaces of steel elements shall be protected either with a primer or immediately with the first basecoat, within 8 hours at most. The Design shall foresee the application of high-strength bolts in some connections, designed as "friction-grip" bolts - TS. Contact surfaces in connections shall be protected by aluminum - AlMg5 - metallization fully in accordance with relevant standards.

The Contractor shall ensure optimum conditions on the site for the storage and application of selected coatings, fully in accordance with approved reports, enclosed Manufacturer's instructions, Institute's certificates, for offered corrosion protection coatings and to the full satisfaction and approval of the Engineer. The Contractor shall provide all necessary equipment and instruments for control on the site.

Measurement and Payment

Measurement and payment shall be made at the unit price per 1kg of steel construction as approved by the Engineer. The unit price shall be quoted for an assembled steel construction protected against corrosion, and shall include all work, tools, and equipment, basic material and fittings, and all necessary temporary and auxiliary constructions. The Contractor's proposal shall contain a cost

breakdown (in percentages) into costs of particular items of work, for the sake of calculations for interim monthly payments. The relevant weight of construction for calculation shall be computed theoretically, namely:

– The theoretical weight shall be determined based on shop specification of material applying the bulk density of steel of 8.00 t/m³ for sheet steel, and 7.85 t/m³ for sections. The weight computed in this way shall be increased by 3% for fitting material used in the shop and for installation on the site.

13.6.1 Reinforced Elastomeric Expansion Joints

Fabrication Requirements

These expansion joints shall be shock and sound-absorbing and watertight systems. Their dimensions shall fully comply with drawings and be shaped according to the cross section of the bridge.

The expansion joints shall be delivered as 2 m long elements, and shorter reducer elements that are to be welded together into one unit. Angled joints shall be prefabricated, and the Manufacturer shall weld them.

Sealants shall be applied in accordance with drawings and shall be used strictly in accordance with the Manufacturer's instructions and subject to the approval of the Engineer.

Anchoring shall be performed with anchors of a minimum diameter of 16 mm, while their layout shall be adjusted to details for the elements to which the joints are to be anchored. The fabrication of expansion joints may start only after the Engineer has given his approval for the Contractor's designs.

Installation of Expansions Joints

Expansion joints shall be installed fully in accordance with approved detailed drawings, with the accuracy requirement of - 1 mm vertically for 1m long rule. Expansion joints shall be adjusted to the mean temperature of installation, i.e. if installation is foreseen for concrete constructions, along with the casting of slab, pre-stressing, contraction, and creeping of concrete shall be taken into account as well.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m² of constructed expansion joints in accordance with the design and as approved by the Engineer.

Payment

For quantity determined in the above-described way, the Contractor shall be paid at the agreed unit price that makes a full compensation for all used equipment, incorporated material, and all work on the fabrication, transport, and installation of expansion joints.

13.7. Installation of Cast Iron Gullies for Designed Bridge Deck Drainage

Scope and Content of Works

The work under this item includes the installation of gullies to drain surface water from the bridge according to the drainage design, which implies the provision of all plants, equipment, materials, and labour, and the execution of all operations on the fabrication of complete gullies, with the installation of gully pots to channel water, as specified in the separately elaborated drainage design, their transport to the site, and installation.

Execution of Works

A gully is a finished product, and shall have, as such, the shape and dimensions according to drawings in a separate drainage design. The Engineer shall determine whether delivered gullies are fully compliant to the type specified in the drainage design, and whether they are damaged during handling before their installation. The upper and lower parts of a gully shall not have cracks or voids in casting, and the gully grating shall properly sit in its frame, which means that it shall not be curved, twisted, or of improper size for the frame. Grating bars shall not be cracked or broken.

Unless otherwise shown on design drawings, the opening for a gully and drain pipe shall be left in the concrete slab in advance, so it shall be adequate, by shape and dimensions, for the gully and drain pipe.

Before placing the gully, the concrete surface shall be coated with a hot bitumen coating.

If the opening is larger than needed to place the gully, gaps shall be filled in with plastic cement mortar, 1:3.

Joints between the gully and the road surfacing shall be finished according to specifications given in Sub-Section 13.10.8, CONSTRUCTION AND SEALING OF JOINTS ON ASPHALT ALONG KERBS AND CORNICES ON PEDESTRIAN WALKWAYS AND ALONG EXPANSION JOINTS of these Technical Specifications.

The gully is placed in its frame as a whole, which means, with the grating in place, and then its height is adjusted by means of an instrument, so that after completed paving, the grating lies flush with the pavement, without any of its parts projecting above, or sinking under the road surface. Cement mortar shall be cured with a usual procedure. Before paving, the grating shall be removed, and the opening closed with a timber cover, to prevent asphalt from getting into the gully. From the date of installation of gully to the date of paving, at least a fortnight shall pass, to ensure that cement mortar has reached the required strength. During paving, it is necessary to protect gullies from damaging, which particularly applies to the placement of asphalt concrete in two layers. The first layer before and after the gully shall not be compacted with a roller, but hand rammers. When a paver passes over a gully, measures shall be taken to prevent the spreader from hitting the gully. Gullies shall be covered with gratings after finished paving, and surface is wetted down for testing. This is done to assess the effectiveness of drainage.

If the gully is the reason for insufficient drainage, its position shall be fixed in a proper way to the full satisfaction of the Engineer. At the place where the drain pipe leaves the underside concrete surface, cement mortar shall be shaped conically, to be higher next to the drain pipe than in the contact with concrete.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of gullies according to the drainage design, and as approved by the Engineer.

Payment

For quantity determined in the above-described way, the Contractor shall be paid at the agreed unit price that makes a full compensation for all material and work according to the scope of works for this Sub-Section of the Technical Specifications.

13.8. Designed Steel Barriers on Bridges**Scope and Content of Works**

The work under this item includes the shop fabrication and mounting of bridge barriers according to the Design, which implies the provision of all plants, equipment, materials, and labour, and the execution of all operations for the fabrication, transport, mounting, and corrosion protection of barriers.

In the Bill of Quantities, barriers shall be separated by type, as follows:

- a) CRASH BARRIERS
- b) CRASH BARRIERS WITH HANDRAILS
- c) OTHER TUBULAR BARRIERS, OR BARRIERS MADE OF SECTIONS

Quality Requirements

The quality of applied materials, and the requirements for fabrication and corrosion protection of steel materials are specified in Sub-Section 12.6.1. of these Technical Specifications.

Other standards applicable for protective steel barriers are:

SRPS U S4.100 Protective barriers, made of steel - Technical requirements for fabrication and delivery

SRPS L S4.108 Protective barriers, made of steel - Shape and dimensions.

Execution of Works

The work on shop fabrication of barriers shall be executed in accordance with requirements of Sub-Section 12.6.1 of these Technical Specifications. Shape, dimensions, and types of steel elements, as well as required dimensions of seams of welded joints, shall be specified in the Design. All visible joints shall be finished off by grinding, to get a clean surface. Before the final joining of individual segments, it is necessary to perform a trial assembly of main elements – posts, handrails, and rails/beams to avoid any variations. If possible, it is necessary to check the position of anchoring points on the construction, and carry out minor adjustments during work in the shop.

Crash barriers are supplied as finished products from the Manufacturer, with connection details previously customized according to details given in the Design. During fabrication of barriers in the shop, it is necessary to ensure that they fit any curves on the bridge. Polygonal barriers on bridges in curves shall not be accepted. After shop fabrication, but before transport to the site, barriers shall be protected with a basecoat, fully in accordance with provisions of relevant standards. The basecoat shall be factory-prepared. It may be applied with a brush or by spraying.

Barriers shall be transported to the site taking necessary precautionary measures to avoid damaging both the steel material, and the basecoat.

Before assembling the barrier, it is necessary to check the condition of openings left for its installation in the structure. The openings shall be cleaned with air under pressure, to remove any foreign objects.

The barrier shall be installed at air temperature in the range from 15°C to 25°C.

The barrier shall be set into its designed position and adjusted in height and direction, and then temporarily fixed in a suitable way.

After fixing the barrier, and wetting down the holes beforehand, anchoring points shall be sealed with fine-grained concrete of the same grade and class as specified for concrete for the superstructure, and the filling is then cured in conformity with requirements set out in Sub-Section 8.10. STRUCTURAL CONCRETE of these Technical Specifications. During and after the installation, it is necessary to check and ensure the effectiveness of expansion joints of the barrier. Before applying protective coatings, the barrier shall be inspected and cleaned from any residues of concrete or traces from welding, and repair the basecoat, if damaged anywhere and to any degree, and de-greased before applying the next coating.

The barrier can then be painted with the second coat, and after it dries, with the finish coat as well, so that there shall be at least three coats in total.

Air temperature during painting on the site shall be neither below +5°C nor over +20°C. The paint shall not be applied to wet and frozen surfaces, nor at a relative air humidity higher than 60%. If painting is done under a cover, and, after applying the paint, weather conditions become unsatisfactory, the cover shall be kept in place until the paint dries, or the weather gets better to the extent that the paint can be exposed to atmosphere.

The Engineer may forbid the application of paint if he considers weather conditions unfavourable. The paint shall not be applied to metal that is too hot and could thus cause the porosity of the applied layer or swelling of the paint due to a sudden loss of the solvent. Inaccessible places shall be protected, too.

Some elements (handrails, posts, railings) shall be finish painted in colours specified in the Design, and if such data are not available in the Design, the decision on colours shall be made by the Engineer.

Crash barriers shall meet the requirements for installation specified for pedestrian barriers. Crash barriers shall be galvanized, and shall not be painted, all the same as anchor plates for pedestrian and safety barriers.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m¹ of installed barrier, prepared according to the Design and as approved by the Engineer.

Payment

For quantity determined in the above-described way, the Contractor shall be paid at the agreed unit price that makes a full compensation for all used equipment, plants, and material, and for all work on the fabrication, transport, assembly, and painting of barriers according to the Design.

13.9. Bridge Bearings**Scope and Content of Works**

The work under this item of the Technical Specifications shall include the provision of all plants, equipment, material, and labour, and the execution of all operations related to the fabrication, transport, and installation, including bedding mortar, of all bearings, in accordance with the Conditions of Contract, and in full compliance with this Sub-Section of the Technical Specifications, drawings, and Engineer's instructions.

In accordance with structural requirements, drawings, and specifications from the Design, this Sub-Section sets out the requirements for applied materials, fabrication and installation of bearings, namely for:

- Special steel bearings
- Neotopf elastomeric bearings, and
- Reinforced elastomeric bearings.

As for materials and design, Neotopf, Neotopf slide bearings, and reinforced elastomeric bearings shall be provided with approval certificates issued by authorized institutes and submitted for the approval of the Engineer.

For all manufactured bearings, in addition to the quality control by the Manufacturer, the control by authorized institutions for this business sector is mandatory.

13.9.1. Reinforced Elastomeric Bearings – Materials and Manufacturing Requirements

Elastomeric bearings are manufactured from synthetic chloroprene caoutchouc resistant to aging, weather conditions, chemical impacts, and ozone.

Elastomer shall meet the requirements related to bearings which are provided with approval certificates issued by authorized institutes.

Bearings shall have all dimensions compliant with data shown on drawings.

Plates that are inserted between layers of elastomer shall be made of high-strength steel and hot-bonded with elastomer layers.

Installation of Bearings

All bearings shall be marked so that the type, size, position, direction, and pre-settings are stated unambiguously. All works on the site regarding the installation of bearings shall be allowed only if performed by the Manufacturer's specialists or representatives authorized and trained by him. The acceptance of bearings and their installation up to the time before the placement of bedding mortar, and after its placement, shall be subject to the approval by the Engineer. Bearings shall be installed according to details and height levels given on drawings, over bedding mortar placed according to requirements specified in Sub-Section 8.10 of these Technical Specifications. Elastomeric bearings shall not come into contact with grease, solutions, and particularly not with oils for formwork. Neotopf slide bearings shall be pre-set in accordance with design requirements. Devices for temporary fixing shall consist of materials that do not damage bearings at the moment of initial movement. Bearings that are not installed properly, or do not meet specified standards, shall be removed and replaced at the Contractor's expense and to the full satisfaction and approval of the Engineer.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of bearings according to kind and type, as specified in the design, and as approved by the Engineer.

Payment

For quantity determined in the above-described way, the Contractor shall be paid at the agreed unit price that makes a full compensation for all materials, equipment, and labour, transport and installation, and for all tests required by the Engineer to determine whether particular bearings meet chemical, physical, and structural requirements stated in this Sub-Section of the Technical Specifications.

The agreed unit price shall include bedding mortar, and all grouting equipment, indicators, and necessary seals, fully as stated in this Sub-Section of the Technical Specifications, indicated on drawings, or instructed by the Engineer.

13.10. Finishing Works on Bridges**13.10.1. Stone and Concrete Kerbs****Scope and Content of Works**

The work under this item includes the placement of stone or concrete kerbs, dimensions as specified in the Design, which implies the provision of all necessary plants and equipment, materials, and labour for the production, transport, and placement of kerbs according to the Design and requirements from this Sub-Section of the Technical Specifications.

Material

If the Design foresees stone kerbs, stone shall meet the requirements for stone material set out in Sub-Section 13.4.1.2. LINING OF END SLOPES- LINING OF STRAIGHT AND ROUNDED SOIL SURFACES, while a minimum compressive strength of stone is required to be 70 MPa. Only stone of eruptive origin may be used. If concrete kerbs are foreseen, the grade and class of concrete shall be specified in the Design, while observing the following:

- Grade of concrete shall not be less than MB 50
- Average flexural bending strength (not applicable for the lengths of 250 and 500mm) 6 MPa
- Frost resistance (SRPS U.M1.016) shall not be lower than M-150
- Water impermeability of concrete (SRPS U.M1.015) shall not be less than V-6
- Degree of damage under the action of frost and salt (Table 2-SRPS U.M1.055) shall be "0 – no spalling"
- Wear abrasion resistance; abrasion loss shall not be higher than 15 cm³ / 50 cm²

For everything else, concrete kerbs shall be governed by provisions of Section 8. CONCRETE and Sub-Section 8.10. STRUCTURAL CONCRETE of these Technical Specifications. Cement mortar, 1:3 ratio, shall meet the requirements of the same standards, and the same provisions as concrete kerbs.

Execution of Works

After completing the bridge deck according to the description given under Sub-Section 13.4.3.3. SPANNING STRUCTURE, kerbs shall be delivered and stockpiled near the place of installation. Cement mortar is placed over a moistened waterproofing system of the deck, and kerbs are positioned as specified in the Design. A kerb shall be wetted down too. The joint toward the strip on the pedestrian walkway side shall be sealed then. Very wet mortars are not allowed, because of the risk of fissures and cracks in mortar due to water loss.

Joints between kerbs shall also be filled with cement mortar, while leaving out one joint, about 2 cm wide, at every 20 m distance, and sealing it with a durable elastic bituminous putty, at the same time when longitudinal joints are sealed, according to the description given under Sub-Section 13.10.8. CONSTRUCTION AND SEALING OF JOINTS IN ASPHALT ALONG KERBS AND CORNICES ON PEDESTRIAN WALKWAYS.

Standard length of kerbs is 1 m. This may vary in case and within limits specified below within this Sub-Section of the Technical Specifications.

The placement of kerbs shall start from expansion joints toward the centre of each span and ends of wings, i.e. from the ends of wings toward the centre of bridge in case of structures without expansion joints. In the part of bridge in the centre of a 3-5 m span, standard kerbs shall be adjusted to the total length needed, with at least three kerbs shortened to a length not smaller than 70 cm.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m³ of placed kerbs, measured on the site and as approved by the Engineer.

Payment

For quantity determined in the above-described way, the Contractor shall be paid at the agreed unit price that makes a full compensation for all used equipment, incorporated materials, and work on the fabrication, transport, and placement of kerbs, including bedding and joints.

13.10.2 Waterproofing of Concrete Deck Surface

Scope and Content of Works

The work under this item includes the construction of a modern waterproofing system over a constructed concrete deck in the area specified in the Design, which implies the provision of all plants, equipment, materials, and labour, and the execution of all operations related to the procurement of materials, transport, and construction of a waterproofing system.

- A waterproofing system, TESTUDO type, with a polymer-bitumen strip for welding, or a product of the same or better performance by any other Manufacturer, shall be used for the waterproofing of bridge decks, subject to the approval of the Engineer.

Execution of Works

Weather conditions for the execution of works are: dry weather, a minimum temperature of 10°C, and a relative air humidity less than 60%.

The concrete surface shall be cleaned from any loose parts of concrete, oil stains, and other impurities, and dedusted with compressed air, as a final treatment.

The flat, dry, and clean concrete surface shall be primed and covered with a levelling bituminous coating, a mix of bitumen and filler for placement in hot. This layer may also serve to fix any minor uneven areas on the concrete surface. The basecoat material shall have the same characteristics that meet requirements set out in SRPS U.M3.240/1989.

Bitumen strips shall be welded to the placed layer of bituminous coating. For the waterproofing of bridge deck, torch-on bitumen strips made of APP or SBS polymer bitumen with polyester felt sheeting shall be used. The properties of polymer-bitumen strips shall meet the quality requirements set out in SRPS U.M3.300/1989 (Torch-on bitumen strips. Composition and quality requirements).

The material for waterproofing compound shall meet provisions of SRPS U.M3.246, if the compound is based on asphalt mastic, or SRPS U.M3.244, if it is based on polymer-bitumen.

Before the commencement of works, it is necessary to pre-test all materials to be used, and during the work, all necessary control tests shall be performed to the full satisfaction of the Engineer.

Any movement over the basecoat is forbidden, except during the execution of other works on waterproofing. In case of damage, either the coating shall be noted down as improperly applied, or the surface shall be recoated as directed by the Engineer.

The waterproofing works shall be executed with a constant technical supervision of works by the Contractor to the full satisfaction of the Engineer.

Measurement and Payment

The quantity to be paid to the Contractor at the agreed unit price, given per m^2 of the placed waterproofing system, shall be determined based on measurements given in the design and as approved by the Engineer.

13.10.3 Coating Concrete Surfaces with Bitumen**Scope and Content of Works**

The work under this item includes the application of bitumen coating on concrete surfaces that will get into a direct contact with seepage water from soil, which implies the provision of all plants, equipment materials, and labour, and the execution of all operations on the preparation of concrete surface, transport, preparation, and application of materials.

Execution of Works

The surfaces of abutments and wing walls, as well as parts of piers that will come into contact with constructed embankment and end slopes, i.e. soil, shall be coated with hot bitumen. Before applying the coating, it is necessary to inspect the concrete surface, remove any spalled and unstable portions, repair concrete on these places with cement mortar, and wait until it sets and loses moisture. The surface shall be clean and dry.

Parts above foundation structures shall be coated. The coating shall be made with bitumen heated to a working temperature, at an ambient temperature above 10°C , over concrete of a minimum temperature above 15°C , in about 2 mm thickness, at the rate of about 3 kg/m. Before applying the coat on the front surfaces of piers/abutments, i.e. external surfaces of wing walls, it is necessary to mark a limit on concrete to which the coating will go, so that the limit is lower by 20 cm than the line of contact of end slope lining, i.e. ground embankment and concrete. The material shall be applied with suitable tools. Any cracks shall be repaired with hot bitumen or emulsion before the construction of embankment and end slopes, i.e. before backfilling foundations.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m^2 of applied coating according to the Design, and as determined and approved by the Engineer.

Payment

For quantity determined in the above-described way, the Contractor shall be paid at the agreed unit price that makes a full compensation for all mentioned within the scope of works under this Sub-Section of the Technical Specifications. Any workings scaffolds that may be used shall not be paid extra.

13.10.4 Asphalt-Concrete Surfacing**Scope and Content of Works**

The work under this item includes the construction of road surfacing with asphalt concrete over a completed waterproofing layer in the thickness of 1 cm and over the surface specified in the Design, which implies the provision of all plants, equipment, materials, and labour, and the execution of all operations related to the production, transport, and placement of asphalt concrete in accordance with Sub-Sections 9.5. and 9.6. of these Technical Specifications.

Materials

The construction of surfacing is foreseen with the use of asphalt concrete, AB-11 type, according to requirements set out in SRPS U.E4.014 (1983), and stone mastic asphalt, SMA 0/11S, according to requirements set out in SRPS U.E4.015.

Basic materials and asphalt mix are subject to provisions of Sub-Sections 9.5.2. (9.5.3.-9.5.3.7.) and 9.6.3. (9.6.3.1. - 9.6.3.7.) of the Technical Specifications for Asphalt and Pavement.

Execution of Works

Fully in compliance with Sub-Section 9.5.10. Technology of Work in the Technical Specifications for bridge deck.

Quality Control

Fully in compliance with Sub-Sections 9.5.11. and 9.6.6. of these Technical Specifications, and Sub-Sections 9.5.12. and 9.6.7. in terms of criteria for measurement and payment.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m^2 of asphalt placed in full designed thickness and width according to the Design, with limitations from Sub-Sections 9.5.13. and 9.6.7. of these Technical Specifications and as approved by the Engineer.

Payment

For quantity determined in the above-described way, the Contractor shall be paid at the agreed unit price that makes a full compensation for all equipment, material, and work on the production, transport, and placement of asphalt under Sub-Sections 9.5.13. and 9.6.7. of these Technical Specifications.

13.10.5 Testing of Finished Bridge**Scope and Content of Works**

The work under this item includes the provision of all plants, instruments, equipment, and labour needed to test the finished bridge with trial load, and the preparation of test reports as a component part of the report for the technical acceptance of the bridge.

Testing Procedure

The finished bridge shall be tested fully in accordance with requirements from this Sub-Section of the Technical Specifications and provisions of SRPS U.M1.046 Testing of bridges with trial load (1984)

The testing may be awarded only to an authorized institution whose eligibility shall be previously determined by the Contractor, submitting specific evidence on that to the Engineer for approval.

The tests shall be performed as regular (Sub-Section 2.1.1. SRPS U.M1.046) and normal (Sub-Section 2.2.1.), and in case of any doubt regarding connections or other qualities of the bridge structure, the Engineer will require a special test load (Sub-Section 2.2.2.). Tests shall be performed with static and dynamic test loads for all bridges with a span $L \geq 15$ m, and if conditions from Sub-Section 2.2.2. SRPS U.M1.046 are present, trial load shall be applied for bridges of smaller span as well. Tests shall be performed

on a completely finished bridge and access structures, which implies a completely finished pavement on the bridge. Trial load shall not be applied before concrete of the main load-bearing structure has reached the age of at least 28 days. Aside from the required age of concrete in the main load-bearing structure, it is also necessary to have evidence that the placed concrete has reached the required grade. If this is not the case, trial load shall be postponed until the required grade of concrete has been achieved. Before trial loading, it is necessary to release the structure from all scaffolds and formwork. Parts of scaffolds that will be used to accommodate testing specialists during their work shall not be dismantled; it is necessary to make these parts as self-supporting as possible, and to provide access to working platforms to the testing group. The Contractor shall be responsible for safe operation on such working scaffolds and platforms. Before performing the tests, the Contractor shall provide a testing programme, which shall be subject to approval by the Designer and Engineer. The testing programme shall include all requirements set out in Sub-Section 3.2.2. SRPS U.M1.046. During the testing, all other loads shall be removed from the bridge, except for those loads that will be used for trial load tests. The testing of the bridge in key phases shall be attended by the Designer and Engineer as well as the Contractor, and shall be completed to the full satisfaction and approval of the Engineer.

Assessment of Results and Report

Trial load tests results shall be considered positive and the bridge a technically correct structure, if the requirements from Sub-Section 4.1. SRPS U.M1.046 are met to the full satisfaction of the Engineer. If, according to Sub-Section 4.2. SRPS, the trial load test shall be repeated, the bridge shall not be open to traffic until the structure has been re-analyzed and adequate measures have been taken. The organization that performed the test shall issue an interim test report, and then the final test report. In case of a negative opinion in the interim report, the bridge may be used for traffic until necessary measures have been taken and defects eliminated only if approved by the Designer and the Engineer. A copy of every report shall be submitted to the Designer and the Engineer. Bridge test reports make a component part of the study report for the technical acceptance of the bridge.

Measurement and Payment

For work performed on trial load testing of the bridge, the Contractor shall be paid in an agreed lump sum amount that makes a full compensation for all materials, auxiliary scaffolds, smaller platforms, loads, and labour, and for the preparation of a bridge test report, all completed to the full satisfaction and approval of the Engineer. In case of repeated tests, for such tests the Contractor shall not be entitled to any compensation, if these tests are required because of defects in construction or testing. If the test is repeated because of a designing mistake, the test shall be paid extra.

13.10.6. Taking Photographs during Bridge Construction

Scope and Content of Works

The work under this item includes taking and printing photographs during bridge construction, which implies the provision of all cameras and equipment, materials, and labour, and the delivery of 5 (five) copies of colour photographs in albums (2 copies for the Investor, 1 copy for the Engineer and 2 copies for the Designer), and negatives (for the Investor) or electronic files on CD for digital photography.

Procedure

Photographs should be taken with a high quality camera and a set of lenses that has to contain, as mandatory, a standard lens of optical power 1.1.7 to 1.2.8, $\phi=50-55$ mm, and an adequate wide-angle telephoto lens. The camera should be equipped with a built-in electric light meter, and a flash for taking pictures in the conditions of insufficient illumination. The camera should have an automatic date stamping feature. Equipment for taking photographs shall be available on the site at all times. First photographs shall be taken of the site before the commencement of bridge construction works. Wherever possible, geodetic flags (ranging poles) shall be put up in places of future bridge piers/abutments. Where ranging poles cannot be placed, a visible object that stands out from the background by colour and shape shall be used. Photographs shall be taken particularly of:

- Excavation after reaching designed levels
- Pile construction process
- Construction in slide formwork
- Formwork and auxiliary scaffolds for piers/abutments
- All reinforcing steel and cables in designed positions
- Scaffolds and formwork for the superstructure
- Placed bearings and expansion joints (before paving)
- Space between wing walls before and after the construction of wedges
- Transition slabs
- Bridge deck surface before and after waterproofing
- Paving process
- All typical details
- Front (rear) view of the bridge taken from the pavement in front of / behind the bridge before its opening to traffic
- Side view of the finished bridge
- Trial loading

Photographs shall show a clearly visible object. Each photograph shall also show a size reference object (a matchbox, levelling staff, flag, man).

Aside from everything mentioned above, on the Engineer's instructions, photographs shall also be taken of any accidents during the works, and of conditions at the time of unplanned or unfavourable interruption of work. Such photographs, aside from the condition, should also show, if possible, the cause and consequences of the event. The Investor, Engineer and Designer shall be handed over photographs arranged in albums, with a legend written under each photograph with the following data:

- The number of photographs
- Date and time of taking the photograph (if the camera does not have an automatic date stamping feature)
- The name of the shot object
- Any description of the photograph
- The distance from which the photograph was taken, with a sketch, if possible
- The type of lens

The photographs may also bear identification marks, if needed, with their meaning and explanation given in the legend. Negatives shall be handed over cut in strips, with 6 photographs in each strip, packed in a way that protects them against damage. CD's shall be provided for digital photography. Albums shall bear the following inscription:

- The name of road, and road and section codes

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- Bridge chainage and name
- Name of obstacle
- The Investor and Contractor
- Photographer(-s)

On the inside cover, the following shall be written:

- Make and type of the camera and film.
- Make, type, and characteristics of lens
- Make and type of flash

An average number of photographs is:

- For smaller and less complex bridges 20 pcs
- For larger and more complex bridges 50 pcs
- For large and complex bridges 200 pcs

Measurement and Payment

For the work under this item, the Contractor shall be paid a lump sum amount that makes a full compensation for all material, used equipment, and labour, and everything else mentioned in the scope and contents of work for this item.

13.10.7. Fabrication and Installation of Plate with Year of Bridge Construction

Scope and Content of Works

The work under this item includes the fabrication and installation of a plate with a year of bridge construction, which implies the provision of all devices and equipment, materials, and labour needed to fabricate and install the plate.

Material

Material of which the plate is to be made is brass.

Shape and Size of Plate

The plate shall be rectangular, 210x300 mm in size, 4 mm thick. If needed, the size of plate may also be 420x600 mm, 6 mm thickness.

Inscription, Type and Shape of Letters

The following shall be inscribed on the plate:

- The year of bridge construction (e.g. 2009-2010)
- The Contractor (in the following format: Contractor: ...name...)
- The Designer (Designer: ...name...)
- For bridges with a technical solution (layout, span size, etc) that represents a special, rare, or outstanding design or outstanding achievement, the name of the engineer-Designer who developed the design is to be stated (in the following format: Designed by: ... Name and Surname...).

Capital block letters shall be used. With the Contractor's and Designer's names, their logos may be inserted. The applied script (Cyrillic - Latin), and the size and shape of letters shall be decided by the Investor after receiving the plate drawing proposed by the Contractor.

Position of Plate

The plate shall be put up on a visible, but not overly exposed place, which means that it shall be protected against damage caused by traffic, high water, and the like. Furthermore, the plate shall be out of reach for the protection against vandalism. The position of plate shall be determined by the Contractor and Engineer together, taking into account the given requirements.

Fabrication and Mounting

The plate shall be flat and smooth on the backside that lies against the structure. The visible surface may be machined in a suitable way. In the plate corners, Ø14 mm holes shall be drilled. The plate shall be fixed onto concrete, or steel, with bolts, thread root diameter Ø12 mm, made of standard steel for bolts. Heads shall be machined so that bolts cannot be loosened without special tools.

Measurement and Payment

For work under this item the Contractor shall be paid an agreed lump sum amount that makes a full compensation for all materials, used equipment, and labour, according to the given scope and contents of works under this item.

13.10.8. Construction and Filling of Joints in Asphalt along Expansion Joints and Kerbs and Cornices on Pedestrian Walkways

Scope and Content of Works

The work under this item includes the construction of longitudinal joints along kerbs on the upper and lower sides, and along the pedestrian walkway cornice, and/or along expansion joints, and their filling with durable elastic bitumen putty, which implies the execution of all operations related to the construction of joints, procurement, transport, and placement of a joint filling compound.

Execution of Works

During the construction of the finishing asphalt layer, hardwood strips, 1.5 cm wide, and as high as the finishing layer, shall be placed on the road surface, and along the upper side of kerb and cornice, strips made of the same material shall be placed, but 1 cm wide, and of the same height as the overall thickness of asphalt on the walkway. The strips shall stay in place during paving, and be removed after asphalt cools down to a temperature suitable for the placement of putty, according to the Manufacturer's instructions. After removing strips, the contact surfaces shall be coated with a primer, and sealed with the putty, all in compliance with instructions of the putty manufacturer. Before applying the primer, joints shall be cleaned from all foreign objects and dried with compressed air. The placement of putty shall follow immediately after the application of primer. The Contractor shall provide compliance certificates from the Manufacturers for materials he intends to use, as well as instructions for preparation and placement of those materials, and to submit them timely to the Engineer for perusal and approval. The Engineer shall demand these documents and compliance with them from the Contractor.

The Engineer shall turn down any proposal that he may consider inadequate for the basic purpose, and this is the sealing of joints and ensuring the contraction of asphalt without cracking. Also, the putty shall be resistant to raveling and other traffic-induced damage. A fully completed joint shall be flush with the surrounding surface.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m¹ of completely finished joint as approved by the Engineer.

Payment

For quantity determined in the above-described way, the Contractor shall be paid at the agreed unit price that makes a full compensation for all mentioned within the scope of works under this Sub-Section of the Technical Specifications.

13.11. Special Works

13.11.1 Installation of Plastic Pipes in Pedestrian (Inspection) Walkways as Designed

Scope and Content of Works

The work under this item includes the placement of plastic pipes in pedestrian, and/or inspection walkways in the position as indicated in the Design, which implies the provision of materials, transport, and labour, and the execution of all operations on the assembling, fixing, and ensuring the free passage through the pipes.

Material

The plastic pipes shall be made of high-quality plastic material, without mechanical damage (cracks, broken edges). The pipes shall be socketed. The thickness of wall shall ensure the pipe to receive load from concrete and asphalt above it, and evenly distributed load on the walkway at the rate of 3 kN/m. The load-bearing capacity of pipes shall be proven with the Manufacturer's compliance certificate which shall be submitted for the approval of the Engineer. The material from which the pipe is made shall be resistant to cement components and aggressive substances.

Execution of Works

The pipes are placed into designed position and fixed to avoid their "surfacing" during the placement of concrete fill. They shall be joined together over spigot-and-sockets joints, taped over to ensure watertightness.

At the end of pedestrian (inspection) walkways, the pipes shall be closed with plastic caps that must be protected against theft. Caps shall be provided with a drain outlet on the underside. A free passage through the pipe shall be ensured in its full length from one end to another end of the walkway, i.e. from one manhole to another, if they are foreseen.

At the points of manholes, there shall be plastic drain pipes, 50 mm diameter, placed at the lowest point, so as to protrude under the structure by at least 10 cm.

During concreting around the pipe at its contact with the manhole, the pipe shall be protected against the penetration of concrete with suitable formwork, and if concrete gets into the pipe anyway, it shall be taken out after removing formwork, while fresh if possible. The surface of concrete shall be coated with hot bitumen, after concrete has dried completely.

Measurement

The quantity to be paid to the Contractor at the agreed unit price shall be the number of m¹ of placed pipes measured and approved on the site by the Engineer.

Payment

For quantity determined in the above-described way, the Contractor shall be paid at the agreed unit price that makes a full compensation for all material, equipment, and work on the procurement, transport, and installation of pipes according to the scope of works under this Sub-Section of the Technical Specifications.

13.11.2 Protective Coating of Concrete Surfaces

Scope and Content of Works

The application of a protective coating on concrete surfaces.

Execution of Works

Inspection, surveying, and determination of the scope of work shall be performed by the Contractor in the presence of the responsible work manager and submitted for the approval of the Engineer.

The protective coating of concrete surfaces shall be applied using "Sikagard-680S" agent, produced by "SIKA", Switzerland, or using a protective coating of another Manufacturer, but of equivalent or better characteristics, subject to the approval of the Engineer. This is an acrylic-based coating that should be applied in two layers, to obtain a protective film of the mean thickness of 0.23 mm. The application of mentioned layers shall be performed with a special gun.

The application of the coating shall be preceded by the treatment of previously sanded concrete surface with "Sika Mono Top-620" smoothing coat, produced by "SIKA", Switzerland, too, or using a product of another Manufacturer, but of equivalent or better characteristics, subject to the approval of the Engineer. This procedure is necessary for the application of protective coating in order to obtain a completely flat and smooth – skimmed surface. The application of this material shall be performed with usual procedures applied for the skimming of concrete surfaces.

Both above-mentioned products, "Sikagard-680S" and "Sika Mono Top-620", apart from above-mentioned specifications, shall be applied fully in accordance with the Manufacturer's instructions.

Material used for coating shall be durable and resistant to weather conditions, alkaline substances, and aging.

Before applying protective coatings, the concrete surface shall be completely dry, cleaned, and dust-free.

Section 13: Bridges

Measurement and Payment

The quantity to be paid to the Contractor at the agreed unit price given per 1m^2 of the concrete surface protected with the coating, shall be determined based on a protocol on performed works verified and approved by the Engineer.

The agreed unit price shall include all necessary materials, used tools, transport, and work, and necessary working scaffolds for the access to concrete surfaces.



**Section 14
Tunnels**

Contents

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General

The provisions in these Technical Specifications shall be deemed to be integral part of itemized descriptions for each group of works in the Bill of Quantities.

A general description heading each group of works is related to all the items in the group unless otherwise specified.

The Contractor shall also peruse the Design, report and location in order to get a clear picture of the volume and kinds of main and temporary works, transport and transfer to be undertaken in accordance with these Technical Specifications.

If quality of any material in any item is not clearly defined the Contractor shall submit his proposals for the approval of the Engineer.

A unit price for an item of work in the Bill of Quantities shall cover:

- Full completion with all pre-actions, transport and procedures.
- Work, material, waste, joining material, depreciation, levies, fees and other related costs.
- Costs and fees for temporary connections to water supply, sewerage, electricity and telephone systems.
- All necessary mobile, immobile, transport and service scaffolds, fabricated, erected, removed, transported to and from the site. The same applies to temporary facilities.
- Cleaning and maintenance of temporary and service buildings, used during construction.

Setting out shall be performed by the Contractor using previously established benchmarks.

- Provision of unobstructed passage for vehicles and safety of workers during the works.
- Health and safety measures for all persons on site.

Temporary electricity installation

Reflector lighting shall enable safe construction work. Lights might be shadowed if necessary, as to be directed to areas inside construction site and avoid irritation. Lighting inside tunnel shall cover the entire length and shall not be lower than necessary for safe work and approach, meaning at least 100 watts per each 10m of tunnel length.

Alternative energy source and emergency lighting shall be present as to enable indispensable works and safe evacuation on occasion of primary power cut off. Appropriate number of hand lamps shall be also available on key locations within the tunnel.

Air circulation during construction

Tunnel, pits, shafts and bypasses shall be ventilated all the time during excavation as to enable safe work without potentially harmful or explosive gases, dust, and oxygen lack. Contractor shall take all appropriate measures as to create conditions for safe and efficient construction. Contractor shall follow work safety regulations-in-force by all activities. In underground and closed areas the breathing air shall not contain less than 19% oxygen by volume. Smoking is forbidden in tunnels, headings, and pits and in all closed areas. When constructing longer tunnels, where fast natural ventilation would not be possible, any excavation shall not be allowed if a safe ventilation system would not be installed.

All shaft, pit and deep trenches bottoms shall be ventilated by exhaust ventilation system.

Measuring equipment in tunnel shall be suitable for continuous measurement of explosive and harmful gases and oxygen percentage.

The equipment shall alarm by sound and visual signals on explosive or harmful gases presence and on location where oxygen contents would be below the level that is safe for works. Direct and efficient signalisation method shall be placed on surface, i.e. on tunnel portals.

Airflow quantities shall be checked weekly on excavation breast and at 20 m far of shaft bottom and recorded, together with comparison with calculated airflows.

All mistakes shall be corrected. Documents on ventilation shall be filed and presented to Engineer for approval.

On the occasion of ventilation equipment failure, all personnel shall be moved back of underground works, and when tunnelling machine, machine operation shall be stopped immediately and machine shall be isolated till ventilation repair would be complete.

The entrance into underground site where oxygen contents below 19% of the present air volume is forbidden, except for rescue, when protection gear would be mandatory.

Tunnel drainage during construction

The contractor shall supply, install, release to operation and maintain sufficient number of pumps and pipes for water control and drainage out of any underground work section. Water hold shall not be allowed. Capacity of pumps installed at each working breast shall always be at least 1.5 times greater than nominal water in-flow volume, plus quantity for wash out that is used by drilling equipment. Contractor shall provide in good operating condition spare pumps of the same or greater capacity than already installed in tunnel.

Contractor shall supply filters or other decontamination equipment, subject to Engineer's request, before filtered water takes off to environment.

Contractor shall remove all accumulated mud, silt, and other debris remained after underground work, as requested by Engineer. Contractor shall install, maintain and keep operational all necessary devices and facilities for filtering polluted waters that would be taken off on tunnel portals during works. Such devices and facilities shall include two pools for deposit, separator for light liquids, neutralization device and necessary control stations. Neutralization device shall be provided and released in operation as to assure pH value of filtered waters between 6,5 and 8,5 before take-off.

Tunnel shall be drained during works as required by Engineer.

- Upon completion of the works and installations, the Contractor shall, at his own cost remove all temporary facilities, tools, inventories and scaffolds, clean the site, restate any excavated ground. Construction rubble shall also be removed to a place Designated for the purpose and approved by the Engineer.

14.1. Tunnel Excavation**General**

This work shall include all excavations for the construction of a tunnel as stated in the Design, including the transport (i.e. haulage) of excavated material to stock piles for various purposes depending on what the material will be used for.

All excavations shall be performed according to cross-sections, Designed height levels, Designed grades, taking into account required properties for planned used of excavated material, as set out in these Technical Specifications.

Excavation profiles shall be surveyed, recorded and entered in the Measurement Book.

Spacing between surveyed profiles shall not exceed 5 m.

Geological mapping shall be carried out following Engineer's order as to enable rock mass categorizing following the same methodology as specified in Design.

The costs of work interruptions for the purpose of surveys or geological mapping shall be covered by the relevant unit prices.

Owing to specific features of a tunnel structure, a method of "smooth" excavation by blasting shall be consistently applied and advanced blasting methods in particularly delicate cases undertaken (powder explosives or Cardox system).

All blasting shall take place without any harm to already constructed primary lining. The blasting method to be applied shall minimize damage to rock mass and shall produce smooth excavation contours.

The Contractor shall provide Engineer's approval for the blasting technology.

Contractor shall engage qualified and skilful labourers for excavation work.

The regulations governing blasting shall be observed and care exercised in handling, storage, and transport of explosive, as well as in the provision of safety of the surrounding area and workforce.

If, in the course of works, the Engineer and/or Contractor would find out that geological conditions are essentially different from those stated in the forecast geological profile document, based on which the technology of work during excavation was approved. The technology may be changed with Engineer's consent.

This item of works shall include the tunnel excavation in materials of category II-VII according to GN200.

All tunnel excavations are classified into the following categories:

14.1. Excavations in Hard Rock Masses

14.1.1. Tunnel Excavations for Type 3

GN200 - VI, VII

Excavation shall be performed by blasting, opening up the profile in one stage (full profile), with improved safety measures and preceding follow-up, analyses and tests.

Before starting the excavation for this type, it is necessary to specify and submit for the approval of the Engineer the length of boring for blast holes.

14.1.1.1a Tunnel Excavation for Type 4

GN200- V, VI

Excavation shall be performed by blasting and mechanically, by opening up the profile in two stages, with preliminary analyses and tests.

Before starting the excavation for this type, it is necessary to specify and submit for the approval of the Engineer the stages of work.

14.1.2. Excavations in Semi-Hard Hill Masses

14.1.2.1. Tunnel Excavation for Type 5

GN200- IV, V

Excavation shall be performed by blasting and mechanically opening up the profile in several stages with intensive safety measures and prior monitoring, analyses and tests.

Before starting the excavation for this type, it is necessary to specify and submit for the approval of the Engineer, the stages and sub-stages of work for the given type.

14.1.2.2. Tunnel Excavation for Type 6

GN200- III, IV

Excavation shall be performed mechanically, Tunnel with/without invert arch.

Manual picking off and refining, if needed.

Opening up the profile in several stages.

Mandatory prior monitoring, analyses, and tests.

14.1.2.3. Tunnel Excavation for Type 7

GN200 - III

Excavation shall be performed mechanically, Tunnel with invert arch.

Manual refining, if needed.

Opening up the profile in several stages.

Mandatory prior monitoring, analyses, and tests.

Before starting the excavation for any type, it shall be necessary to specify and submit for the approval of the Engineer the stages and sub-stages of work for the given type.

14.1.3. Excavation in Soft Materials

14.1.3.1. Tunnel Excavation for Type 2

GN200- I, II, III

Excavation shall be performed with a tunnel boring machine (TBM), with a shield.

14.1.3.2. Tunnel Excavation for Type 2.1

GN200 II, III

Excavation shall be performed mechanically, the opening up of a profile in several stages, under the protection of a tube shield.

14.1.3.3. Tunnel Excavation for Type 2.2

GN200 II, III

Excavation shall be performed mechanically, the opening up of a profile in several stages, under the protection of a shield made of self-drilling anchor bolts.

14.1.4. Tunnel Excavation in Open Cut

Excavation for tunnel type 1 - Tunnel with strip foundations

Excavation for tunnel type 1a - Tunnel with invert arch

Measurement

Excavation shall be done in conformity with profiles, tunnel types, planned levels and designed gradients, and as approved by the Engineer.

Payment

The quantity to be paid for shall be the excavated rock massifs presented by Design for given types and/or as approved by Engineer. Price shall depend on actual ground category and number of excavated stages within tunnel cross section.

14.2. Primary tunnel lining

The work shall comprise excavated tunnel profile supporting, both locally and globally.

The following elements of preliminary tunnel lining shall be built into excavated tunnel profile:

Shotcrete with mesh reinforcement, anchors and steel ribs.

Primary tunnel lining shall accept and transfer all forces occurring around an excavated tunnel profile.

14.2.1. Mesh reinforcement MA 500/600 placing in shotcrete

The work includes placing MA 500/600 mesh reinforcement over the first layer of shotcrete (about 3.5 cm) sprayed over an excavated profile.

The mesh shall be fixed to shotcrete layer with short anchors $\phi 12$, 0.2-0.3m long, driven into rock massif through the fresh concrete, at 0.5x 0.5 m grid.

Common rules for reinforcement shall apply, subject to inspection and approval by the Engineer.

Sections, spacing, tying and concrete cover dimensions shall be checked and submitted for the approval of the Engineer before placing the reinforcement.

Mesh reinforcement shall be accompanied with the manufacturer's test certificate, which shall be submitted for the approval of the Engineer.

Damage and deformation shall be prevented by adequate organization of transport and storage.

The reinforcement shall be wire brushed to remove dirt and grease, corrosion and other flaws.

Reinforcing steel shall comply with the Rules on technical norms for plain and reinforced concrete (PBA/87), instructions for use and the approved standards:

SRPS C.K6.020 Hot rolled steel, Reinforcing steel, Technical requirements, 1987

SRPS C.K6.120 Hot rolled steel, Reinforcing steel, Shapes and measures, 1986

SRPS U.MI.091 Welded mesh reinforcement for civil works, 1986

The quality of material may also be proved in some other way if so instructed by the Engineer.

Measurement

The quantity to be paid to the Contractor at the contract unit price shall be the number of kilograms of placed mesh reinforcement with tail lengths according to drawings and specifications and as directed and approved by the Engineer.

The Contractor's unit price shall include waste from reinforcement cut, tailoring, overlaps "S" bars.

Payment

Measured quantities shall be paid to the Contractor at contracted unit price, per 1kg of placed mesh and the payment will be full compensation for the volume and contents of the work in this item.

14.2.2. Sn-anchors

The purpose of anchor bolts is to preserve or improve mechanical properties of rock around excavated area and establish an equilibrium of forces in the ground.

To anchor rock massif means to drive metal bars in it, which will strengthen it so that it can take in the stresses that otherwise it would not be able to do for its structure and mechanical characteristics.

Effect of Anchor Bolts

To make an anchor functional it will be necessary to anchor it deep in rock massif and bring it to the intimate contact with.

The anchor part lying on a free rock massif face is called fixing head or outer head or just an anchor head.

Materials: corrugated steel grade 500 or 600 MPa. Anchor plate dimensions 160 x 160 x 10 (12) mm.

Anchor tensile force shall be transferred to surrounding rock by friction of the anchor bar over the entire surface, when embedded in mortar (SN anchor).

The bearing capacity of anchor bar after a period of two hours shall be 50% of the breaking strength. If not, this shall be achieved by adding rapid setting additives to grout.

In the choice of cement mortar (grout) the composition of rock shall be considered.

Unless otherwise defined in the Design, two cubes of grout (15x15x15 cm) for 3-day and 28 day tests shall be taken.

Anchor bearing capacity determination shall take place by tensioning anchor to pullout. If not differently determined by Design, pullout check of anchors shall take place for 3% of anchors driven.

Satisfactory bearing capacity shall be 80kN, unless otherwise specified for some tunnel sections by the Design.

Anchors subjected to much lighter pull-out tests shall be driven once again in the close vicinity of their pull-out points. Unsatisfactory anchor bolts will not be counted in the sum of 3%.

Place, time and location of anchor bolt tests shall be decided by the Engineer.

Anchor bolts shall be monitored (pull-out test) by an accredited institution.

Separate records and protocol of anchors driving, indicating places of driven anchors, anchors length and method of driving and other shall be kept.

A protocol on anchors driving shall be incorporated in the Measurement Book.

Trial anchor driving shall be obligatory. The same is valid for anchors pull-off.

Anchor bearing plates

There are two types:

1. Flat bearing plate with round or oval hole, respectively
2. Arched bearing plate with round or oval hole, respectively

Plates shall be placed on top of a coat of mortar and tightly tightened to rest on it and come into full contact with it.

A PVC hose 10-15 mm dia shall be placed from anchor tip to borehole outlet and protrude by about 50 cm from it. It shall let the air out during grouting and show whether the grout mix fills the area around the anchor body in borehole well.

Before any grouting starts, the borehole top shall be plugged to prevent grout leakage. Then plate with nut shall be fitted and injection started.

Grout mixing

Plastic cementations mixture can be obtained with various additives: hydrophilic and hydrophobic.

Plasticizer shall be fed to the mix in 2% increments of cement mass.

When a most suitable powder additive is chosen during an anchor driving trial, it shall be added to sand mix prior to cement.

Ratio of cement to sand shall be 1:1 (1:2) and it shall be finally defined in situ by a trial and error method, depending on actual site conditions and type of additive.

Addition of water shall depend on the additive as its presence will considerably reduce the required water quantity and make the mixture plastic and liquid, easy for transport.

Water quantity to be added shall be defined experimentally, and water-cement factor shall not exceed W/C = 0.34 to 0.45.

For the purpose of smooth grout transport, maximum sand grain size shall be 2 mm.

The quality of grout shall fulfil the requirements in the following standards:

SRPS U E3.015	Grouts for grouting.
SRPS U MR.027	Grouting: Testing of compressive strength of grout.
SRPS U MS.023	Grouting: Testing of bleeding and volumetric changes of grout.
SRPS U MS.024	Grouting: Test of flow of grout.

Measurement

The contracted unit price shall cover all material, work, work force, tools, accessories and labour, as well as the quality control of driven anchor bolts (pull-out tests) as approved by the Engineer.

Payment

Payment to the Contractor shall be made at unit contract price per each anchor of appropriate diameter and length.

Following anchor types may be used for stabilization of tunnel excavation:

14.2.2.2 IBO -anchors

IBO -anchor is a steel pipe with outside round thread that have boring crown at one end, and the other end an appropriate nut and bearing plate. IBO -anchors may be united (elongated) by couplings with inside thread.

IBO -anchors shall possess declared limit force of unit: shank + nut + bearing plate (for instance 250 kN). Coupling shall have the same bearing capacity as the unit above. Anchors shall be usually manufactured of steel as per SRPS C B0.500 or of stainless tubes as per SRPS C BS.021.

Contractor shall present to Engineer for approval the proof of shank + nut + bearing plate unit bearing capacity, as well as for anchor couplings.

IBO -anchors shall be used when efficient bar -anchors placing of other type would be impossible. IBO -anchors shall be placed by driving the bar into the ground without pulling. Grout, grouting pressure and grout quantity shall be determined by Contractor, depending on ground conditions and in conformity with anchor manufacturer instructions. Placing procedure shall be approved by Engineer.

Payment

Payment for IBO -anchors shall be by one piece for different types and lengths. Drilling and grouting shall not be paid separately. Auxiliary materials as bearing plates, anchor plates, nuts, couplings, shall not be paid separately, but these shall be incorporated in contract unit price.

14.2.2.3 Swellex -anchors

"Standard" Swellex -anchors may be used for local anchoring and rock anchoring during construction.

Front plates of anchor shall enable good contact and anchor force sure transfer to shorerete: steel arch or rock surface.

Boring holes shall be drilled to the required depths. The hole shall be cleaned of all boring remnants, mud and debris. Latest time for anchor placing shall be two hours after drilling.

Anchor placing and swelling shall take place in conformity with manufacturer suggestions. Equipment for swelling shall be as proposed by manufacturer.

Anchors shall be drained after swelling.

Payment

Payment for Swellex -anchors shall be by one piece for different types and lengths. Drilling, grouting and swelling shall not be paid separately. Auxiliary materials as bearing plates, anchor plates, nuts, couplings, shall not be paid separately, but shall be incorporated in contract unit price. The contract unit price shall include all labour, equipment and materials for construction and work completion, testing and quality control.

14.2.3. Protection of excavated profile with jet (spray) concrete class MMb30

General technical specifications, Sub-Sections related to shorerete: 8.3.5.3, 8.3.5.4, and special requirements for jet (spray) concrete shall apply.

The granulometric composition of aggregate shall fall within the following limit ranges:

Grain size A - 0.15 - 9.50 mm

Grain size B - 0.15 - 12.50 mm

Grain size C - 0.20 - 5.00 mm for finishing treatment

Ø 0 - 0.2 mm - 15%

Ø 0.2 - 1.0 mm - 25%

Ø 1.0 - 3.0 mm - 35%

Ø 3.0 - 5.0 mm - 25%

The specified limit ranges for grain size may be revised, if proven justified by experimental tests through the concrete Design and subject to the approval of the Engineer.

Admixtures for Spray (Jet) Concrete

Admixtures shall meet requirements from SRPS U.E3.011 and the Rules for plain and reinforced concrete, and special requirements from these Rules. The usage of accelerators is envisaged, and plasticizers may also be used. Accelerators should meet two requirements: setting time, and hardening rank. The sprayed mix that contains an accelerator shall start setting immediately (within 1 minute at latest), and finish setting in 10 hours at most, after leaving the mixer.

The compressive strength of sprayed concrete that contains an accelerator (unless otherwise specified in the Design) shall be at least 5.0 MPa, after 6 hours.

All admixtures shall be checked during test spraying, and may be applied only if the test spraying gave positive results. If admixtures are in liquid state, they shall be batched through water injected into the nozzle. If admixtures are powders, they shall be batched into a dry mix. Admixtures are added and selected so that their action does not start before they leave the nozzle.

Preliminary Tests and Proofs

Contractor shall submit to Engineer for approval the programme of preliminary tests according to requirements from the Design. During preliminary tests, all components of concrete and equipment shall be included in the tests, and all properties of finished concrete specified in the Design shall be proved. These tests shall form a basis to prepare a mix for shotcrete. Test shotcrete shall be considered necessary. Concrete test surfaces shall serve to check personnel and equipment. Hardened concrete shall later be subjected to core testing.

If accelerators would be used, it is necessary to prove the strength of concrete at 6, 12, 24 hours, and then 3, 7, and 28 days. If accelerators would not be used, the strength of concrete shall be proved at 7 and 28 days. Concrete class shall be defined by a 20 cm cube. The final approval of a planned mix shall be issued after completed testing of all properties specified in the Design. The Engineer shall issue the approval in writing, through the Site Log.

The control testing procedure shall include the properties of sprayed concrete in a freshly hardened state and in a hardened condition, as specified in the Design. The testing of sprayed concrete in a fresh state shall be performed at least once at every 50 - 70 m³ of sprayed concrete. The testing of sprayed concrete in a hardened condition shall be carried out on cylinders, D: 12.5mm in diameter, on a series of three cylinders taken at every 50 m³ of placed sprayed concrete. The mean strength of three successively tested samples shall be higher or equal to the specified class of concrete. Each particular result shall not be less than 90% of the specified class of sprayed concrete. Compressive strength shall be tested according to SIH NORM 162/66. Tensile strength shall be tested on the same samples as for compressive strength, applying the so-called Brazilian method.

If, due to a thicker lining, the shotcrete would be applied in several layers, it is necessary to take care that a new layer is applied immediately after the bottom layer has set, not on an already hardened layer.

Measurement

The thickness of lining shall be defined by Design depending on rock properties.

Depending on rock properties, the Contractor shall foresee appropriately larger dimensions of excavations, in order to ensure, due to related rock deformations, the necessary space around the excavation for a shotcrete lining, within the limits specified in the Design.

All expense of additional excavation and protection of a needed profile shall be borne by the Contractor and be included in the unit prices.

Payment

The Contractor shall be paid at the contract price per m³ of placed shotcrete, in specified and approved thickness.

14.2.5. Protection of excavated profile with ribs.

Steel ribs constitute one of construction methods for rock stabilization around excavation. Their role is to facilitate protection of workers from unexpected collapse of ground from arch and sides. A combination of ribs and anchors, mesh and shotcrete forms a skeleton that prevents rock mass from deforming in the direction of the profile bored. Ribs shall be of high-grade steel, mostly bell-shaped U-beam section or lattice. They may have another form if a calculation proves that their bearing capacity, spacing and support are satisfactory. Ribs shall be joined in the way that fully preserves the arch static. Ribs shall be supported in all points of their circumference. Voids, if any, shall be filled with concrete mix as directed by the Engineer.

Measurement

Measurement shall be done by considering the theoretical weight of profile with the circumference that must be covered by a steel arch, as approved by the Engineer.

The unit price shall cover labour, overlaps, connections, bonding material and all required stiffeners.

If horizontal or tilted stiffeners are needed to tie ribs, then the weight of these selected stiffening sections shall be measured and paid at the same quoted prices and under the same conditions as support arched-ribs where approved by the Engineer.

Payment

Payment to the Contractor will be made at the unit price per kg of fixed rib.

14.2.6. Improvement of Mechanical Properties of Hill Mass - "Jet-Grouting"

JET GROUTING is a comprehensive and efficient soil stabilization technique applied in most diverse building conditions. The essence of this technology lies in the use of a jet of cement and water that, under pressure, break the ground and become mixed together "in situ". A conglomerate made of the ground and cement is formed in this way, with its characteristics being considerable strength and low water-permeability.

This procedure shall be applied for all ground types, including clay, dust, sand, and gravel, or their various combinations.

According to experiences to date, the depth where "JET GROUTING" may be applied is 60-70 m.

During the works execution, the procedure does not cause harmful vibrations. It does not require large working space. It is safe for labourers and equipment. The works might be executed next to structures in operation, without any consequences for their operation and existence.

Description of Procedure

The jet grouting procedure consists in the formation of a borehole in the ground with a specified diameter and depth. After drilling completion, a rotary drilling rod with nozzles, shall disperse stabilizing mass under pressure, when the ground structure becomes eroded and these two substances – the stabilizing solution and the eroded ground – mix together forming a new substance, mix of bonding material and ground.

There are four possible types of "JET GROUTING" depending on the type of soil to be eroded and the design of working machine, and these are:

Single fluid system

Triple fluid system

Double fluid system

Super "JET GROUTING" system

The single fluid "JET GROUTING" system is the one where the applied stabilizer serves both to erode the structure of soil and to form the mix with soil. The stabilizer is pumped into the soil under high pressure through a drilling rod with a set of nozzles located above the drill bit. Due to a high rotation speed (10-30 rpm) and high grouting pressure (20-60 MPa), a column is formed from the improved soil. Based on international experience, column diameters are within the range from 40 to 120 cm.

The triple fluid "JET GROUTING" system differs from the single fluid system in that, to erode the structure of original soil in the depth, this system uses, instead of stabilizer, water under pressure whose action is enhanced with compressed air molecules concentrated around the water jet. Compressed air extends the action of water jet. When drilling to designed depth is complete, the stabilizer is dispersed through a special nozzle, while lifting the rod.

The double fluid "JET GROUTING" procedure is the procedure that makes a combination with one and three fluids. Namely, the working method is the same as that of the single fluid procedure, but compressed air is added in the synergy with cementitious solution jet. This procedure achieves a two times faster erosion of soil structure. This procedure gives stabilized columns of 1.00 – 1.80 m in diameter, depending on the soil type.

The super "JET GROUTING" procedure is a modification of the double fluid system. A cementitious solution, as a stabilizer, and compressed air are pumped through special chambers in the drilling equipment.

To strengthen the soil and cement combined column created by "JET GROUTING", one steel reinforcing bar, diameter 25-32 cm, RA or GA 400/500 steel grade, may be driven through the middle of column immediately after completing the jet grouting procedure, while cement has not started setting yet.

Materials

Basic factors that serve to create columns (piles) by "JET GROUTING" are: natural formations of clayey, silty, sandy, or gravelly soils, or their mixes. Eroded soil and the stabilizing compound made from water and cement, with or without any admixture, become mixed mechanically to produce the soil, with better mechanical properties. The stabilizing mix composition depends on the soil type, size of soil grains, and natural moisture. Based on the required column strength, constructed by "JET GROUTING", the cement quantity for 1 m³ of the mix of soil and cement shall be defined.

It is possible to use any stabilizer for grouting; the most often used are water-cement mixes. To achieve the soil impermeability, the most often used grout is the one made by mixing cement, water, and bentonite.

To achieve the desired effect of quality for columns, it is very important to determine the water-cement ratio. A higher water-cement ratio will produce a higher plasticity of the cement-water compound, but the ultimate compressive strength is lower.

The cement contents in the stabilized soil column plays a significant role. A higher content of cement will produce higher deformation-resistant columns properties, but the time of treatment is increased.

The higher grout pumping pressure, the spreading energy will be greater, i.e. the faster soil structure eroding. Higher pressure will not result with wider column.

Piles constructed by "JET GROUTING" procedure may be constructed individually or in groups. When they are in groups, they may be spaced or in contact. They may be in one or more rows, depending on the Design solution.

Equipment

To perform grouting by the "JET GROUTING" procedure, the Contractor shall possess equipment depending on the type of "JET GROUTING" procedure. In general, the required equipment shall cover:

A drilling rig, with a special drill rod and a timer to control the rod retrieval speed (20-50 cm/min), a nozzle support for stabilizing material.

A high-capacity pump for high-pressure water jet (70 MPa, 300l/min).

A pump for low-pressure stabilizer (7MPa, 120l/min).

A grout batcher.

A water tank.

Quality Control

To apply effectively the soil stabilization "JET GROUTING" procedure, it is necessary to conduct preliminary controls ("preliminary test"). Control of work shall be carried out after operation completion.

- Preliminary tests

Preliminary tests shall be agreed with Engineer before routine operations commencement. When constructing the columns, it is necessary to test equipment and work procedure, to obtain the designed diameter and required compressive strength of the columns. For that purpose, it is necessary to test pressure under which the cement stabilizer, compressed air, and water are pumped out.

Also, the testing of rod retrieval speed shall serve to determine the diameter of grouted column. The amount of cement per 1m³ of the constructed grouted column shall be tested in order to obtain the Designed strength.

- Tests during works

In the course of construction of stabilized piles it is necessary to collect real data and surveys (computer monitoring) on the entire grouting operation, which will then serve to get important data on the time and depth of grouting. This will help in creating necessary documents for each column separately, and in checking whether the columns are constructed according to the Design.

- Follow-up tests

This testing phase includes the laboratory tests of specimens taken in situ from hardened columns for the reached strength and bulk density, and the control of achieved diameter of columns by inclined boring.

All testing shall be completed to the satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

Remedial measures shall be taken on the parts of piles where there is any variation with respect to the Design and as directed and approved by the Engineer.

Measurement

Actually constructed columns (stiffening) applying the "JET GROUTING" procedure shall be measured in m³ as approved by the Engineer.

Payment

The measured condition of actually constructed columns (stiffening) applying the "JET GROUTING" procedure shall be paid at the agreed price given for 1 m³ of performed and approved works.

14.2.7 Pipe Shield (Pipe Umbrella)

Pipe roofing (umbrella) is composed of steel pipes that are placed with tunnel vault (calotte). It is applied with materials where initial stability of underground opening is not present (and very feeble rock mass). The purpose is to enable excavation of upper tunnel half avoiding the necessity for opening development within the zone.

Perforated steel weldless pipes with outer diameter 114.3 mm (4") and wall thickness 5 mm at least. The steel shall be Č1213 as per standard SRPS C. B5.021.

Pipe roofing shall be placed as presented with drawings in Design, or as instructed by Engineer.

Steel pipes shall be placed simultaneously with boring in the way that central or eccentric crown pulls behind the pipe into borehole.

Steel pipes shall be placed from the driving front towards non-excavated ground. In non-stable boreholes steel pipes may be used as borehole formwork. The distance between steel pipes in excavation profile apex shall conform to the distance presented in drawings, but also adapted to geologic conditions on tunnel front.

Steel pipes shall be cleaned after boring by compressed air before grouting. The grouting shall be carried out under low pressure.

Payment

Pipe shield shall be paid by number of drilled and grouted pipe of real length or otherwise, as directed by Engineer.

14.2.8 Micro Piles

Micro piles shall be placed in base of upper galleries with shallow layer zones and/or under houses. Micro piles transfer loads from shotcrete structure to surrounding rock massif, reducing that way shotcrete structure settlements in upper gallery, and shear risk between upper gallery structure and temporary invert arch. Simultaneously they increase sidewalls safety during bench excavation.

Micro pile is composed of weldless steel pipe with wall thickness at least 6 mm. Steel pipe shall be completely grouted by mortar. Borehole diameter shall conform to external pile diameter.

Steel grade for pipe shall be determined by Design, in conformity with standard SRPS C.B5.02. IBO anchors may be used for micro piles.

Steel pipes shall be placed in previously bored holes or self-drilling anchors might be used (for instance, IBO). Corrugated pipe of steel or PVC with internal diameter 70 mm or more shall be placed in shotcrete lining as to ease boring.

Tests are necessary before placing, as to prove that steel piles are completely covered by mortar. The number of piles tested and testing procedure shall be proposed by Contractor and shall be approved by Engineer.

Payment

Micro piles shall be paid by piece for different type and length.

14.2.9 Steel Pipes or Spears

Steel pipes or spears are safety elements that are placed before any excavation work. They shall be applied when rock and earth material condition might demonstrate tendency to resist with over-profile excavation, fall down or material impact immediately after excavation.

Welded steel pipe of nominal diameter 42.4 mm and 48.3 mm shall be used. Wall thickness shall be at least 3 mm. The length of steel pipes/spears shall be at least 1.0 m longer than estimated excavation stage. Pipe steel quality shall conform to SRPS C.B5.025.

Spears of deformed steel bars might be used instead steel pipes. The minimal spear diameter shall be 25 mm. Steel pipes or spears shall be placed into prior bored holes. Pipe filling by mortar before or after pipe placing, shall be determined by Contractor, as agreed with Engineer.

Payment

Pipes or spears shall be paid by piece, for different length. Boring and grouting shall not be paid separately. The Contract Unit Price shall include all labour, equipment and materials, as necessary for construction and work completion, testing and quality control.

14.3 Concrete and Reinforced Concrete

General Conditions and Special Provisions from these Technical Specifications, Section K, shall be in force.

14.3.1 Placing concrete in Footing of Primary Lining.

The description of works refers to the footing of primary lining for Type I.

The work shall be executed in one-sided formwork.

The foundation pit shall be protected against all types of water during placing concrete and concrete setting.

Concrete shall meet the Design requirements regarding grade, resistance to water absorption, frost, and salt.

The concrete placing may start when the Engineer inspects and approves the reinforcement put in place.

Concrete shall be placed in 30 cm high layer and compacted with an immersion vibrator.

The Engineer will not allow concreting if the Contractor does not have at least one functional STAND-BY immersion vibrator at his disposal.

Concrete shall be mixed mechanically.

Transport shall be organized in such way to ensure the homogeneity of mix and prevent segregation.

Concrete shall be placed before the setting process starts.

The type of checks and tests according to the prepared and accepted concrete Design shall be submitted for the approval of the Engineer.

All testing shall be completed to the satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

Measurement

The quantity to be paid is the number of cubic meters of placed concrete, measured on site and approved by the Engineer.

Payment

The quantities determined in the above-described way shall be paid at Contract Unit Prices stated for respective units of measurement, and the unit prices shall make a full compensation for all work on the procurement, transport, placement, and curing of concrete, and any pumping of water out of the foundation pit.

14.3.2 Reinforcing Footing of Primary Lining, P.A. 400/500, M.A. 500/560

The work under this item includes the reinforcement of footing of the primary lining.

General specifications for reinforcing steel shall apply.

Before making the reinforcement, the Engineer shall check the number of rods, spacing, tying method, and thickness of cover.

Reinforcing rods (mesh reinforcement) shall be provided with the Manufacturer's compliance certificates which shall be submitted for the approval of the Engineer.

Transport and storage shall be organized in such a way to avoid any damage and deformation.

Before fixing reinforcing steel, it shall be cleaned from any dirt and grease, corrosion, and any other damage.

Reinforcing steel shall be in compliance with the Rules on technical norms for plain and reinforced concrete (PBAB/87), instructions for use, and related standards:

SRPS C.K6.020 Hot rolled steel, Reinforcing steel, Technical requirements, 1987

SRPS C.K6.120 Hot rolled steel, Reinforcing steel, Shape and dimensions, 1986

The grade of material shall be proved in other ways as well, if so agreed and instructed by the Engineer.

Measurement

The quantity to be paid to the Contractor at the agreed unit price is the number of kilograms of placed reinforcing steel, as shown on drawings and stated in specifications, i.e., reinforcement schedules, i.e., as determined and approved by the Engineer.

The Contractor shall include in the unit price for reinforcing steel, waste that he will have in cutting and bending reinforcing steel, overlaps, and "S" steel pieces.

Payment

For the quantities determined in this way, the Contractor will be paid at the Contract Unit Price (for 1 kg) that makes a full compensation for the scope and contents of works given under this item.

14.3.3 Placing Concrete in Primary Lining – open Cut

The tunnel structure completed shall be post-filled by chosen excavation material (crushed material and stone pieces < 130mm).

Placing concrete shall take place in double-sided formwork.

The tunnel arch construction shall be concreted under steel formwork on a mobile platform in 6.0m rings. The formwork Design and the Design of working platform with sliding technology are necessary and shall be provided by the Contractor, and submitted for approval by the Engineer and Designer.

Before starting the concreting of lining, the Contractor shall submit to the Engineer for approval, certificates on proper functioning and quality of all elements for the execution of this type of works (certificate on suitability of formwork, scaffolds, certificate on required functioning of external or immersion vibrators).

Certificates shall be issued by an authorized institution for this type of works.

The quality of formwork shall be such that concrete is left with a smooth surface after its removal.

The rings shall be joined with a tongue-and-groove system, or by overlapping of longitudinally positioned reinforcing steel, 1.20 m in length, or in any other way agreed with the Engineer.

Formwork shall be coated with appropriate agents for easy release from concrete. The release agent shall have the compliance certificate issued by an authorized laboratory.

Formwork shall have horizontal, vertical, and diagonal braces to prevent any deformation.

Material used to joint concrete shall have appropriate certificates for this type of work.

The Concrete DESIGN, prepared by the Contractor, and approved by the Engineer, shall define all operations in time and space (formwork removal time, time and method of curing and protection of concrete, appearance of visible surfaces...)

The placement of concrete shall start only when the Engineer approves formwork, scaffolds, reinforcing steel.

General technical requirements for plain and reinforced concrete shall be met in full.

Measurement

The quantity to be paid is the number of cubic meters (m³) of placed concrete, measured on site and approved by the Engineer.

Payment

The quantities determined in the above-described way shall be paid at agreed unit prices stated for respective units of measurement, and the unit prices shall make a full compensation for all work on the procurement, transport, placement, and curing of concrete, scaffolds, and formwork.

14.3.4 Reinforcing of Primary Tunnel Lining

General specifications for reinforcing steel

The works included in this Sub-Section of Technical Specifications consists of the procurement of plants, equipment, material, and labour, and the execution of all operations related to reinforcing steel, in conformity with Conditions of Contract, and in full compliance with this Sub-Section of the Technical Specifications, drawings, and the Engineer's instructions.

Reinforcing steel shall be in compliance with the rules on technical norms for plain and reinforced concrete (PBAB/87), instructions for use, and related standards:

SRPS C K6 020 Hot rolled steel, Reinforcing steel, Technical requirements, 1987

SRPS C K6 120 Hot rolled steel, Reinforcing steel, Shape and dimensions, 1986

SRPS U M1 091 Welded mesh reinforcement for construction, 1986

The quality of material shall be proven in another way as well, if so agreed and instructed by the Engineer.

All reinforcing steel shall be put in place according to drawings from graphical documents of this Design. The Designed concrete cover requirements shall be met. A gap, at least 3.5-4.0 cm, shall be left between profiles for proper placement of concrete.

The Contractor shall tie wires around all intersected reinforcing bars to ensure that their position is not disturbed during concreting.

The placement of pieces of gravel or rock between formwork and reinforcing cages is forbidden. "S" steel pieces shall be used to accurately place and space reinforcement.

If there is no detailed reinforcement drawing for any item of works, the Contractor shall prepare and submit it to the Engineer for approval before putting the reinforcement in place.

Concreting shall start when the Engineer approves the implemented arrangement of reinforcing cages in writing.

For reinforcing concrete structures and elements, wires and rods made of smooth steel, G.A., 240/360, high-strength naturally hard ribbed steels, grade 400/500, and welded mesh reinforcement made of cold drawn wire, grade 500/600, shall be used.

Before putting reinforcing steel in place, the Contractor shall submit to the Engineer for approval a quality certificate for procured reinforcing steel.

The certificate shall be issued by an institution authorized for this type of works.

Reinforcing steel shall be protected against damage at all times, be free from dust, loose flakes and rust, paint, oils, or other foreign materials.

Reinforcing rods shall be cut and bent carefully by a qualified person. They shall be bent in cold according to pattern, and shall not vary noticeably from shape and dimensions shown on drawings.

Measurement

The quantity to be paid to the Contractor at the agreed unit price is the number of kilograms (kg) of placed reinforcing steel, as shown on drawings and stated in specifications, i.e. reinforcement schedules, i.e. as determined and approved by the Engineer.

The Contractor shall include in the unit price for reinforcing steel, waste that he will have in cutting and bending reinforcing steel, and "S" steel pieces.

Payment

For the quantities determined in this way, the Contractor will be paid at the agreed unit price (for 1 kg) that makes a full compensation for the scope and contents of works given under this item.

14.3.5 Concrete Placing in Footing of Secondary Lining MB35, VR, M100

Everything as specified for Sub-Section 14.3.1 shall apply.

14.3.6 Reinforcing Footing of Secondary Lining, R.A. 400/500, M.A. 500/560

Everything as specified for Sub-Section 14.3.2 shall apply.

14.3.7 Concreting Secondary Lining

Concrete shall be placed in one-sided formwork.

The tunnel arch construction shall be concreted under steel formwork on a mobile platform in 6.0m rises. The formwork Design and the Design of working platform with sliding technology are necessary and shall be provided by the Contractor, and submitted for approval by the Engineer and Designer.

Since these are exposed surfaces, formwork shall also be fabricated for that purpose, in order to leave, after its removal, a flat concrete surface, visually regular arched lines, and even texture of concrete.

The placement of concrete may start only when the Engineer approves formwork, scaffolds, and reinforcing steel.

Concrete shall be placed in 40 cm high layers, and compacted with immersion vibrators.

General technical specifications for plain and reinforced concrete shall be fully complied with.

Measurement

The quantity to be paid is the number of cubic metres of placed concrete, measured on site and approved by the Engineer.

Payment

The quantities determined in the above-described way shall be paid at agreed unit prices stated for respective units of measurement, and the unit prices shall make a full compensation for all work on the procurement, transport, placement, and curing of concrete, scaffolds, and formwork.

14.3.8 Reinforcing Secondary Lining, R.A. 400/500, M.A. 500/560

Everything as specified for Sub-Section 14.3.4 shall apply.

14.3.9 Concreting Precast Round Segments of Tunnel Lining MB40, VR, M100

Tolerance with segment dimensions shall be 0.2 mm.

General technical specifications for plain and reinforced concrete shall be fully complied with.

Specifications from Sub-Sections 8.3.6, 8.3.6.1-8.3.6.1.5 Precast Concrete Elements shall be fully complied with.

Specifications from Sub-Section 8.10 shall be complied with.

14.3.10 Reinforcing Precast Round Segments of Tunnel Lining, R.A. 400/500, M.A. 500/560

Everything as specified for Sub-Section 14.3.4 shall apply.

Sub-Sections 8.3.6.1-8.3.6.1.5, and Sub-Section 8.10 of these Technical Specifications shall be fully complied with.

14.3.11 Concreting Footing of Tunnel Refuges, MB35, VR, M100

Everything as specified for Sub-Section 14.3.1 shall apply.

14.3.12 Reinforcing Footing of Refuges, R.A. 400/500, M.A. 500/560

Everything as specified for Sub-Section 14.3.2 shall apply.

14.3.13 Concrete Secondary Lining in Refuges MB35, V8, M100

Concrete shall be performed in one-sided formwork.

The formwork Design is necessary and shall be provided by the Contractor, and submitted for approval by the Engineer and Designer.

Since these are exposed surfaces, formwork shall also be fabricated for that purpose, in order to leave, after its removal, a flat concrete surface, visually regular, arched or straight lines, and even texture of concrete.

The placement of concrete may start only when the Engineer approves formwork and reinforcing steel.

Concrete shall be placed in 30 cm high layers and compacted with vibrations, and then the procedure shall be repeated in agreement with the Engineer.

General technical specifications for plain and reinforced concrete shall be fully complied with.

Measurement

The quantity to be paid is the number of cubic metres of placed concrete, measured on site and approved by the Engineer.

Payment

The quantities determined in the above-described way shall be paid at agreed unit prices stated for respective units of measurement, and the unit prices shall make a full compensation for all work on the procurement, transport, placement, and curing of concrete, scaffolds, and formwork.

14.3.14 Reinforcing Secondary Lining of Refuges, R.A. 400/500, M.A. 500/560

Everything as specified for Sub-Section 14.3.4 shall apply.

14.3.15 Concrete of Channel Segments under Service Paths MB35, V8, M100

These precast elements shall be tied (fixed) with reinforcing steel to the adjacent reinforced concrete elements. The way to perform such tying up shall be agreed with the Engineer.

General technical specifications for plain and reinforced concrete shall be fully complied with.

Specifications from Sub-Sections 8.3.6.1-8.3.6.1.5 Precast Concrete Elements shall be fully complied with.

Specifications from Sub-Section 8.10 shall be complied with.

14.3.16 Concrete of Round Shaft for Reception of External Drainage Water

Concrete shall be placed in two-sided formwork. Concrete shall be placed in 20 cm high layers, and compacted with immersion vibrators.

General technical specifications for plain and reinforced concrete shall be fully complied with.

14.3.17 Concrete of Shaft for Reception of External Drainage Water behind Secondary Lining

Concrete shall be placed in single-sided formwork.

Precast shafts might be used also, if all necessary conditions are fulfilled (constant longitudinal gradient and cross fall in tunnel).

Everything as specified for Sub-Section 14.3.16 shall apply.

14.3.18 Plain Concrete under Foundations, Invert Arch, Channels, and Other Reinforced Concrete Structures

General specifications for concrete shall apply.

The foundation pit shall be protected against all types of water during placing concrete and concrete setting processes.

Concrete shall comply with the Design requirements regarding the class.

The placement of concrete may start after the Engineer approves the excavated foundation pit.

Concrete shall be placed in 10-30 cm high layers (depending on the overall height of plain concrete) and shall be compacted with an immersion vibrator.

Measurement

The quantity to be paid is the number of cubic meters of placed concrete, measured on site and approved by the Engineer.

Payment

The quantities determined in the above-described way shall be paid at agreed unit prices stated for respective units of measurement, and the unit prices shall make a full compensation for all work on the procurement, transport, placement, and curing of concrete, and any pumping of water out of the foundation pit.

14.3.19 Concrete above Drainage Pipes, MB10

This item of works refers to concrete around and above drainage pipes.

The description of works is in compliance with General Specifications for concrete works within these Technical Specifications.

Measurement

The quantity to be paid is the number of cubic meters of concrete of grade MB10, fully completed and approved by the Engineer.

When calculating quantities for payment, the Designed dimensions shall be used, or the Engineer's instructions shall be followed.

If concrete reaches a higher grade, only the required grade shall be recognized for payment.

Payment

The quantities determined in the above-described way shall be paid at agreed unit prices stated for respective units of measurement, and the unit prices shall make a full compensation for all material, work, and use of machines, equipment, and tools.

14.4. Waterproofing

14.4.1. General Characteristics of Waterproofing Membrane

Waterproofing for tunnel structure shall be done with new technology materials, which will come with test certificates issued by accredited institutions in EU and submitted for the approval of the Engineer.

Such materials shall be supplied with quality attest issued by accredited institutions in Serbia.

Quality testing of such materials shall take place on specimens taken from batch, delivered for use on site.

For tunnel structure waterproofing might be used prefabricated materials (bitumen-based membranes, PVC or polyethylene - HDPE or LDPE membranes), or sprayed waterproofing materials

Waterproofing membrane shall be: d) 1.5 mm, 2.0 mm, 2.50 mm

Minimum general properties that a watertight membrane shall meet are:

1. Bubble-free exposed surfaces
2. Extension - stretch - 200%
3. Outer exposed surface without scratches and pits.
4. Frost resistance: no fissures when rolled ($\varnothing 20\text{mm}$), -20°C
5. 6-hour temperature stability at 80°C (no surface changes or discolouring).
6. Breaking strength tested in two directions $>15\text{N/mm}^2$.
7. 72-hour long water tightness property at 4 bar pressure

The waterproofing membrane shall be made of thermoplastic polyolefins (low density polyethylene) and be highly flexible.

It shall be easy for welding, of good mechanical characteristics, provided with signal tape.

The membrane must contain polymer antioxidant and thermal stabilizers.

The product shall not contain plasticizers and fillers that may migrate with time.

The product must satisfy fire fighting requirements according to DIN 4102 standard

Special requirements for technical characteristics of a waterproofing membrane are summarised in the following table:-

Waterproof membrane characteristics -LDPE

Surface		Smooth		
	Tested properties	Unit	Test method	Value
	Density (white)	g/cm ³	ASTM D 792 UNE EN ISO 1183-1	0.900-0,920
	Density of geomembrane	g/cm ³	ASTM D 792 UNE EN ISO 1183-1	0.910-0,930
	Flow index during melting	g/10min	ASTM D 1238, 1905.00-1902.16 UNE-EN ISO 1133, 1905.00-1902.16	≤2,5 - ≤0.7 ≤2,5 - ≤0.7
	Soot content	%	ASTM D 218	0,2-0,3
	Dispersion		ASTM D 596	A1 / A2
	Soot content		UNE 53131	≤4
	Oxidation induction time	min	ASTM D 3895	
	Resistance to cracking under strain	h	ASTM D 1683 ASTM D 5397	> 3000 > 300
	Resistance to ozone		ASTM D 1149: 7d 100 ppin UNE 104302	No cracks [no cracks]
	Brittleness at low temperatures		UNE-EN ISO 62	≤0,1
	Water absorption	%	UNE-EN ISO 62	≤0,1
	Coefficient of longitudinal thermal expansion (0*(n=4))	1/°C	ASTM D 696	-
	Dielectric constant		ASTM D1248	-
	Unevenness	mm	GR1 GM12	-
	Coextruded layer thickness	%		≤50
	Self-destruction	-	DIN 4102	B1/B2

Waterproofing membrane characteristics and properties-LDPE

Tested properties	Unit	Tested test method	Value		
Thickness	mm	ASTM D 751 UNE 53213-2	1,5	2,0	2,5
Tolerance	%			±4	
Tensioning properties					
Breaking tension force	N/mm	ASTM D 638 Type IV			
Breaking elongation	%				
Limit tension force	N/mm	UNE-EN ISO 527 Type V	35(33)	46(44)	58(55)
Limit elongation	%		800-900 (-800)		
Cleavage resistance	N	UNE 53516 ISO 34-1	100(96)	134(128)	167(160)
CBR	kN	UNE-EN ISO 12236	2,2	3,0	3,7
Strength of short duration	-	UNE-EN ISO 868	40(38)		
Stability of dimensions	%	ASTM D 1204(1h, 80°C) UNE 104302(1h, 80°C)	±2		

Physical and mechanical properties of thermoplastic PVC foil			
Property		Requirement	Testing method
Evenness - maximum		50 mm	DIN 16726
Breaking strength (longitudinal and transversal) - minimum		10 N/mm ²	DIN EN ISO 527-3
Tensile (longitudinal and transversal) - minimum		200%	DIN EN ISO 527-3
Shearing test		Cracking outside joints	DIN EN ISO 527-3
Water pressure, at 5.0 Bars- 72 hours		Impermeable	DIN 16726
Punching resistance: at 750 mm high		Impermeable	DIN 16726
Bending at low temperatures		No cracks identified	DIN 16726
Behaviour after being exposed to 80° C	Visual evaluation	No bubbles identified	
	Change in sizes (longitudinal and transversal) - maximum	3%	DIN 16726
	Change of tensile strength (longitudinal and transversal) - maximum	± 20%	DIN 16726 DIN EN ISO 527-3
	Change of elongation (longitudinal and transversal) - maximum	± 20% (rel.)	DIN 16726 DIN EN ISO 527-3
	Bending at low temperatures	No cracks identified	DIN 16726
Behaviour after being treated with water solutions	Change of tensile strength (longitudinal and transversal) - maximum	± 20%	DIN 16726 DIN EN ISO 527-3
	Change of elongation (longitudinal and transversal) - maximum	± 20% (rel.)	DIN 16726 DIN EN ISO 527-3
	Bending at low temperatures		DIN 16726

14.4.2. Waterproofing in Open Cut Parts of Tunnel

Waterproofing membrane shall be placed.

1. On outer side of tunnel structure in open cut

The base on which waterproofing membrane should be placed must be prepared first. Preparation shall comprise all unevenness removal sharp edges, pots, etc. Surface shall be clean, without any cement, oil, lime traces, or other impurities. Waterproofing shall be properly protected against any possible mechanical damage during tunnel structure fill.

Inside tunnel structure in open cut

2. On inner side of tunnel structure in open cut

In such case the waterproofing shall be between primary tunnel structure, constructed in open cut, and secondary lining. Waterproofing shall be placed same way as in underground constructed tunnel section (Bored Parts).

14.4.3. Waterproofing of Bored Parts of Tunnel

For bored parts of the tunnel, the membrane shall be placed over the primary tunnel support, but only when determined that the tunnel profile achieved the state of equilibrium with surrounding hill mass.

Between jet concrete and membrane, geotextile shall be placed (300 gr/m²) as a protective base for the waterproofing membrane. This geotextile also plays the role of a filtration layer.

Then, round plastic discs with steel nails shall be hammered.

The waterproofing membrane shall be welded to the base over plastic discs with hot air, using a wedge machine specifically designed for this purpose.

This membrane shall have a certificate issued by recognized international and national authorized institutions, specialized for this type of works and submitted for the approval of the Engineer.

This waterproofing membrane is practically sandwiched between the primary and secondary tunnel linings and conducts water from rock mass into the tunnel drainage system.

Measurement

The quantity payable to the Contractor at the unit price will be the number of square meters of placed waterproofing measured in situ and approved by the Engineer.

Payment

The contracted unit price shall cover procurement of main and other kinds of material, tools, accessories and labour.

14.4.4. Sprayed waterproofing membrane

MASTRSEAL 345 (MEYCO-BASF) or Similar
 Chemical base - E.V.A. - ethylene vinyl acetate
 Dispersion will be ordered already prepared from manufacturer. Water added percentage should be between 24 and 50% of the product eight.

Extent of Activity:

The product is an elastic watertight membrane that should be applied by spraying. It may be used both with shotcrete or/and "in situ" concrete.

Application:

- Facility surfaces prepared with shotcrete.
- Replacement for foil membranes.
- Intercalations with layered structures (concrete/membrane/concrete).
- In tunneling, when shotcrete would be used.
- For waterproofing of facilities that are constructed of shotcrete with complex geometry.
- Directly on rock, after mine firing.
- Directly on steel, for example: anchor heads, iron joints, etc.

Description and Functioning:

Waterproof membrane applicable by spraying using the equipment for dry application:

Extraordinary elasticity and high pull-off resistance on both linings (primary and secondary one):

Powder without any harmful matter, usable within very small rooms:

Hardening by a chemical process within 4-6 hours, depending on environment conditions. Afterwards it can be coated by shotcrete or by "in situ" concrete.

Membrane attains final strength after one week approximately:

Membrane may be applied on wet surfaces also.

On the occasion of stronger water penetration, the combined use is recommended with polyurethane based injection systems.

Technical data:

Delivery form.....powder
 Color.....light brown
 Water pressure resistance.....5 bar
 Density (at 20°C).....590±100 g/l
 Consumption (powder) by m².....0,72kg/mm
 Layer thickness.....3 - 6 mm
 Usable at temperature.....-5 to +40°C
 Compressive strength (at 20°C).....1,5 - 3,5 MPa
 Breakpoint deformation.....(at 20°C)>100%
 Adhesion to concrete strength (7days).....1,2 ± 0,2 MPa
 Limit hardness.....RD> 5
 Fire risk (DIN4102, B2).....Self-extinguishing

14.5. Drainage and De-watering

This item includes all materials, accessories and labour needed to install a drainage system and connect it to main discharge outlet through a manhole or directly to a drainage channel.

Materials shall comply with SRPS standards and the relevant subsections in this specification. Drain pipes shall be used as interceptors as shown on Design drawings.

The Contractor shall check whether the levels of excavation comply with the Design prior to the commencement of the works and request the approval of the Engineer.

Drain pipes shall be laid on a blinding course of concrete class MB 20 as to enable water drainage and channelling to interceptor and discharge outlet into the tunnel drainage system.

Drain pipes shall be perforated at top half and joints shall not be grouted except the connection with the manhole.

Drain pipes shall be wrapped with geotextile (200 gr/m²)

As detailed in Design, mono concrete (MB 10) shall be placed on top of drain pipes or mono-granular (gravel serving as a pre-filter for percolating and ground water).

These pre-filters shall be fixed very carefully to avoid damage to drain pipe and impairment of its function.

Material for drain pipes: PVC, and/or HDPE - high density polyethylene.

Measurement

Measurement will be done per m of pipe length actually measured and approved by the Engineer. Manholes shall be measured per each completed manhole as approved by the Engineer.

Payment

Drain pipes will be paid per contracted unit prices per 1 m of length and shall cover work and materials so that the Contractor will not be entitled to any additional compensation. Manholes shall be paid per each completed manhole.

14.6. Miscellaneous**14.6.1. Contact Grout for Filling Up Gap between Segments and Bored Profile in Hill Mass When Installing Segments with TBM**

Prior to application, the grout shall be tested by trial installation. Compaction, adhesion and plasticity shall be tested.

Depending on the geological structure, the Engineer shall set the quality requirements that this grout should meet and the proof of contact grout quality according to requirements from the following standards:

SRPS U E3.015	Grouts for injection grouting. Technical requirements
SRPS U M8.022	Grouting. Testing of compressive strength of grout.
SRPS U M8.023	Grouting. Testing of bleeding and volumetric changes of grout
SRPS U M8.024	Grouting. Testing of flow of grout

A mandatory admixture to such contact grout is Bentolite that gives water-imperviability to this mix.

Aside from its role to produce a surface peripheral interconnection of concrete segments and excavated tunnel profile, this contact grout also interconnects precast concrete segments crosswise and lengthwise, thus creating conditions for the redistribution of a part of pressure of the relieving hill arch from the segments to this grout.

This contact grout also reduces and balances the total settlement of the tunnel structure.

Measurement

The quantity to be paid to the Contractor at the agreed unit price is the number of m³ of placed contact grout, measured on site (at the end-of-pipe from the grouting machine) and approved by the Engineer.

The quantity recognized is the volume of the mass of the outer radius, 10 cm thick, with a 10% variation:

$$2\pi Rl \times 0.10 \times 1.10$$

R) outer diameter of the tunnel segment

Payment

The agreed unit price shall include the procurement of materials and auxiliary materials, tools, accessories, and labour.

14.6.2. Fire Protection of Internal Tunnel Lining

This protection is achieved by applying a 3.5 cm thick layer.

The layer shall be applied in two runs. The first run, 2.5 mm thick, a minimum 24-hour break for hardening, and then achieving designed thickness.

The base shall be dry. Dampness on the base shall not be allowed either.

The compound is a chemical mix of calcium silicate and resistant agents that withstand temperatures of 1200°C – for 60 minutes with all the characteristics and quality standards as specified in the following tables.

The layer is applied with a robotic machine.

The layer shall be distributed uniformly around the tunnel space, and of uniform texture.

This layer shall be resistant to aggressive gases that may appear in the tunnel.

The chemical compound shall be tested in Serbian institutes for compliance with all the characteristics and quality standards as specified in the following tables.

The chemical compound for this layer shall be environmentally harmless in set - hardened condition.

Core sampling for tests, after the compound hardens, is mandatory to ensure compliance with all the characteristics and quality standards as specified in the following tables.

Workers and technical staff present during this operation shall wear protective masks.

Before applying this protective layer, the lining shall be washed from any dirt.

Fire-Protection Mortar Characteristics

Colour and finish layer	Almost white, monolithic spraying texture, finishing layer may be smooth or with a roller
Minimum actual thickness	8 mm without reinforcement, 15mm with reinforcement
Theoretical coverage	62m ² /tonne for 25mm thickness
Cleaning	With a hydraulic kit
Initial settings	2-6 hours at 20°C and 50%RH
Density (normal)	775kg/m ³ ±15% (when dry and in place)
Corrosion resistance	Does not cause corrosion of metal, even recommended for corrosion protection
pH value	12.0-12.5
Sound absorption	Sound reduction coefficient 0.35
Fire protection	Concrete and steel structures that are protected may ensure resistance to fire for up to 240 minutes. They do not release toxic and destructive fumes and are not health hazards before, during and after application. They are applied throughout the world and are subject to the following standards: - UK (BS 476: Section 20-21, 1987, Appendix D) - International Standards ISO 834 - Holland, RWS (Fire-protection test for tunnels, Procedure G1-98036-1a) - France: Hydrocarbon modified HCM - Italy (UNI 11076) - USA (ASTM E119, UL263 and UL 1709 – Proj. No. HR719)

Preparation:

Typical bases	Concrete and steel
Preparation of base	The base shall be clean, dry, and free from visible drops (including condensate), concrete particles, oils from reinforcing steel, rust, and other conditions that prevent good adhesion.
Mesh reinforcement	All fire tests were done on the protection without mesh to prove good properties and that it stays undamaged under most fire conditions. Low-bearing -HDPE mesh is recommended for outer works and for inner when vibrations are high, with a high possibility of mechanical damage.

Application

First steps	The application shall be under supervision and implementation by a person from the Supplier's factory, operating under the management and control of the Contractor and subject to the approval of the Engineer.
Methods	<ul style="list-style-type: none"> - Mix with water in an appropriate mixer and apply by spraying mechanically. - Finish may be as sprayed, skimmed, or patterned. - For minor repairs, use mix for application by hand.
Limits	May be used at temperatures of the base of 2°C and higher, but shall not be applied at ambient temperature below 4 °C. Maximum temperature of the base and air is 50 °C.

Measurement

The quantity to be paid to the Contractor at the agreed unit price is the number of m² of the constructed protection system, measured on site and approved by the Engineer.

Checking of thickness by inserting the steel needle of 1.5mm in diameter at 100m² intervals of the placed layer immediately after placing but not later than 1 hour after the machine placing the fire protection mortar stops operation.

Payment

The Contract Unit Price includes the procurement of materials and auxiliary materials, tools, accessories, machines, and labour.

14.6.3 Steel Lattice for TBM to Press Against in the Beginning Phase of Tunneling

Steel lattice shall be made of steel, C363.

The lattice elements are hot rolled sections- SRPS C.B3.131

The lattice shall be fixed to the concrete base with M22,10.9 bolts over an adequate contact plate.

The Contractor shall provide the lattice, according to the type of TBM selected for work. Shop drawings for the assembly of lattice and its fixing shall be submitted for approval by the Engineer and Designer.

Measurement

The quantity to be paid to the Contractor at the agreed unit price is given per 1 kg of mounted steel, measured on site and approved by the Engineer.

Payment

The agreed unit price shall include the procurement of materials, auxiliary materials, tools, accessories, and labour.

14.6.4 Steel Panels Made of Sheet Steel

The panels are made of flat, wide steel C 363 as specified in the Design and as shown on the Design Drawings.

The panels shall be installed into concrete segment during precasting.

During the opening (excavation) of a refuge for the removal of vehicles, steel panels shall be straighten up to ensure a connection with the primary lining of the refuge (ribs and concrete lining).

Measurement

The quantity to be paid to the Contractor at the agreed unit price is given per 1 m² of incorporated panels, measured on site and as approved by the Engineer.

Payment

The agreed unit price shall include the procurement of materials, auxiliary materials, tools, accessories, and labour.

14.6.5 Contact Grouting

Grouting shall take place as to achieve:

- A full bond between the tunnel segment and surrounding mass;
- Water-impermeability of the contact area;
- Tightening sand-containing, gravel-containing and mud-containing layers;

Grouting shall take place using:

- Low-viscosity hydro mortar based on colloidal silica;
- Highly reactive two-component polyurethane foam.

Mixing of grout

In order to obtain a plastic cement mix various admixtures are added: hydrophilic and hydrophobic.

Plasticizers are batched in the units of weight, as 2% of the weight of cement in the mix.

Once the most suitable powder admixture is selected through test grouting, it is added into the mix of sand before adding cement.

Cement mix to sand ratio is 1:1 (1:2), which shall be determined by trial, according to actual conditions on the site and the type of admixture.

The addition of water depends on the addition of admixtures, since the presence of admixtures substantially reduces the need for adding water, and makes the mix more plastic and fluid, with the possibility of easy transport.

When the compound hardens, it expands to a certain degree that may be up to 0.3 %.



The addition of water shall be determined experimentally, and the water/cement ratio shall not exceed W/C = 0.34 - 0.45

To transport grout without major problems, a maximum sand grain size shall be 2 mm, whereas quartz sand shall be sieved through 2 mm mesh sieve.

The proof of grout quality according to requirements from the following standards:

SRPS U.E3.015 Grouts for injection grouting Technical requirements

SRPS U.M8.022 Grouting, Testing of compressive strength of grout

SRPS U.M8.023 Grouting, Testing of bleeding and volumetric changes of grout

SRPS U.M8.024 Grouting, Testing of flow of grout

All testing shall be completed to the satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer

Measurement

The quantity to be paid to the Contractor at the agreed unit price is the number of m³ of placed grout for 1 m of performed contact grouting measured on site and as approved by the Engineer.

Through test grouting, depending on the characteristics of the geological environment, the Engineer shall prescribe the average consumption (m³) of grout for injecting for the length of 1 m of grouting.

Payment

The agreed unit price shall include the procurement of materials, auxiliary materials, tools, accessories, and labour.

14.6.6 Grouting for Consolidation

Segments and spots in tunnel that shall be grouted for consolidation shall be determined by Engineer. Boreholes and their depth, boring direction, grout composition and grouting pressure shall be determined by Design or by proposal prepared based on trial section.

Grout composition shall be determined by proposal for grouting work that shall be based on geo-technical properties of rock mass, if may be cement suspension, cement mortar, or a mix based on clay suspension, with or without additives, combined with cement. Grouting mixes shall be tested and checked during the work.

Grouting shall take place as to achieve same pressure on primary lining vault circumference, if possible.

Control of grouting for consolidation success shall be carried out using test borings with pressure test, when the watertightness of grouted rock shall be determined.

No work on grouting for consolidation shall be accepted for payment to Contractor on rock where the rock instability was produced by himself, disregarding regulations for excavation and supporting (bad blasting, incorrect excavation protection, etc)

All expenses for installing, moving and dismantling of necessary equipment and scaffolds, tidy closure by cement mortar of all grouting boreholes along the entire length, cleaning of cement suspension from boreholes in concrete lining, cleaning debris and grout remnants in tunnel, all obstructions and breaking due to parallel work shall be incorporated by Contractor into unit price for boring and grouting, for such expenses shall not be accepted for payment

Grouting quality shall be as regulated by following standards:

SRPS U.E3.015 Grouting Mixtures Technical Specifications

SRPS U.M8.022 Grouting, Compressive Strength Testing of Grouting Mixtures

SRPS U.M8.023 Grouting, Water Separation Testing, Volume Changes of Grouting Mixture

SRPS U.M8.024 Grouting, Grouting Mixture Flow Test

Measurement

Measurement and payment for grouting work shall take place following items of Cost Estimate from Contract, by 1 m³ (one linear meter) of boring and by quantity in kg (kilograms) of grouting mix used, all based on Measurement Book, daily signed by Engineer

Payment

The Contract Unit price shall include materials supply, auxiliary materials, tools and labour.

14.6.7 Convergence Measurement in Tunnel

Benchmarks movements on primary tunnel lining shall be measured

The number of points for measurement as presented with Design

Measurements shall take place using surveying equipment in Global Positioning System

The measurement of movement shall be performed at 6 hours, 12 hours, 2 days, one week, one month, depending on the programme and algorithm that is given independently from the detailed tunnel Design.

14.6.8 Geological survey of rock mass during tunnelling works

The number of surveyed profiles shall be defined through the Engineer's office.

14.6.9 Records of justified and unjustified deviations from Design and of finished details

This activity shall be performed by the Contractor and submitted for the approval of the Engineer for the purposes of recording the as-built status and preparation of as-built drawings

14.6.9.1 Designing of the Executive design for formwork

Includes: 1 Formwork design for cut and cover parts of tunnel

2 Formwork design for secondary lining in tunnel

14.6.10 Wooden support in cases of danger of collapse and breaking in materials from tunnel faces

Wooden balks- dia Ø25-30cm, length = 3-6m

Timber – conifers II class

14.6.10.1 Tunnel Supports Protection against Vehicle Exhaust and Industrial Salt Aggression during Winter Season

First coat. Three – component epoxy mortar and compound for fine leveling and strengthening

Color – gray

A perfect concrete protection in aggressive environment

Coat thickness min 5mm, max 3mm

Bedding temperature +8°C min / +30°C max

The coat may be applied on the fresh or wet concrete without standing water

Consumption : 2kg/m² 2mm

Second – finishing coat : one – component reactive coating, silane based, white colored

It prevents water penetration, eliminates chlorides and increases concrete resistance against freezing-thawing cycles and against the salt action.

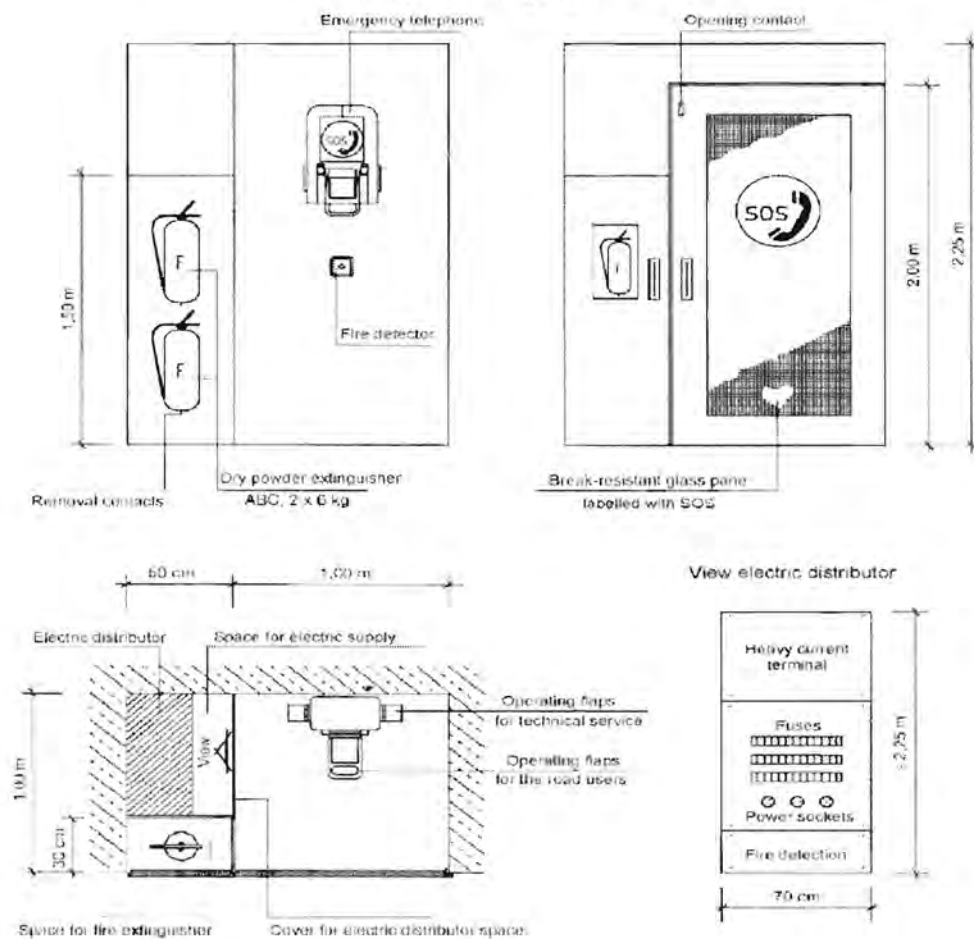
The coating shall be applied in one pass, by brush or paint roller. Theoretically consumption 200-300 g/m².

Application temperature: +5°C min / +30°C max.

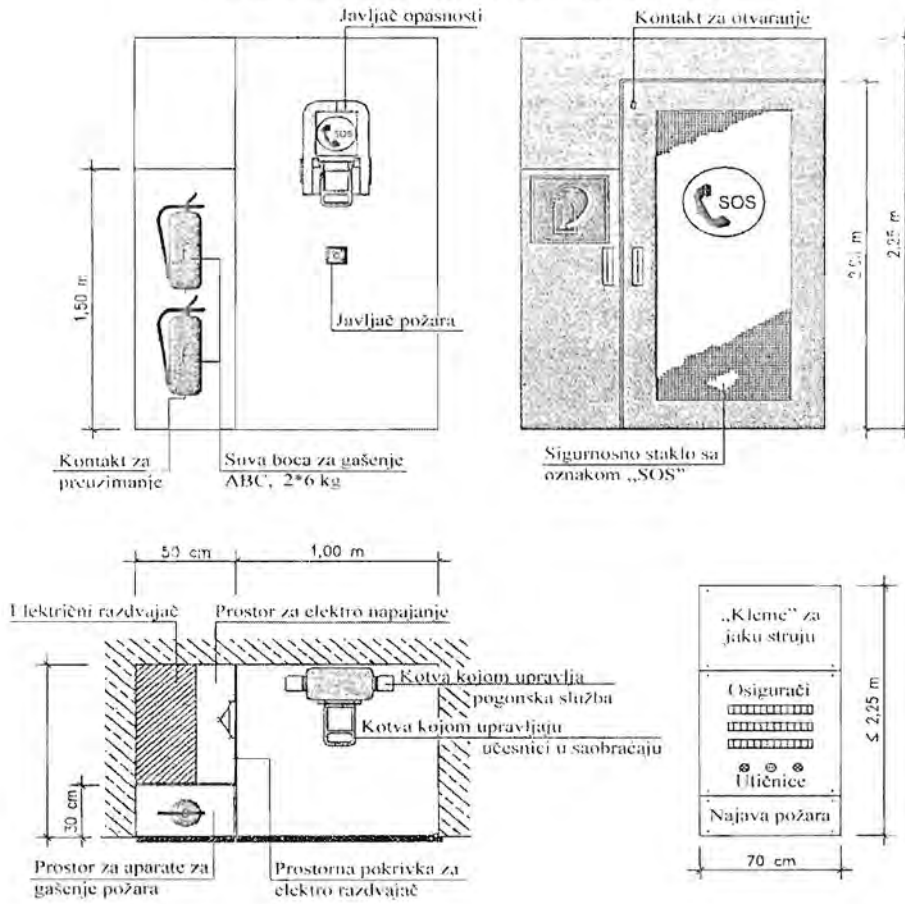
14.6.11. Doors

S.O.S- Niches

Equipment emergency call station



OPREMA GOVORNICE ZA POZIVE U SLUČAJU OPASNOSTI



Characteristic for doors : Single wing , with safety glass light and S O S marking

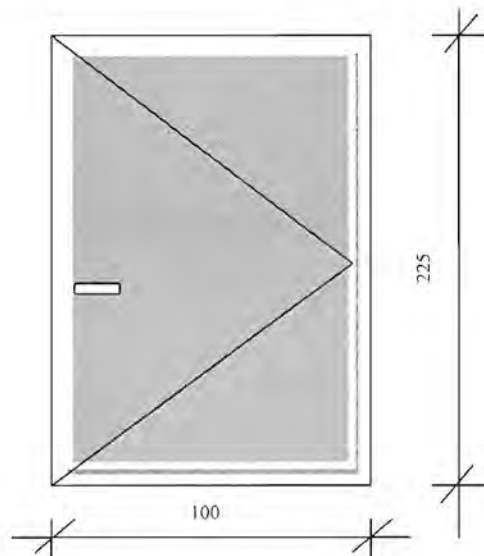
Material for doors : Reinforced concrete t 10 cm
 Dimension (cm/cm) : 100/700
 Aluminium profiles

Finishing : Plastification in grey colour
 Partition wall

Other characteristics : Warning inside and outside of the cabine - In the case of fire emergency immediately leave the cabine

14.6.11. Doors

Doors for E.N. niche
 Vrata za E.N-nišu



521/733

Characteristic for doors: Single wing
100/225

Dimension (cm/cm).

Material for door:
Partition wall:

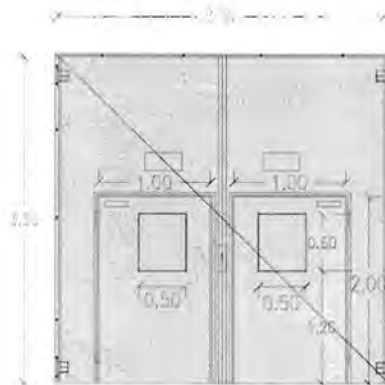
Steel pickled sheet, with fire resistant filling materials
Reinforced concrete, t=10cm, with protection – fire resistant plaster – with thickness min 3.5cm, based on calcium silicate

Fire protection is to be applied outside (tunnel side)

Fire resistant conditions : 90min (according to fire resistant dimensioning „ZTV Tunnel (D)“
Finishing : Plastification in grey colour

14.6.11 Doors

Doors for cross connections



Characteristics for doors: Slide, self closed doors, multipurpose – pedestrian or vehicle- (if needed) openings (single,multi wings)

Dimension (cm/cm): Single wing – 100cm x 200cm – opening in the direction of movement

Material for door: Steel pickled sheet, with fire resistant filling materials

Partition wall: Reinforced concrete, t=10cm, with protection – fire resistant plaster – with thickness min 3.5cm, based on calcium silicate, Protection is to be applied outside (tunnel side)

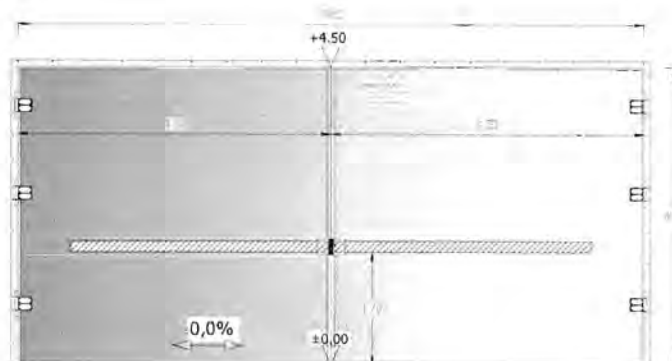
Fire resistant conditions: 90min (according to fire resistant dimensioning „ZTV Tunnel (D)“

Finishing: Plastification in green colour

Other characteristics: The doors are equipped with appropriate door furniture,handles and closing mechanism. Opening force should not exceed 100 N

14.6.11. Doors

Doors for cross connections for vehicles



Characteristics for doors:	Slide, self closed doors, for vehicle openings (multi wings)
Dimension (cm/cm).	Double wing – 900cm x 450cm – opening in the direction of cross connection
Material for door	Steel pickled sheet, with fire resistant filling materials
Partition wall.	Reinforced concrete, t=20cm, with protection – fire resistant plaster with thickness min 3 Scm, based on calcium silicate. Protection is to be applied outside (tunnel side)
Fire resistant conditions:	30min
Finishing:	Plastification in green colour
Other characteristics	The doors are equipped with appropriate door furniture, handles and closing mechanism

14.6.12 Cutting and removing the temporary invert

- Cutting and removing the temporary invert shall be done according to technological procedure recommended by Contractor, approved by Supervisor
- Cutting the temporary invert – mechanically, with cutter for concrete
- Cutting and removing the temporary invert shall be done in several phases
- After removing the temporary invert, it is needed to measure the displacements of marks
- Works on cutting and removing the temporary invert must be proceeded in phases symmetrically to the tunnel axis.

14.7 Tunnel dewatering and hydrat system

14.7.1 Polymer – Concrete Channel in tunnel

Prefabricated polymer-concrete channel shall be used for collecting and discharge surface runoff within the tunnel. Channel shall be opened on top by ACO Drain or similar.

Tunnel channel Type 4, left/right 77035/77036. Channels shall fit to the edge profile of the tunnel. Channel placing shall take place in conformity with graphics. The channel shall meet requirements for loading class 400KN. Linear elements joining together shall be carried out by polymer-bituminous mass. The layer shall be correctly leveled as to assure homogenous flow trough the channel without any obstacles.

Characteristics of polymer-concrete element shall be as follows:

- Flexural strength 22N/mm²,
- Compressive strength >22N/mm²;
- Elasticity modulus, about 25kN/mm²;
- Density 2,1 – 2,3 g/cm³;
- Water penetration depth 0 mm;
- Resistance to chemicals impact – high;
- Depth of surface irregularities – about 25µm;
- 600x370x2500 mm, weight 460 kg/piece

Measurement

The quantity to be paid for shall be the number of pieces placed.

Payment

For the quantity as determined above the Contractor shall be paid at the contract unit price, which price and amount shall be full compensation for all supply, transport, preparation and placing and quality control and all necessary labor.

14.7.1.1 Channel of polymer-concrete

The pre-fabricated channel of polymer-concrete shall be used for collecting and evacuation of surface discharge. The channel shall have grill on top, ACO Drain or similar. Tunnel channel Type 400KN-V200 and V300. Channels shall be incorporated in the tunnel edge profile. Channel shall be placed in conformity with graphical attachments. The channel shall comply with requirements for loading class 400KN. Joining of linear elements shall be carried out by polymer-bitumen mass. It shall be necessary that the joint be leveled as to enable undisturbed water flow through the channel, without obstacles.

Characteristics of polymer-concrete element shall be as follows:

- Flexural strength 22 N/mm²
- Compressive strength 1-22 N/mm²
- Elasticity modulus about 25 kN/mm²
- Density 2,1 – 2,3 g/cm³
- Water penetration 0 mm
- Resistance against chemical action - high
- Depth of surface unevenness – about 25 µm

Measurement:

The quantity to be paid shall be the number of pieces placed.

Payment:

Payment shall be based on the number of pieces. The unit price shall include supply, transportation, placing, preparation and placing and quality control.

14.7.2 Revision with Bucket and Outlet on tunnel channel

ACO Drain collecting shaft with outlet DN200 for the *Tunnel channel - Type Prigon*. The element that will be placed at outlet spots from the channel to the collector. The material shall be the same as for the channel. The bucket shall be placed as to collect residue. This element will provide outflow to the collector on defined locations for openings: 370x(530x)117 mm weighing 620 kg/piece. Collecting shaft shall be provided by certificate M0 on fire resistance. Covers shall fit to the edge profile of the tunnel. Loading class D400.

Polymer-concrete shaft properties shall be the same as for the channel.

Collecting shaft-outlet from the channel with grating V200, which shall be placed with left recesses for vehicles removal shall have same technical properties as the applied tunnel channel.

Measurement:

The quantity to be paid for shall be the number of pieces placed.

Payment:

For the quantity as determined above the Contractor shall be paid at the contract unit price, which price and amount shall be full compensation for all supply, transport, preparation and placing and quality control and all necessary labor.

14.7.2.1 Revision with Bucket and Outlet

ACO Drain or similar catch shaft with outlet DN200 for *Tunnel Channel - Type V200 and V300*. The element that shall be placed on location of discharge from the channel into collector. The material shall be the same as for the channel itself. The bucket shall be placed as to collect the deposit. By means of this element the discharge into collector will take place on described locations for openings. The catch shaft shall be supplied by M0 certificate for fire resistance. Covers shall fit to the edge profile of the tunnel. Loading class D400.

Measurement:

The quantity to be paid shall be the number of pieces placed.

Payment:

Payment shall be based on the number of pieces. The unit price shall include supply, transportation, placing, preparation and placing and quality control.

14.7.3 Plaster Lath

The double plaster lath shall be placed on openings of channel shaft outlets with grating V200 and V300.

Measurement:

The quantity to be paid shall be the necessary area in square meters (m²).

Payment:

Payment shall be based on area in square meters (m²). The unit price shall include supply, transportation, placing, preparation and placing and quality control.

14.7.4 Separator

ACO Passavant OLEOPATOR or similar, NG6 SF1200 D400 separator for light oils and gasoline, filtration class (up to 5 mg/l of oil derivatives at the separator outlet), manufactured of reinforced concrete, with flow 6 l/sec, with catch basin 1200 l, coalescent filter and fitting DN150. Loading class 400 KN, version with super-elevation. The separator shall be equipped by safety ball float and connector for SecurAT alarm-call element. Separator diameter shall be Ø1470. The separator shall be equipped by watertight internal protection.

The durability of an ACO separator shall be the same as concrete durability. Bodies shall be manufactured of reinforced concrete following LN 206-1, strength class C35/45, exposure to environment HA3 (chemically aggressive waters in facilities for waste water treatment), XF4 (traffic surfaces treated by de-icing chemicals, elements dominantly horizontal, exposed to water spraying from traffic surfaces where de-icing chemicals are sprayed, parking lots without protective layer).

Measurement:

The quantity to be paid shall be the number of separators, necessary couplings included.

Payment:

Payment shall be based on the number of separators with couplings. The unit price shall include supply, transportation, placing, preparation and placing and quality control.

14.7.5 SECURAT

SECURAT is a device for surveillance and alarming with optic and acoustic alarm call. Protection system Ecs IIB for range "zone 0" of danger of explosion, device conforming to EN 50014. Installation of two potential-less probes (for oil and ascendance) with 5 m long cables, connecting box for range of zone 0, holders etc. inside the separator, conforming to LN858. The device for surveillance and alarming (IP30) shall be installed in the separate casing with near facility, out of range of explosion risk (not included with supply). Connection to mains 230V/50-60Hz.



Protective casing for installation of SECURAT for surveillance and alarming device in IP 65 protection.

Measurement

The quantity to be paid shall be the number of pieces placed.

Payment

Payment shall be based on the number of pieces. The unit price shall include supply, transportation, placing, preparation and placing and quality control.

14.7.6 Valve Shaft

Valve shaft of System ACO or similar, manufactured of reinforced concrete as per DIN 4281, with inter-flange valve DN 150. The valve activation shall be by electro-motorized valve drive (activation impulse received by SECURAT surveillance and alarming device). Passage pipe DN 150 as per DIN 19534/19537, with inspection opening and connector for evacuation (S-coupling with bolt. Connectors DN150 as per DIN 19534/19537. Anti-explosion protection included.

Installation depth T = 955 mm, with uplift possibility (measured of pipe bottom to cover top) with watertight openings in the wall.

Measurement

The quantity to be paid shall be the number of pieces placed.

Payment

Payment shall be based on the number of pieces. The unit price shall include supply, transportation, placing, preparation and placing and quality control.

14.7.7 Reservoir with Entrance Portal for Discharges originated on the Occasion of Fire Extinguishing

Placing precast pipes of reinforced concrete with internal diameter $\phi 2400$, on sand bedding. Total reservoir volume shall be minimal about 100 m³ (72*30).

The total net reserved space shall be 6 x 12 m, with excavation as presented by drawing attached.

Operation description is presented with Technical Report and graphics.

Openings shall be provided on reservoir top as to enable placing of reinforced concrete inspection shafts $\phi 1000$ for evacuation and control.

Reservoir characteristics shall be in conformity with physical and mechanical characteristics as required for structures of reinforced concrete.

Measurement

Quantities to be paid for shall be as follows:

- The number of placed pieces per linear meter (m¹) of pipe $\phi 2400$ or as agreed with manufacturer, if some other pipe length would be more favorable, depending on technology;
- The number of placed pieces of pipes for placing shafts $\phi 1000$ on reservoirs $\phi 2400$
- The number of placed conical parts $\phi 1000$, $\phi 600$.
- For openings on pipe $\phi 2400$ closed by reinforced concrete plates 25 cm thick - concrete quantity in cubic meters (m³), double reinforcement mesh MA500/560, Q424 number of kilograms (kg).

Payment

For quantities as determined above the Contractor shall be paid at the contract unit price per each item, which price and amount shall be full compensation for all supply, transport, preparation and placing and quality control and all necessary labor.

14.7.8 Pipes of Ductile Cast Iron

Importance of proper placing of pipes

Placing pipes is practical work on site. Nevertheless:

- Manufacturer's instructions;
- Engineer's requirements;
- Contractor's precaution.

Impact risk, ditch cave-in, pipe damage, non-proper bedding or fill-up material, etc. may occur on site. Such occurrences may be sudden (when damaged parts replacement would be required) or they might be demonstrated through time by parts failure or by serious problems, as leakage, breaking or disintegration of couplings.

By using pipes of ductile iron a safety reserve would be achieved, enabling pipes to sustain certain risks without damage. The success is guaranteed from the very beginning by a simple and safe placing procedure.

Ductile material

The ductile iron is an alloy of iron, carbon and silica where the carbon is pure, in form of spherical graphite. The carbon in previously used casting pig is in form of thin leafs, resulting with material brittleness.

Graphite particles in ductile iron look like small balls, excluding any possibility of fractures expansion. The material is not brittle any more, it is now strong and elastic. The basic properties of ductile iron are:

Elasticity Re ≥ 270 Mpa)

Tensional strength (Rm ≥ 420 Mpa)

Strength on impact

Large extension (> 10%)



Compliance with standards

Specification	French	EN	ISO
General technical specifications for pipes From ductile iron under pressure	NF EN 545	EN 545	2531
Coupling EXPRESS		NF A 48-860	-
Coupling STANDARD		NF A 48-870	-
Pipes with sockets	NF EN 545	EN 545	2531
Pipes with flanges	NF EN 545	EN 545	2531
Pipes with conn. and sockets		NF EN 545	EN 545
Pipes with conn. and flanges		NF EN 545	EN 545
Dimensions of flanges – rotating		NF A 48-840	2531
Dimensions of flanges – fixed		NF A 48-840	2531
Gaskets for connections of spec. material	NF T 47-305		4633
Pipe surround of zinc	NF EN 545	EN 545	8179
Exterior pipe surround of polyurethane	NF EN	EN 545	-
Pipe surround of cement mortar	NF EN 545	EN 545	4179
Model for quality assurance in design, development, manufacturing, placing and maint.	NF LN 79001	EN 29001	9001
Model for quality assurance in manufacturing and placing	(NF X 50-131) NF EN 29002 (NF X 50-132)	EN 29002	9002

Ductile pipes have great safety reserve above their indicated working pressures. That is the consequence of material ductility, giving great capability to iron pieces to accept work and energy in elasticity domain (which is alone considered in design).

Measurement

The quantity to be paid shall be the measured pipe length in linear meters (m).

Payment

Payment shall be based on the length in linear meters (m) of the pipe placed. The unit price shall include supply, transportation, placing, preparation and placing and quality control.

14.7.9 Fittings

Fittings are specified with design and presented in graphical attachments. Mechanical, physical and hydraulic characteristics are the same as for the pipeline.

Measurement

The quantity to be paid shall be the number of fittings.

Payment

Payment shall be based on the number of fittings. The unit price shall include supply, transportation, placing, preparation and placing and quality control.

14.7.10 Gate Valves

Gate valves shall be of the same material as the pipeline. They were designed for working pressure 10 bars. Placing shall conform to graphical attachments.

Measurement

The quantity to be paid shall be the number of gate valves.

Payment

Payment shall be based on the number of gate valves. The unit price shall include supply, transportation, placing, preparation and placing and quality control.

14.7.11 Manhole Covers

Manhole covers on elements of the system shall be for loading 400 EN. Graphical attachments shall be followed.

Measurement

The quantity to be paid shall be the number of manhole covers.

Payment

Payment shall be based on the number of manhole covers. The unit price shall include supply, transportation, placing, preparation and placing and quality control.

14.7.12 Manhole Step Irons

Graphical attachments shall be followed. Appropriate Serbian standard shall be respected.

Measurement

The quantity to be paid shall be the number of step irons.

Payment

Payment shall be based on the number of step irons. The unit price shall include supply, transportation, placing, preparation and placing and quality control.

14.7.13 Pump Station

Pump station with necessary uplift height and power shall be installed in conformity with graphical attachments. The unit composed of three pumps - two of them operating and one spare - with suction and uplift as per DN100, PN10, including valves, non-return falling cover, pressostats, electricity board, all on base. The pump shall be placed immediately after reservoir box. It shall be located into pre-fabricated manhole of polypropylene in conformity with graphical attachment.

The quantity to be paid shall be the number of pump stations.

Payment

Payment shall be based on the number of pump stations. The unit price shall include supply, transportation, placing, preparation and placing and quality control.

14.7.14 Tunnel Hydrants

Tunnel hydrants "Valman" or similar are defined by the head and footing of nodular cast and by the body of prochromie with the wheel for fast opening. The hydrant is equipped by a system for automatic drain, which comprises the incorporated air valve with the hydrant head and the automatic outlet with the footing.

Characteristics: Working pressure shall be 12 bars. DN100. The network within which hydrants will be installed is of the ring-type. Flow within the network will be $Q=20$ l/sec. The height shall be 1m.

Tunnel hydrants shall be distributed in conformity with graphical attachments, within fire stop refuges. Fire stop refuges shall be located opposite SOS refuges. The distance between hydrants was graphically presented.

The hose and the hose reel shall be supplied with fire stop refuge.

Measurement

The quantity to be paid shall be the number of hydrants.

Payment

Payment shall be based on the number of hydrants. The unit price shall include supply, transportation, placing, preparation and placing and quality control.

14.7.15 Reservoir

Installeer voorspelvoerdigde houers gemaak van polypropyleen of die wil. Material te ryk weerstand is bereik deur termiese beskerming (die voering van veselglas en aluminium laag). Staal klampe voorspel 3m. Reservoirs (3 pieces) shall be placed in the reservoir case of reinforced concrete, as presented with graphical attachment. The volume necessary is presented with graphical attachment ($72 + 30$) m³. It is necessary to provide a mobile pump within the technical center as to enable the possible water surplus evacuation from the casing. Vehicle step on reservoir casing shall not be allowed, because the cover with allowable loading 400 KN was not foreseen.

Measurement

The quantity to be paid shall be the number of reservoirs.

Payment

Payment shall be based on the number of reservoirs. The unit price shall include supply, transportation, placing, preparation and placing and quality control.

14.7.16 Waterproofing

Waterproofing of HDPE shall be placed and RC reservoir plates and on vertical sides up to the level of fill-in limit, in conformity with graphical attachment.

Measurement

The quantity to be paid shall be the necessary area in square meters (m²).

Payment:

Payment shall be based on the area placed in square meters. The unit price shall include supply, transportation, placing, preparation and placing and quality control.

14.7.17 Manhole Covers

Manhole covers shall be placed on system segments with allowable loading 400KN. Placing shall be in conformity with graphics.

Measurement

The quantity to be paid for shall be the number of pieces placed.

Payment

For the quantity as determined above the Contractor shall be paid at the contract unit price, which price and amount shall be full compensation for all supply, transport, preparation and placing and quality control and all necessary labor.

Section 15 Telecommunications

Contents

- 15.1. Fire alarm and gas detection system
- 15.2. Computer Networking (IP Video Monitoring)
- 15.3. Talk-Back (SOS) System
- 15.4. Cable Conduits, Laying of Copper and Optic Telecommunication Cables
- 15.5. Laying of Optic Cables

15.1. Fire alarm and gas detection system

15.1.1 General

A fire alarm system with equipment shall be supplied and executed in accordance with attached plans, technical description, Priced Bill of Quantities, these Technical Specifications and Rules on technical norms for fixed fire alarm installations (OfE Journal of FRY, No./93) and subject to the approval of the Engineer.

Installation cables in a fire alarm system shall be placed in ceiling voids, false floors, on dedicated cable trays for signal, alarm and telecommunication installations, clipped on walls, and drawn in dedicated pipes in mortar.

Installation cables to be clipped on walls shall not be exposed to mechanical damage and shall be as little eye-catching as possible. Clip spacing shall depend on cable outside diameter and shall not exceed 30 to 50cm.

Plastic pipes for installation cables in walls shall be fully covered with an entire layer of wall finishing materials.

Trays for signal, fire alarm and telecommunication installations shall be mounted as instructed by the Manufacturer in harmony with other installations. Metal cable trays shall be bonded and earthed to building earthing system.

Within false floors, installation cables shall be laid in sheet metal troughs fitted with the accessories required. In relation to power cables, fire alarm cables shall be laid in dedicated sections in a multiple trough at the distance which will prevent interference.

Parallel running of fire alarm wiring and power lines shall be avoided. If this is not possible then the following instructions shall be observed:

- telephone and fire alarm installation shall be fixed 10cm below ceiling.
- clock, talk-back and other telecommunication installation 10cm below these
- power cables 10cm below the preceding ones.

Crossing of fire alarm wiring and power lines shall be avoided. If unavoidable they shall cross at the right angle. The distance between them shall be minimum 1cm and in case this is not possible then an insulating bed minimum 3 mm thick may be inserted.

The system shall be supplied with power from two sources: electrical mains and back-up battery. A dedicated circuit with a specially marked fuse (red) shall be used for power supply.

Fire alarm panels and cabinets in the fixed installation shall be red.

Fire alarm elements (sounders, bells, lamps, flashing lights) shall differ from other alarming components. These shall be red or carry inscription plates with "fire alarm" lettering.

Joints (bonds) shall be minimum in number. Each bond shall be effected by soldering or with splicing modules. Cables and conductors for call points and detectors may be bonded only in them.

Cable terminals for connections to devices shall have sufficient lengths. Terminals to be connected to call point/detector bases shall be minimum 30cm.

Manual call points shall be mounted at 1.5 m above the floor, at easily accessible places, along routes of evacuation or on staircases.

The completed installation and the cables laid shall be marked with appropriate metal rings by the Contractor.

Cable cross sectional area shall be selected to cater for power consumption of used appliances and to meet the required maximum allowable electric resistance in the line. Conductor section in a cable shall not be below 0.6mm.

Insulation resistance between a line and earth shall be minimum 500kΩ. It shall not be measured with an instrument operating at a voltage above 50V, unless the fixed installation is separated from the line and the cable.

Fully bonded equipment in a fixed installation shall be subjected to functional tests and the operation of each component - manual call point/detector, alarm component and signal transmission components, as well as of central unit and all its controls shall be tested.

All tests shall be completed to the satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

15.1.2. Mounting of Spot Detectors

Distance of detectors from walls, high pieces of furniture and stored goods shall not be smaller than 0.5m, except in corridors, shafts or similar openings in building fabric whose width is less than 1 m.

If beams or ventilation shafts are not more than 0.15m away from the ceiling, then side distance to a call point shall not be less than 0.5m.

If a ventilation shaft exists in ceiling, a call point shall not be fitted closer than 0.4m to it.

In ventilated rooms with grilles in side walls, call points shall be mounted not closer than 1.5m to these.

Call points shall be mounted onto a gallery ceiling at the distance of 1/3 of the gallery treading width measured from its free edge.

15.1.3. Fire Alarm Control Unit

The control unit shall be addressable, in a mechanically resistant metal housing, for wall-on mounting with well visible indicators and unauthorized handling prevented.

It shall have a programmable option for incorporation of names in Serbian, of holding times, day and night operation and of all other parameters for each detector, module and zone.

The control unit shall be fed with 230V/50Hz power, and have an inbuilt battery charger, a multiline LCD display with background lighting, LEDs and a keyboard for control and programming operations (on the front).

The unit shall have terminals for two addressable loops, a relay NO/NC terminal for a general alarm case, a relay NO/NC terminal for a general fault case, a terminal to the line with parallel LCD displays, a terminal to 24 VDC (one fixed, one resettable) if some modules are not fed directly from loop, and a terminal to series printer.

The control unit shall have an option to add a distant ("parallel") LCD display that will show the same data as the unit itself and an option to be connected to an automatic telephone alarm set.

Fire alarm shall be signalled both by light and sound on the control unit. Sounds (alarm) on the unit shall differ from an audio signal of fault (defect).

The control unit shall be accompanied with a manual in Serbian and instructions printed on a single sheet of plasticized paper to be hung on the wall next to it. The control unit shall bear an inscription plate giving data on the manufacturer, type identification, year of manufacture, factory number and reference number of the quality statement.

15.1.4 Measurement

The exact measurement of installed equipment and used material is determined based on the construction book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications.

15.1.5 Payment

Payment of installed equipment and material is executed according to the prices determined by the Contract, and the measurement approved by the Engineer.

15.2. Computer Networking (IP Video Monitoring)

The structural cable installation in this project shall fully comply with the technical description, these Technical Specifications, Priced Bill of Quantities, drawings and the international standard ISO/IEC 11801, and subject to the approval of the Engineer.

Prior to commencement of the works the Contractor shall determine and mark precise positions of all system elements (power outlets, distribution boards, active components, cable conduits etc).

One end of hTP cables shall terminate on a panel in cabinet and the other end at RJ45 socket, while braided cables shall be earthed properly.

An hTP cable shall neither be interrupted nor extended.

An hTP cable shall be drawn through troughs, a walled-in hose, underfloor ductwork or clipped to wall as provided in the design.

An hTP cable shall not be twisted along its length, knotted, kinked or damaged in any other way. Mechanical loads on hTP cables while drawn in or laid shall not exceed the ratings specified by the cable manufacturer (tensile force during drawing in, radius of bending etc.)

hTP cables shall be mounted in vertical or horizontal positions. Positioning under an angle is not permitted.

An hTP cable shall neither be laid nor drawn near a heating source (heating pipes, radiators, stoves, heaters). If unavoidable, then heat insulation shall be necessary.

Outdoors, hTP cables shall be drawn through dedicated thermo-plastic pipes. These pipes (e.g. on outer walls of buildings) shall be weather resistant (-35°C to +50°C / 95% relative humidity). It is not permitted to place them under direct sun rays. Standard PVC or PE pipes shall be used for TT cables to be buried in the ground.

An hTP cable shall not be run near appliances, objects or sources that may cause damage to it.

Maximum link length in horizontal cabling, ISO/IEC 11801 standard shall not exceed 90m. A link means a cable section between a plug-in outlet on the panel and a socket outlet on the wall.

Structural cabling elements (cabinets for passive and active components, wall-on ductwork if any, plug-in outlets) shall be fitted in the way to preserve functionality of the network without deteriorating however the use of rooms, aesthetics (harmonization with interior decoration) and the like.

Sockets shall be placed at the level 20 - 40cm above floor. If due to physical requirements cable troughs are to be fixed on the wall at desk level (80 - 100cm above floor) sockets can be incorporated into them.

Cable tail at a power outlet shall be 10cm long and at the end at the panel 30 cm - 100 cm long

Both ends of a drawn cable shall be given identical numbers (label) immediately after drawing in.

Cable identification number shall correspond to the power outlet number where it is terminated.

The drawn in hTTP cables shall be tested for breaks and short circuits. If positive, the cable shall be pulled out and replaced.

Properly arranged cables shall be terminated, in power outlets, or on the panel as provided in the design.

RJ45 connectors, plug and socket outlets and connecting panel shall be mounted using professional tools.

Connection of a terminal unit (computer) to a wall power outlet and reconnecting of the panel and active components shall be done with appropriate cable lengths (max 5m).

When cables and power cables in a structural cable system run in parallel and are directly laid in walls the minimum distance shall be 20cm, i.e. 10cm if the structural cable is braided.

Structural cable system can be laid together with power cables in partitioned plastic troughs or partitioned floor ducts specially constructed.

The cables in a structural cable system may cross power cables under the angle of 90°.

When cables and passive network components are mounted in place, the following measurements and tests shall be performed on the structural cabling: link length (max 90m), attenuation per pair, crosstalk level, DC loop resistance, impedance (100Ω), attenuation to crosstalk ratio. Instruments for measurements and testing shall come with test certificates issued by the accredited institution (not dated earlier than 12 months ago).

All tests shall be completed to the satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

Required measured values (standard ISO/IEC 11801) for cable category 6 are given in the table below:

f [MHz]	1	16	100	250
Return Loss (min) [dB]	19	18	12	8
Insertion Loss (max) [dB]	4	8,3	21,7	35,9
NEXT (min) [dB]	65	53,2	39,9	33,1
PS NEXT (min) [dB]	62	50,6	37,1	30,2
ACR (min) [dB]	61	44,9	18,2	-2,8
PC ACR (min) [dB]	58	42,3	15,4	-5,8
ELFEXT (min) [dB]	63,3	39,2	23,3	15,3
PS ELFEXT (min) [dB]	60,3	36,2	20,3	12,3
Prop. Delay (max) [µs]	0,580	0,553	0,548	0,546

Required mechanical characteristics of cables:

- Conductor diameter: 0.4 to 0.8 mm
- Temperature for mounting: 0°C to 50°C
- Working temperature: -10 C to 40 C
- Minimum bending radius for mounting: as per manufacturer's catalogue
- Minimum bending radius after mounting:
 - 25mm for cable diameters to 6mm,
 - 50mm for cable diameters over 6mm

15.2.1 Measurement

The exact measurement of installed equipment and used material is determined based on the construction book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications.

15.2.2 Payment

Payment of installed equipment and material is executed according to the prices determined by the Contract, and the measurement approved by the Engineer

15.3. Talk-Back (SOS) System

Telephone and Talk-Back installations shall be delivered and executed in strict accordance with plans, technical description, Priced Bill of Quantities, these Technical Specifications and ZJPTT instructions governing telephone subscriber installation, and subject to the approval of the Engineer.

Cables, conductors, equipment and materials shall comply with IEC standards, and ZJPTT rules and technical requirements.

Cables (installation conductors) in a telephone installation shall be laid in pipes as designed.

Pipes with cables (installation conductors) shall be laid in a straight line (vertical or horizontal). Laying in a curved line is permitted in exceptional cases when tangent route is not possible provided the Engineer's consent is obtained. Horizontally laid pipes shall be slightly graded towards distribution boxes in the installation. Free pipe ends shall be fitted with insulated bushings.

A cabled connection between expansion joints shall not be damaged when one expansion joint happens to sink.

Cables and conductors shall be drawn into pipes after rendering. They shall not be twisted along its length, knotted, kinked or damaged in any other way. Mechanical loads on a cable being drawn in or laid shall not exceed the technical data specified by the cable manufacturer (tensile force during drawing in, radius of bending etc.)

Cables to be drawn in pipes may be powdered but only with talcum powder.

Drawn installation conductors shall be continuous without splices along the section from a termination and/or distribution panel to a telephone outlet. Conductors may be spliced only in exceptional cases if continuous drawing is not possible, and this may be done solely in installation boxes. Conductors shall be soldered or extended with a special module.

Both ends of a drawn cable shall be numbered (labelled) immediately after drawing. Cable number shall correspond to the number of the socket where it terminates.

Distribution boxes shall be fitted at the points where cables change grade and branch and at the terminals of the telephone installation.

Telephone boxes shall have the required capacity, comply with the applicable PTT conditions, be accessible at 1.6 m above the floor level on public premises and be provided with lock and key.

Pipes in walls or under floor shall not be covered with any aggressive etching material. Scraps of gypsum and mortar shall be carefully removed from them.

Parallel runs with smoke channels or heating pipes shall be avoided. If impossible, they shall be placed 5 cm away from each other or minimum 3 cm where they cross smoke channels and heating pipes. A telephone installation shall be protected with appropriate thermal insulation.

A telephone installation parallel to other installations shall be executed as follows:

- telephone installation 10 cm below ceiling,
- TV installation 10 cm below telephone installation
- signal wires 10 cm below TV installation
- power cables 10 cm below signal lines.

Telephone sockets shall be fitted at the level of 0.3 m above the floor (as indicated in the design) and not closer than 0.3 m from a 230V/50Hz socket outlet measured along a horizontal line.

Metal cabinets (termination - T/O and distribution - R/O) in a telephone installation shall be connected by a 10 mm² conductor to the nearest potential equalizing bond in the switchboard in the power supply system. If telephone installation cables and conductors are within static enclosures these shall be bonded to earth at end side only, i.e. in the switchboard of higher order.

The following tests and measurements are required: numbering and insulation resistance. Loop resistance if requested by the Engineer. The results of these measurements and tests shall comply with ZJPTT specifications. Measurements and tests shall be performed between ends of cable and conductor from the switchboard of higher order towards the end with disconnected loads.

Insulation resistance shall be measured with a megohmmeter, minimum 100 V test voltage. Between conductors it shall be not less than 20 MΩ, and between the conductor and earth not less than 10 MΩ, for all wires in a multi pair cable namely for the a/b wire in an installation conductor, with devices and power source disconnected.

Loop resistance shall be measured by the Watson bridge method and comply with the values of the cables specified in the Manufacturer's catalogue

All tests shall be completed to the satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

15.3.1 Measurement

The exact measurement of installed equipment and used material is determined based on the construction book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications.

15.3.2 Payment

Payment of installed equipment and material is executed according to the prices determined by the Contract, and the measurement approved by the Engineer

15.4. Cable Conduits, Laying of Copper and Optic Telecommunication Cables

15.4.1. General Specifications

These Technical Specifications are an integral part of the final design documents for which the Contractor shall fully comply without exception.

Cables, equipment and accessories shall be supplied and executed as shown on the plans in the Technical Description, the Priced Bill of Quantities, and these Technical Specifications, and subject to the approval of the Engineer.

Cables, equipment, accessories and material shall comply with IUS, DIN or VDE standards. Pieces of equipment and cables shall be delivered ready for mounting unless otherwise stated.

During the execution of the works the Contractor shall take care of any other works executed, existent underground and above ground installations in the work area to the full satisfaction of the Engineer. If during civil works and mounting of cable and equipment other buildings or installations suffer damage, it shall be remedied by the Contractor at his cost and subject to the approval of the Engineer.

15.4.2. Civil Works Specifications

15.4.2.1. Cable conduits

Cable conduits serve for drawing in cables and armoured cables of small size if provided so in the design.

Cable conduits consist of manholes and pipes in between them.

Manholes

Manholes can be of hand and standing type. Hand manholes serve for cable drawing in and accommodation of joints and other equipment. Their appearance, construction and use comply with the final design.

Standing manholes, clear height 180cm enable workers to stand. Trench crosswise dimensions shall be given in the design and shall be not less than 150 x 150 cm.

Manholes will be built with solid bricks in cement lime mortar, 25 cm thick walls. Outer and inner vertical and horizontal waterproofing shall be placed as provided in the final design. The bottom shall be cast of lean concrete, be gently graded towards the middle (2%) and be drained in the absence of waterproofing.

The top plate shall be of reinforced concrete, calculated to withstand local load.

The cover shall be of cast iron pursuant to ZJPTT Technical specification No.02-3128/1 dated 5th March 1964. Lightweight or heavy covers shall suit local loads but in principle lightweight covers shall be placed in lawns, sidewalks and unbuilt area and heavy ones in road pavement. They shall be flush with ground (sidewalk, pavement) level. Each cover shall sit in the midst of the top plate but it may also be differently placed if provided in the design. The collar between the plate and ground surface shall hold the cover in place. It shall be cast of concrete together with the top plate and shall be statically analyzed to suit specified loadings.

Burial depth (from top plate level up to ground level) shall be indicated in the final design.

Pipe inlets in side walls shall be placed as provided in the design. Minimum depth of the top edge of any such inlet pipe shall be not less than 0.8 m and its top edge not deeper than 0.4 m below underside of the top plate.

Cables shall be hung on consoles in manholes, fixed in manhole walls. Consoles shall be inserted at a later date and their positions and dimensions shall depend on the requirements.

Pipes

Manholes shall be interconnected with PVC pipes, of 110 mm nominal diameter, 6m long compliant with ZJPTT Technical specification no. 02-11550/1-72; pipes shall be enlarged at one end.

Pipes shall be laid between manholes in a horizontal line, one next to the other, 2 pipes, 3 pipes, 4 pipes. If pipes exceed four in number they shall be positioned in rows one on top of another: 2-2, 2-3 and N-4, N being one number between 1 and 8.

Pipes shall be fixed in position with plastic combs placed at the distance of not more than 2 m.

Pipe bundles shall be covered with sand. If necessary they shall be covered with concrete. Concrete class shall be decided in the structural analysis in the final design.

Pipes to be laid in a straight line between manholes shall be laid according to designed lines and grades and extended by inserting one pipe into the enlarged end of the next pipe. The joint shall be covered with sealing ring.

If pipes are to be laid along a curve their exact position and radius shall be specified in the final design, and a minimum cable bending radius shall be taken into account.

Upon completion of the cable conduit (manholes and pipes) it shall be tested by pushing a round brush with a rope at its end through all

pipes. This will also help to remove possible dirt from pipes

15.4.2.2. Trench

A trench route shall be set out as designed and shall be tied to permanent unchangeable points: road, structures along the road, buildings, regulation lines, control points and the like.

A trench shall satisfy the following requirements:

- Be straight wherever possible and follow road curves.
- Privately owned parcels of land shall be avoided but if this is not possible trenches shall run close to their boundaries.
- Be sufficiently distant from roots of trees and other vegetation to avoid damage.
- Be not less than 10m far from 110kV transmission line towers and 15m from 220kV transmission line towers.
- Be 1.0 m deep and 0.4 m wide near the bottom. In privately owned arable land the depth shall not exceed 1.2 m. Otherwise, a different route shall be selected or cable conduits laid in. The trench bottom width shall be increased by 5 cm for each additional cable to be laid.
- Excavated earth shall be thrown out of trench to one side only to the distance of about 0.5m.
- Trenches shall be, as a rule, backfilled with excavated soil in 20 cm thick layers and tamped. If specifically required in the design or ordered by the Engineer for civil works, backfilling may be done with gravel or sand respectively. Surplus soil shall be hauled to a dump site.
- Prior to cable laying the trench bottom shall be carefully cleaned and covered with a layer of sand (fragmented earth if foreseen by the design) 10cm thick. Laid cables shall be covered with another layer of sand (fragmented earth) 10 cm thick. On top of this, plastic shields or bricks shall be placed in a continuous row (two rows in parallel for several cables). At about the mid point of trench depth yellow warning tape bearing the inscription "PAŽNJA TT KABL" (Caution Telecommunication cable) shall be placed.
- The surface of a backfilled trench shall be reinstated; sidewalk and pavement repaired and asphalted, and grass lawn restored by returning bushes to their original places.
- Under obstacles: roads, railway tracks, embankments and other, Ø100 mm inside dia. hard plastic pipes shall be laid, two of them in sand or concrete bed, depending on load. Minimum depth of these pipes shall be 0.8 m below the ground surface. Obstacles shall be crossed at the angle of 90° and not less than 45°.

15.4.2.3. Cable Laying

As a rule, a cable shall be pulled out (unreeled) off a mobile drum. If a cable is pulled from a stationary drum then pulleys shall be used to avoid dragging cables over ground surface and/or trench bottom. If the use of pulleys is not possible for any reason whatsoever, cables may be pulled out by hand but maximum weight per worker shall then be considered and the cable shall never be bent more than its minimum bending radius would allow.

A cable with a tail length shall be laid close to the trench midst. If several cables are laid in one trench they shall not cross. Abutted cable lengths shall overlap by 1 to 1.5m as instructed by the Cable Manufacturer.

Joints shall be made at trench enlargements the size and shape of which shall depend on the capacity of the cables to be extended, i.e. on joint size. Enlargements shall be excavated at the time of joint construction. A 10 cm thick layer of sand shall be spread over the enlarged area and each finished joint shall be fully covered with sand.

Enlargements shall be designed as follows:

- Joint axis shall be by 0.3m staggered in relation to cable axis in trench for the purpose of tensile force relief,
- Bends in cable approaching a joint shall be by about 50% bigger than the minimum allowable bending curve to avoid radial forces.

There are no constraints on laying the following cables in a trench together with a telephone cable:

- Other telecommunication and signalling cables
- Fibre-optic cables for any purpose
- Other cables that do not transmit energy (feeders to high power antenna systems are considered to be power supply cables).

Horizontal distance between a telephone cable and a power cable (including feeders to high power antenna systems) shall not be less than 50 cm. If otherwise, special safety measures shall be undertaken. Where telephone and low voltage power cables run in parallel, it will be sufficient to lay a continuous row of bricks on edge. High voltage cables running in parallel shall be laid in earthed steel pipes and telecommunication cables in plastic pipes.

Crossing angle of telecommunication cables and power cables shall be 90°, never less than 45°. If the angle is smaller such a case shall be considered as parallel running. As a telecommunication cable shall always cross over and above a power cable, minimum vertical distance shall be 30cm for low voltage cables and 50cm for high voltage ones. If such distances cannot be achieved then additional safety measures shall be undertaken (see the preceding paragraph).

Cables shall be marked with lead clips spaced at 5 m and inscribed with:

- Cable type
- Cable structure,
- Month and year of laying.
- Additional identification if there are two or more identical cables in one trench.

Characteristic points in cable route shall be appropriately marked with brass plates in sidewalks and concrete posts with plates on unbuild ground. In both cases plates shall bear the following symbols:

- Straight cable runs shall be marked approximately in the midpoint between two joints,

- Above joints,
- At the points of direction changes,
- At the points where cables branch off the main route,
- At blind cable ends,
- At pipe ends (start and end) below obstacles.

15.4.2.4 Drawing cables in pipes and/or conduits

Only one cable may be drawn in one pipe. Several cables may be drawn in one pipe only if the sum of their diameters does not exceed 60mm. Optic cables will be always drawn in special hoses. Cables shall never be spliced in pipes

Cables shall be first drawn in pipes lying at the lowest row as shown on the design drawing. Cables in manholes cables shall be hung on consoles fixed to side walls.

Cables may be drawn without joints through several manholes if maximum drawing force for the cable type concerned is not exceeded

Cables shall be drawn with hand or motor powered winch the force being monitored all the time. The best solution will be to have a winch equipped with a union which will slip as soon as pre-set drawing force is exceeded. The pulling rope shall be joined to the cable with a steel sleeve. Cable shall be pulled axially through pipe to minimize friction. If necessary, pulleys needed to stabilize the drawing rope shall be used.

Lubricants may be used to reduce friction in pipes. The best solution will be to blow in plastic pellets having the diameter of several tenth points of a millimetre which will, due to static electricity adhere to the pipe inside and significantly reduce friction resistance.

Cables shall be unreeled from drums positioned according to earlier planned arrangement shown in the site organization plan.

Prior to drawing a cable in a pipe the latter shall be cleaned with a brush and its suitability thus checked.

Damaged and stretched out cable end sections shall be cut off after pulling but a sufficient tail length shall be left as reserve for cables to be placed on consoles in manholes or overlapped at joints.

15.4.3 Instructions to Contractors

Before commencement of the works the Contractor shall check correctness and compliance of telecommunication cable design with other designs and schedules and schematics of other underground installations and adjust them in cooperation with the Engineer.

The defined items in the Priced Bill of Quantities refer to the supply of the full range of equipment, devices, cables, accessories, materials and all works needed to make these functional unless explicitly otherwise specified in the design

Transport, preparation of site, health and safety measures and other related costs shall be covered in the unit prices.

The Contractor shall suggest to the Employer modifications and amendments that would contribute to a more rational and quality technical solution. Minor design modifications and amendments may be carried out by the Engineer. Major modifications and deviations shall be approved by the Designer in advance.

All modifications and amendments shall be confirmed in writing by the Engineer and all associated cost revisions shall be resolved by the Engineer in accordance with the Conditions of Contract.

Demolition or any other operations on existing underground or above ground structures are not permitted without the Engineer's presence and without an approval and attending on the part of the owner.

The Contractor shall provide all required information to the Engineer who shall consult and obtain an approval from the Employer and the Designer if execution of unforeseen or extensively bigger works than planned is pending

The full compliance of supplied equipment and of the works executed shall be guaranteed by the Contractor in accordance with the conditions of contract, these Technical Specifications and subject to the approval of the Engineer.

15.4.4 Testing and Start-Up

15.4.4.1 Start-Up

The network can be put into operation only after a technical inspection and issue of a certificate for use. The technical inspection shall include:

- Check of compliance of the structure with the design and/or verified modifications and additions by quality and quantity of incorporated cables, equipment and works executed.
- Measurements and tests

15.4.4.2 Measurements and Tests

a. Measurements and Tests Prior to Execution of the Works

The equipment, accessories and materials will be subjected to visual inspection. Only sound, undamaged and new equipment may be fitted. Inspection of the equipment, accessories, material and cables by the manufacturer's commission in factory shall be stipulated in the contract between the Contractor and the Employer and shall be completed to the full satisfaction and approval of the Engineer

b. Checks and Tests Prior to Cable Laying

A drum, its sides and cover planks shall be undamaged. It shall bear an inscription plate with the necessary data which shall also be impressed in the wood on the sides. The drum shall come with a test certificate. Cables from a drum without a compliance certificate shall not be used unless specific additional measurements are carried out.

If the drum is undamaged and therefore suitable, the pressure in the cable shall be checked with a hand pressure gauge (cables with air-paper insulation). If the pressure is within the permitted values the cable may be used without additional checks. If the pressure is lower or zero (then causes of gas leakage shall first be identified and appropriate measures undertaken. If the pressure is zero, the insulation shall be checked.

In case the drum is damaged, the cable shall be carefully inspected and used provided the sheath is undamaged and the pressure is good. No use of a damaged or kinked cable is allowed even if the pressure is normal and insulation suitable since other parameters may be disturbed and may become evident while the cable is pulled out (working capacity, capacitance couplings). Damaged cables may be used provided such damaged lengths are cut out and the remainder checked for insulation and dielectric strength.

The insulation of paper insulated cables shall be checked in the above cases. Insulation shall be measured with an insulation meter of appropriate range and measuring voltage not less than 100 V. If voltage is 500 V no further check of dielectric strength between wires will be needed. The Engineer will decide whether an additional check of dielectric strength between wires is needed. Insulation resistance values are given in ZJPTT Technical Specifications, cable catalogues, and compliance certificates.

c. Measurements and Testing in the Course of Work

In exceptional cases only the cables laid shall be checked prior to finishing, if the Engineer thinks it necessary and if long time has elapsed between cable laying and finishing so that damages may be rightly suspected.

Measurement of cables for capacitance coupling compensation shall follow the Technical description attached to the design.

d. Measuring and Testing a Finished Cable Installation

These measurements and tests are obligatory and shall be attended by the Engineer. They will be done between cable leads-in, between leads-in and amplifier and between amplifiers. The following measurements shall be performed:

- Insulation resistance
- Dielectric strength
- Numbering and loop resistance
- Working and crosstalk attenuation in low frequency range.

The following additional measurements shall be done on cables with carrier frequency and/or coaxial quads/pairs:

- Working attenuation within the range envisaged for telecommunication transmission.

Carrier frequency symmetrical quads:

- Crosstalk attenuation at near and far ends within the range foreseen for telecommunication transmission between pairs in a quad and pairs of different quads (if there is a number of quads).

Coaxial pairs:

- Resistance of internal and external conductors,
- Insulation resistance and dielectric strength between internal and external conductors and other conductors and Al cable sheath bonded together,
- Cross talk attenuation to 200 kHz
- Reflection and impedance by a reflectometric method.

Measurements method and results shall comply with ZJPTT Instructions on quality control for cabled telephone lines, ref.no. 02-6217.1-67.

All tests shall be completed to the satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

15.4.5 Measurement

The exact measurement of installed equipment and used material is determined based on the construction book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications.

15.4.6 Payment

Payment of installed equipment and material is executed according to the prices determined by the Contract, and the measurement approved by the Engineer.

15.5. Laying of Optic Cables

15.5.1. Calculation of Permitted Drawing Force

If a cable is to withstand drawing force without damage the following requirements shall be fulfilled.

- Maintenance of minimum bending radius depending on cable diameter and sheath type along a curved route;
- Maximum permitted drawing force dependent on cable structure shall not be overrun.

Permissible bending radius for a loaded cable shall be minimum 20 times cable diameter.

The drawing force occurring at cable starting end when a cable section is drawn in at a go depends on:

- Friction resistance which has to be overcome while a cable is being drawn in conduit,
- Direction of drawing, i.e. the effect of full cable weight

Cable weight also has minor or major effect on graded and curved sections.

Insulation friction between a cable and cable conduit depends on:

- Friction coefficient between the cable and conduit surface,
- Cable weight,
- Conduit geometry (curves, up and down gradients...)

Since a small length optic cable is concerned in this case, it will be blown in and drawing force will therefore be below the permitted value of 1500N

15.5.2. Measurements of Relevant Parameters of an Optic Cable

According to the instructions on measurements on telecommunication lines with optic cables that are aimed at checking whether a cable was laid and mounted in the way that will ensure proper operation in its lifetime the following measurements will be carried out.

1. Measurements prior to laying (on drum)
2. Measurements after laying
3. Measurements during installation
4. Final measurements on a regenerator section

Immediately after laying the fibres shall be measured on a cable length and defects in any identified so that appropriate measures may be undertaken. Optic length and attenuation per unit of length shall be measured with an optic reflectometer at 1300 nm.

In the course of cable laying, before and after a joint is completed, optic depth and longitudinal attenuation of fibres shall be measured as well as attenuation of a joint at 1300 nm at both ends to avoid joining at inappropriate attenuation.

When cable joining is completed along a whole regenerator section then with an optic reflectometer attenuation at all joints at 1300 nm in both directions, longitudinal attenuation of each cable length between joints in one direction and total attenuation shall be measured using in both directions a stabilized optic source and a power meter at 1300 nm. The results shall be entered in appropriate tables in A4 format and will constitute a measurement protocol which shall be an integral part of the record documents.

All tests shall be completed to the satisfaction of the Engineer and all test results shall be submitted for the approval of the Engineer.

15.5.3. Laying of Cables

The planned works shall be of good quality, shall comply with the applicable technical regulations, shall be executed by approved contractors, using equipment manufactured and tested for compliance according to the relevant ZJ PJ T technical regulations, all in full compliance with these Technical Specifications and subject to the approval of the Engineer.

The works shall be done in as short a period as possible.

The Contractor shall observe all requirements and approvals obtained and incorporated in the design documents. Each modification shall be first approved and verified by the designer and shall then be confirmed as an instruction by the Engineer.

The Contractor shall be solely responsible for any damage due to a failure on his part to observe design requirements in the course of works.

The Contractor shall observe the Law on Occupational Health and Safety (Off. Gazette of RS No. 42/91), and undertake protective measures listed in the attachment to the design documentation.

The Contractor shall keep a Measurement Book and a Building Journal and these will have to be regularly verified by the Engineer in charge of the project.

The work shall be so organized as to proceed without interruptions and to end within the term specified. No work may commence until all materials are in place.

The Contractor shall be responsible for proper signage on the site to avoid accidents. Only cables and materials that will be used in one day may be delivered to site. No vehicles and equipment may be left on the road but if unavoidable, then warning signs shall be erected together with regular traffic signs according to the Law on Traffic Safety.

Vehicles used for the above transport on a public road shall be escorted by traffic police if the Contractor thinks that traffic flow may be endangered.

The Contractor shall provide space for the storage of cables according to laying sequence. The cables shall be accessible for testing and use.

The Contractor shall visually check cables on drums and accessories while taking them from the Employer of the factory and measure power on all fibres and accessories with an optic meter.

The Contractor shall lay and install an optic cable fully observing the Instructions governing the laying, installation and measurements of optic cables on telecommunication lines.

After cable laying and installation the Contractor shall plot data about the completed installation on geodetic plans, scale 1:500 or 1:1000, adding the necessary analytical elements (coordinate lines related to the state control network and a measurement protocol in accordance with the applicable instructions on technical records of lines with optic cables).

15.5.4 Preparation of Conduits for Insertion of Optic Cables

These conduits shall be prepared prior to the insertion of optic cables, and/or adjusted for optic cables. Effective adjustment of telecommunication conduits means that a polyethylene pipes of smaller diameter shall be drawn into a 110 mm telecommunication conduit, namely:

- Three ø40mm pipes
- Four ø32 mm pipes
- Two ø40mm pipes and two ø32 mm pipes.

PE pipes shall be placed in TT conduits in the following way:

- Align drums(coils) with PE pipes on top of the trench at the end opposite to the direction of laying.
- Fix ends of pipes assembled in a neat bundle with adhesive PVC tape about 30cm long.
- Cover the end of the bundle of pipes formed as above with a drawing sleeve and tie a pulling strand or a 3-5 mm steel wire to the other sleeve end.
- One or two workers shall pull the strand and PE pipes from the other end. The required number of workers shall be engaged there.

It is essential that the bundle of PE pipes corresponds to the conduit length between manholes as the bundle shall terminate flush with the wall containing pipe outlets, namely flush with the conduit end.

To prevent movement of PE pipes in the conduit while an optic cable is drawn in, the bundle ends shall be fixed at the points where they enter a manhole with a sufficiently robust rubber ring. The ring would end at the point where the conduit enters the manhole. It is not recommended to fix PE pipes with concrete.

The duct in a conduit to be selected for drawing in PE pipes shall be the last top one as optic cable will be best protected in it. In manholes, 10 to 15 cm beneath the top plate small wall consoles shall be fitted for optic cables runs. At the points where PE pipes terminate in manholes, the pipes which will remain unused shall be plugged with rubber plugs or heat shrinking caps and those used for optic cable drawing in with plugs ensuring tight contact of the pipe and the cable.

15.5.5 Drawing in a Cable in PE Pipes in Conduits

The following preparatory actions shall precede the laying of an optic cable:

- Erect a fence around the site together with traffic signs,
- Remove covers from the manholes along a section equal to cable factory length, i.e. a section between two consecutive joints,
- Check harmful gas content in manholes and eliminate causes of their presence. Continue checking in the course of the works,
- Ventilate the manholes for about 15-30 minutes,
- Provide lighting
- Remove water and clean manholes (if there is water and objects that may obstructing work in them).

Work may proceed at the temperature not below -5 nor higher than 50 C. Optic cables are very sensitive to longitudinal stresses due to their small size and weight.

A cable shall be drawn in by hand. Therefore many workers shall be engaged and their work shall be fully synchronized. One worker shall be charged with hand drawing of cable in each manhole or gallery.

Strict account of permitted drawing force shall be taken during cable drawing in. It will be 1500 N for the cable type selected here bearing in mind that friction occurring while a cable in a polyethylene sheath is drawn in a PE pipe is 0.35 - 0.45. Minimum allowable cable bending shall not be exceeded either.

15.5.6 Optic Cable Route Setting Out

An optic cable in telecommunication conduits shall be appropriately marked for the purpose of identification and protection. The identification sign shall be inscribed on a plastic plate fixed on the cable with a transparent PVC tape. It shall be positioned at an eye-striking place and shall contain:

- Name of section
- Type, kind and capacity of cable

• Year of construction

Optic distributors at end points shall bear identification similar to the one mentioned above. Supports for optic connectors shall also be marked and enable easy identification of the optic fibre on a section.

15.5.7 Completion/acceptance/handover

All materials and equipment which are to be installed have to be in accordance with the existing SRPS standards, and if they do not exist, with the existing IEC standards.

The equipment, before installation, has to be examined according to the existing regulations.

All installation works have to be executed in accordance with the existing SRPS standards, and if they do not exist, with the existing IEC standards.

During the construction the Contractor is obliged to provide normal traffic conditions, placing the appropriate signs, and to secure excavations at locations where they could cause accidents to pedestrians

Upon the completed construction, before putting the structure into operation, carry out all necessary examinations and trial work. Upon completion of all works, the Contractor and the Engineer shall create the exact plan of the plant and network and to insert all completed changes in one copy of this design, with the aim to provide exact as-built documentation and to submit through the Employer to the authority which will use this plant and network.

15.5.8 Measurement

The exact measurement of installed equipment and used material is determined based on the construction book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications.

15.5.9 Payment

Payment of installed equipment and material is executed according to the prices determined by the Contract, and the measurement approved by the Engineer

Section 16 Electrical installations

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16.1. Cable Electric Mains 1Kv

16.1.1. General Specifications

These Technical Specifications constitute an integral part of the design and contract documentation for which the Contractor shall ensure full compliance.

Works shall be carried out fully complying with the text and drawings in the technical design documentation, the regulations and norms governing installations of this type, and these Technical Specifications, all subject to the approval of the Engineer.

Prior to the commencement of works, the Contractor shall peruse the design documentation, give his comments and observations, if any, and duly submit them to the Engineer through the Building Journal.

Modifications or variations that may considerably affect the design solution shall be permitted solely upon a written consent of the Designer and subject to the approval of the Engineer.

During the execution of works the Contractor shall keep daily records entering all required data (Building Journal)

During the execution of works due care shall be exercised to avoid damage to other works and existing installations.

Breaking or chasing of reinforced concrete structures to make room for electrical works may be done only upon a written consent of the Engineer.

The materials and equipment to be incorporated shall have the characteristics specified in the design documentation and applicable norms and standards.

The Manufacturer's declaration of quality and appropriate Compliance certificates shall be provided for such equipment and materials.

During the execution of works the Contractor shall undertake safety measures in compliance with the applicable rules and norms.

16.1.2. Cable laying

16.1.2.1. General Recommendations

In general, electrical cables shall be buried direct in the ground. At street, road and path crossings and in all other places where a cable has to be protected from mechanical damage, cables shall be laid in protective pipes and cable conduits respectively.

Cables shall be laid by hand or using mechanical means when allowable bending radii and drawing forces shall be considered.

Allowable bending radii for cable types PP00, PP41 XHE-49, NPO-13 and NPZO-13 is 15 D (mm), and/or 15 D1, and for XP00 cable type it is 12 D.

Allowable drawing forces over tension sleeves for types PP00 ASJ, PP 41 ASJXHE-49A, XP00-AS, is 5D² (N), and for NPO-13 A and NPZO-13 A -3 D² (N).

It is not recommendable to lay cables when the outside temperature is below +5 °C. If the temperature is lower a cable shall be warmed in advance and laid as quickly as possible. The warming up shall last 36 to 48 hours for a cable on a drum in a room at the ambient temperature of 10° C to 20 °C. Fast warming up can be achieved by letting 5 A/mm² electric current through the cable for about one hour while preventing the cable surface temperature to exceed 25° C.

The cable route shall be surveyed before backfilling. Points of crossing of the cable with other cables and installations, points of splicing, and cable exact length shall be plotted on the laying plan.

Ends of a laid cable, points of crossing with other underground installations and other characteristic points shall be specially marked with plates containing basic cable data. Such plates shall not be fixed to cable wires.

Routes of electric cable lines are generally specified in urban and technical terms of reference to suit other underground installations. Cables in a public lighting system shall be laid along mast axis.

16.1.2.2. Laying Cables in Trench

The width of the strip of land for cable laying shall be minimum 0.7 m.

The size of a trench for cables to be buried direct in the ground shall depend on its nominal voltage, type of soil, number of cables in trench and available size.

Trench bottom shall be made flat and stones and other sharp objects removed to avoid any burden on the cable. If this is not possible, a 0.2 m thick bedding for cable shall be placed in trench. The cable shall be laid at the bottom of the trench and /or on such a bedding. It shall be laid in a winding line so that cable will be by 2% longer than its route.

As a rule, a cable shall be covered with 0.3 m thick layers of excavated earth. The first layer next to the cable and/or bedding shall consist of excavated fine grained earth, same as cable bedding. If, however, excavated material contains lots of stone, debris, mud, earth contaminated with chemicals, then fine grained earth, sand or specially prepared material of good heat conductivity shall be brought to the place.

A plastic warning tape shall be placed on top of the cable in due time prior to backfilling. The tape shall be red with warning lettering that a power cable lies beneath it. The tape shall be about 0.1 m wide and of the quality guaranteeing the same lifetime as the cable itself.

An open cable trench shall bear visible marks and provide safety for pedestrians and vehicles.

16.1.2.3. Laying Cables in Conduits

Cable conduits shall be used for crossings under streets, roadways, tramway tracks, railway tracks, yards with vehicular passages and where permissible distances of power cables from other underground installations are exceeded.

Cable conduits shall be constructed from plastic, asbestos cement pipes or prefabricated concrete elements (ducts). Warning tapes shall be laid over conduits. As a rule, steel pipes shall be avoided.

Minimum inside diameter of pipes shall be at least 1.5 times the cable outside diameter.

Cable conduits shall be placed on a bedding of 10 cm thick lean concrete. The pipes shall be carefully joined and joints grouted with cement mortar or other suitable materials. Edges of openings in concrete conduits shall be covered with sheet lead.

Unused pipe openings shall be closed with plastic plugs or similarly in another way. Where cable conduits cannot be placed in open trench, they shall be placed in a boring.

16.1.2.4. Convergence and Crossing with Power Cables and Other Installations

Minimum distance of 0.5m shall be required wherever power cables run parallel with telecommunication cables. They shall cross at the distance of 0.5m.

A power cable shall cross a telecommunication cable at the distance of 0.5 m. Crossing angle shall be as close to the right angle as possible and not less than 45°. As a rule, power cables shall be placed beneath telecommunication ones.

If the above distances, Sub-Section 16.1.2.2. cannot be achieved, power cable shall be placed in a protective pipe but the distance shall never be less than 0.3 m.

Laying power cables parallel to, under or above water supply pipes and sewers is not permitted except at crossings.

Horizontal distance between power cables and water supply or sewerage pipes shall not be less than 0.4m. If such a distance cannot be achieved, power cable shall be drawn through a protective pipe.

At points of crossing a cable may run above or under water supply pipes at the minimum distance of 0.3m shall be ensured between the cable and the pipe.

A trench shall be excavated by hand at the points where power cables run parallel to water supply pipe or sewer (no mechanical means).

It is not permitted to guide power cables above or under heating ducts except at crossings.

At crossings, a cable shall as a rule pass above heating line duct and only in exceptional cases it can pass under it. Minimum horizontal distance between a cable and the outer edge of a heating line duct shall be 0.6m.

Spacing between power cables if running in parallel in a trench shall be minimum 0.07m and 0.2m if crossing.

If one trench has to accommodate cables of low and medium voltage or several cables of medium voltage, they shall be separated with a row of bricks or some other insulating materials, subject to the approval of the Engineer.

The distance between a power cable and a gas pipeline crossing and running in parallel shall be minimum 0.8 m in built up urban environment and 1.2m in unbuilt area.

These distances may be reduced down to 0.3m if a cable is placed in 2 m long sections of a protective pipe at each end of a crossing.

If a cable line crosses a road outside urban area it shall be laid in a protective pipe drawn in a bored passage under the road without breaking it.

Vertical distance of cable conduits and road surface shall not be below 0.8 m.

The distance between a cable line and a road running in parallel shall be:

- Minimum 5 m for a motorway or class I road
- Minimum 3 m for roads below class I

16.1.2.5. Cable Accessories

Use of heat shrinking and cold shrinking cable accessories or prefabricated elements is recommended. It is permitted to use conventional cable accessories for paper insulated cables (IPO 13).

Conductors shall be joined by pressing (SRPS N.F4.101) while special bolted clamps are also permitted.

Cable joints and terminations shall be fitted by skilled persons.

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A medium voltage cable termination shall be fitted with accessories for simple fixing of metallic sheath and armour, and of electrical safety elements to earth terminal of a transformer station or a mast.

A cable joint shall not be grounded on its own whether made of insulating materials or metal.

Joints and terminations shall comply with the standards governing works of this kind and with recommendations and instructions issued by the manufacturer.

Each cable of selected type and cross sectional area, bolted clamps and jointing material to be pressed shall be accompanied with prototype Compliance certificates particularly concerning "speedy ageing".

If aluminium cables are used then particular attention shall be paid to jointing quality. These shall be joined by soldering, welding and pressing according to a specific procedure. Aluminium cables shall be connected to copper terminal ends, rails and the like via tin plated copper lugs. Aluminium and copper cables shall not be joined in a cable splice but only in transformer stations, distribution boards and termination boxes. Aluminium cables shall be handled with special tools that have not been in contact with copper. Special bolted clamps can also be used for low voltage cables.

A finished cable joint shall be covered with a sand layer not thinner than 10 cm at any point and bricks all over it. Joints in buildings or in manholes need not be covered with sand.

Joints and terminations shall comply with SRPS N.F4 group of standards. In their absence, work shall proceed according to VDE regulations, manufacturer's instructions and "Elektroistribucija" requirements.

Finished cable joints shall not be buried until their positions are surveyed by the Contractor and approved by the Engineer.

The laid, spliced and buried power cable shall be subjected to voltage test.

Each joint and termination shall be provided with a plate showing type, cross sectional area, voltage and name of a facility in which the cable is terminated at the other end.

16.1.2.6. Testing of power Cables and Accessories

Power cables shall be tested by type according to SRPS N.C5.025, SRPS N.C5.235 and SRPS IEC 60502.

Cables and cable accessories shall be subjected to obligatory (piece) test, type test, special tests and tests at acceptance.

Cables and cable accessories shall be accompanied with compliance certificates issued by an accredited institution.

The cable laid, spliced and terminated shall be subjected to voltage test along its whole line.

16.1.2.7. Final Requirements

The completed and tested installation with adjusted safety and control units shall be handed over to the Employer during technical acceptance by the Engineer.

The Contractor shall incorporate comments of the Technical Acceptance Commission without any right to compensation.

During the technical acceptance the Contractor shall submit the following to the relevant Technical Acceptance Commission and also during commissioning of the facility to the Employer:

- Two copies of as built drawings
- Compliance certificates and declarations concerning the quality of incorporated equipment and certificates on measurements and tests performed.

Period of guarantee for the works shall start from the date of commissioning.

Anything else concerning the facility unspecified in these technical conditions shall be defined by the contract between the Employer and the Contractor and shall be subject to the approval of the Engineer.

Measurement and payment

The exact quantity of installed material and payment are determined based on the construction book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications.

16.2. Combined Electric Mains 10 kV

16.2.1. General specifications

When erecting a 10 kV overhead line the Contractor shall observe the approved technical regulations and standards, technical documentation, the technical requirements and drawings of the Manufacturer of equipment.

These Technical Specifications constitute an integral part of the design and contract documentation for which the Contractor shall ensure full compliance in the erection of 10 kV overhead power line.

The Contractor shall observe and apply during the execution of the works:

- a) Applicable SRPS, IEC regulations and standards;

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- b) Rules on electrical installations operating at nominal voltage over 1000 V. Off. Journal of SFRY No 4/74, amended in Off. Journal of SFRY No. 13/78, Off. Journal of FRY No 61/95.
- c) Rules on technical norms for grounding electrical installations operating at nominal voltage over 1000 V. Off. Journal of FRY No 61/95.
- d) Rules on technical measures for operation and maintenance of electrical installations and overhead power lines. Off. Journal of FRY No 41/93.
- e) Law on Occupational Health and Safety, Off. Gazette of SRS, No 42/91.
- f) Rules on general measures for safety at work and protection against dangerous current in rooms intended and used for operating electrical facility and on sites, Off. Gazette of SRS No. 21/89.
- g) The manufacturer's requirements ;
- h) Technical documents;
- i) Regulations and recommendations of EPS and EDB.

The first and main obligation of the Contractor is to peruse the technical documentation, prepare a schedule of works and execute them in accordance with the technical documentation. In case of ambiguities in the technical documentation the Contractor shall ask the Designer to clarify

The Employer shall nominate an expert (the Engineer) to supervise the execution of works, their quality, quantities and resolve unclear issues. Modifications and deviations of any kind affecting the technical concept and choice of materials shall be permitted solely upon a written consent of the Engineer appointed by the Employer. Prior to giving such a consent the Engineer shall obtain the Designer's approval. The Engineer and/or the Employer shall be responsible for any consequences of a design modification if done without the Designer's approval.

The Design Reviewing Commission that has approved this design documentation shall be responsible for major variations from the approved design.

In executing the works the Contractor shall use planned equipment and materials in the way described in the design and in compliance with standards and regulations governing works of this kind.

The equipment and materials to be incorporated shall comply with IEC, ISO, SRPS standards and recommendations unless otherwise indicated in the design specification.

The equipment and materials to be incorporated shall be controlled and tested by the Buyer's inspectors in the course of production, packing and transport.

Fitting of electrical equipment may start upon the receipt of the Engineer's written statement that the equipment has arrived in orderly condition and that it complies with design characteristics. Materials for transmission lines shall be new and unused.

The equipment to be incorporated shall be supplied by reputable manufacturers and come with Compliance certificates which shall be submitted to the Engineer for approval.

The Contractor shall check the situation along the designed route looking for any impediments to the execution of the works according to design documentation. In the period after completion of the design and before commencement of the works the situation on the designed route earlier surveyed by the designer may worsen. In case of any obstructions the Engineer shall be consulted.

The Contractor shall take care to avoid damage in places where works are executed. Any damage, either due to insufficient care or carelessness at work shall be compensated by the Contractor to the Employer or to any other Contractor working there at the same time, and necessary repairs shall be done by the Contractor at his own cost. The Contractor shall take care to minimize damage to any existent works and installations. He shall also coordinate the works so as to avoid disruptions and improper deviations. Reinforced concrete structures may be demolished, cut or punctured only with a written consent of the Designer and the Engineer.

The use of installations may start only upon completion of the works and tests by the relevant authorities, subject to the final approval of the Engineer.

16.2.2 Masts

The Contractor and the Engineer shall precisely mark support points for new concrete masts before their erection. Mast spacing shall conform to the tension lengths shown on the layout drawing and in the longitudinal profile unless there are justified reasons for deviating from them. Any excavated foundation pits shall be inspected by a geologist.

If such an inspection confirms considerable deviations, then a new foundation or a new placing method shall be selected by the Contractor and submitted for the approval of the Engineer.

The allocated support points shall be:

- In road land strip
- On the property line
- Easily accessible to vehicles for the purpose of erection of equipment
- Easily accessible to vehicles for the purpose of replacement of fittings
- Free from danger of ground collapse
- Free from danger of landslide
- Free from danger of torrents
- Free from danger of ground water
- Free from danger of snow drifts

Masts shall be vertical and aligned on a tangent section of the route. The verticality of each mast shall be checked from two directions at the right angle



Mast stems shall carry fittings for conductor erection.

Mast stems shall be of reinforced concrete of circular - ring cross section, in compliance with SRPS U.MI.047 and SRPS IEC 60652.

Mast stems shall be 15m, minimum fixing depth 1.8m, and recommended fixing depth 2.0m

Mast stems to which disconnectors or switch-disconnectors are to be fitted shall be coated with an agent for additional protection and/or impregnated to prevent corrosion.

Foundations for concrete masts shall be prismatic, made of concrete.

Masts with single stem shall be provided with prismatic foundations of horizontal square cross sectional area while foundations for masts with twin stems shall be rectangular.

Prismatic foundations for concrete masts shall be cast in situ or precast

Mast dimensions shall adequately prevent strain in materials mounting above permissible stress limit in all load cases. Each mast section shall be calculated assuming loads that will cause maximum stress in it.

The Contractor shall prepare adequate documents for grounding each mast.

Each support point shall bear a number derived from the common numbering system, engraved in an aluminium plate or direct on mast stem in fast colour at the level of 2.50 m above ground.

Each support point shall be provided with a warning notice indicating the presence of voltage at the level of 2.50 m above ground.

At least one plastic pipe, 40-50mm dia shall be inserted in foundation to take an earth wire for the mast through it.

Upper end of the plastic pipe shall protrude above top foundation surface beneath the earthing terminal while its bottom end shall enter the soil at least 0.6 m below the ground surface.

Where underground cables are to be connected to a mast, then its foundation shall contain an appropriate number of plastic pipes, 100 mm dia to allow their passage through the foundation.

Cantilevers for conductor erection shall be of concrete and shall be fitted to a concrete mast stem prior to erection. Other cantilever types may be used if more adequate in some cases.

All necessary fittings shall be fixed prior to mast erection, if possible.

Assembled masts shall be conveyed and erected to avoid damage or loads in excess of designed ones. Minor damage shall be repaired while masts with damage that may weaken their stability shall not be used.

16.2.3 Conductors

Conductors shall be steel-reinforced aluminium ones with maximum number of wires.

10 kV steel reinforced aluminium conductors are: Al/C 50/8 i Al/C 70/12.

Conductor route in unbuilt area shall be short and tangent, without turns, as much as possible.

Conductor route in built up urban environment shall not pass through yards and gardens unless unavoidable and subject to the approval of the Engineer.

The route shall be close to existent streets as this will lower the cost considerably.

In setting a conductor route grounds with possible additional ice load occurrence shall be avoided as well as galloping of phase conductors.

If an overhead power line has to cross arable land, its support points shall be allocated along the existing property lines.

The longitudinal profile shall indicate all structures/ buildings to be crossed by the line.

The distance between live parts and between live and earthed parts and mast sections assuming wind effect or additional loads shall be minimum equal to safety clearance.

Headroom below an overhead power line crossing or getting closer to buildings/structures shall be equal to safety clearance unless a particular value is indicated for it.

In the area accessible to vehicles (around built up areas, above meadows and fields), headroom shall be 6 m and safety clearance 5 m.

For permanently accessible parts of buildings (terraces, balconies), headroom shall be 5m and safety clearance 4 m. Overhead power lines above buildings shall be provided with upgraded electrical insulation and those above houses and public buildings in which large numbers of people sojourn shall require upgraded mechanical insulation too.

In built up urban environment headroom shall be 7m. Electrical insulation shall be upgraded as well as mechanical at the points of crossing with streets or roads.

On regional and local roads headroom shall be 7 m. As a rule, the distance of any mast section from outer road edge shall not be less than 10m but may be reduced to 5m in exceptional cases. Electrical insulation shall be upgraded. In a crossing tension length only one joint per conductor or a protective wire is permitted. As a rule crossing angle between an overhead power line and a regional road shall be minimum 20°. The crossing angle will be limitless on local roads.

On main roads the headroom shall be 7m. Horizontal distance of any mast section from the outer road edge shall be 20m and may be reduced but not below 10 m. Both mechanical and electrical insulation shall be upgraded. In a crossing tension length no joints will be permitted in conductors. As a rule, the crossing angle shall be minimum 30°.

On a motorway headroom shall be 7 m. The distance of any mast section from the motorway edge shall be minimum 40m and may be reduced but not below 10 m. Both mechanical and electrical insulation shall be upgraded. In a crossing tension length no splices in conductors are permitted. Crossing angle shall be minimum 30°. If overhead power lines are in parallel then their distance from the motorway along 5 km and longer motorway sections may be minimum 50 m.

At the points where a high voltage overhead power line crosses other high voltage lines and at the points where they converge, safety vertical clearance shall be 2.5m, and safety horizontal clearance 1m. These requirements have to be fulfilled even in cases of additional load on the upper line and no load on the lower one. As a rule a higher voltage line shall be placed above a low voltage line. The upper line shall be provided with upgraded electrical insulation.

Running of a low voltage line over and above a high voltage line is not permitted.

Where a high voltage line crosses a low voltage one, safety vertical clearance shall be 2.5 m and horizontal safety clearance 2 m. The upper line shall have upgraded electrical insulation.

At the point where an overhead 10 kV line crosses a telecommunication line, the height from the bottom conductor in the electrical line and the top conductor in the telecommunication line shall be 4m. At the point where an overhead 10 kV line crosses a telecommunication line no safety net shall be placed. At the point where an overhead 10 kV line crosses a telecommunication line mechanical and electrical insulation shall be upgraded and no joints will be permitted in that tension length. As a rule, the crossing angle between an overhead 10 kV line and a telecommunication line shall not be less than 45°, but it may be reduced down to 30°.

It is not permitted to take a telecommunication line over an overhead power line.

Conductors, steel reinforced aluminium ones in our case shall be fitted through the following stages of work:

- Preparations preceding pulling out of steel reinforced aluminium conductors
- Pulling out of conductors along the route
- Tensioning of steel reinforced aluminium conductor
- Attaching steel reinforced aluminium conductors to string insulator units

A steel reinforced aluminium conductor shall be pulled out over an aluminium pulley hung on a cantilever.

Pulleys for conductor pulling-out fitted to tensioning and end masts shall be stronger and bigger than those supporting masts.

Tensioning masts at corners shall be anchored contrary to tensioning force direction during conductor pulling out and tensioning.

Conductors shall not be pulled over sharp objects, rocky ground, fences, or fields sprinkled with fertilizers. If this is unavoidable, then wooden boards, joists, scaffolds and the like shall be placed over such obstructions.

Steel-reinforced aluminium strand shall be tensioned at the values shown in the sag table dependent on temperature and tension length.

The temperature shall be measured very carefully if tensioning is done by taking sight on levelling staff.

It is recommended to measure the ambient temperature of the air with a thermometer placed on a mast, 5 m above the ground level.

In a tension length, the conductor shall be left to rest on pulleys for two days for sag to settle in the meantime. Then conductors shall be attached to carrying string insulators.

Conductors shall be spliced with appropriate splices and/or clamps of the same materials. Steel splices and clamps shall be hot dip galvanized or made of stainless steel.

No more than one splice per conductor shall be permitted in one tension length.

Conductors of different cross sectional area or of different materials may be spliced only at the points where they do not withstand any mechanical load. Clamps shall serve for reliable prevention of electrolytic destruction.

In a tension length, conductor splices shall withstand 90 % of conductor breaking load.

Post and suspended insulators shall be used. Post insulators shall be firmly fixed to masts. Hanging insulators shall be so fitted to a mast that they can freely swing around the point of fixing.

The positions of insulators and/or string insulator units shall not diminish the insulating properties of conductors.

Multiple insulator strings may be used provided that loads are equally distributed over them under normal conditions.

Both mechanical and electrical insulation of each conductor shall be upgraded if necessary.

Upgraded electrical insulation means that the selected insulator will have longer creepage path.

Conductors shall be supported on puncture proof porcelain post insulators.

Conductors in tension shall include string insulators with glass pins

Tensioned conductors shall be attached to string insulators with wedge clamps or compressive clamps suitable for steel reinforced aluminium conductor.

Tension clamps for fixing steel reinforced aluminium conductor in tension to string insulators shall comply with SRPS N F2.010

Concrete cantilevers shall have 22 mm dia holes. String insulators shall be attached to concrete cantilevers with flag supports and anchor bolts already fitted to them. Flag and anchor bolt for string insulator suspension shall withstand nominal breaking force of 40 kN.

Joints in steel reinforced aluminium conductors shall be non-disconnecting. They shall be formed by plastic deformation of the body when pressed or by plastic deformation of the body when notched.

Electrical continuity of steel-reinforced aluminium conductors shall be preserved with at least two conducting clamps and a joint pressurized with bolts or one conducting clamp and an aluminium lug with M12 bolts at conductor unloaded ends.

The joint of a conducting clamp and an aluminium lug shall be formed by plastic deformation by pressing clamp body. M12 bolts shall be fitted with two spring plate-shaped washers and a nut.

A branch circuit shall include at least two conducting clamps and a pressure bolted connection.

The branch circuit shall consist of a conductor of the same type and cross sectional area as branching conductor.

Branch conducting clamps for steel reinforced aluminium conductors shall be fitted along the load free conductor section.

Connections to various units in the equipment shall be made using conductors of the same type and cross sectional area as conductors in the overhead power line.

Levers in a disconnector or a switch disconnector control mechanisms shall be positioned.

- At the side of the overhead power line,
- At the apex of an obtuse angle in overhead power line if the point of support is positioned at an angle,
- At the point where a mast can be most easily approached.

Joints of steel reinforced aluminium and copper shall be done with bimetallic conducting clamps.

16.2.4. 10 kV Cable Trench

16.2.4.1. General Recommendations

In general, electrical cables shall be buried direct in the ground. At street, road and path crossings and in all other places where a cable has to be protected from mechanical damage, cables shall be laid in protective pipes and cable conduits respectively. Cables shall be laid by hand or using mechanical means provided always that allowable bending radii and drawing forces are considered.

Allowable bending radius for cable types PP00, PP41 XHF-49, NPO-13 and NPZO-13 is $15 D$ (mm), and/or $15 D_1$, and for XP00 cable type it is $12 D$.

Allowable drawing forces over tension sleeves for types PP00 ASJ, PP 41 ASJ XHE-49A, XP00-AS is $5D^2$ (N), and for NPO-13 A and NPZO-13 A is $-3 D^2$ (N).

It is not recommendable to lay cables when the outside temperature is below $+5^\circ\text{C}$. If the temperature is lower a cable shall be warmed in advance and laid as quickly as possible. The warming up shall last 36 to 48 hours for a cable on a drum at the ambient room temperature of 10°C to 20°C . Fast warming up can be achieved by letting 5 A/mm^2 electric current through the cable for about one hour while preventing the cable surface temperature to exceed 25°C .

The cable route shall be surveyed before backfilling. Points of crossing of the cable with other cables and installations, points of splicing, and the cable exact length shall be plotted on the laying plan and submitted for the approval of the Engineer.

Ends of a laid cable, points of crossing with other underground installations and other characteristic points shall be specially marked with plates containing basic cable data. Such plates shall not be fixed to cable wires.

Routes of electric cable lines are generally specified in urban and technical terms of reference to suit other underground installations. Lighting cables shall be laid along mast axis.

16.2.4.2. Laying of Cables in Trench

It is recommended to place power cables direct in the ground.

The size of a trench for cable to be laid direct in the ground shall depend on its nominal voltage, type of soil, number of cables in trench and available size.

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Trench bottom shall be made flat and stones and other sharp objects removed to avoid any burden on the cable. If this is not possible, a 0.2m thick bedding for cable shall be placed in trench. Cable shall be laid at trench bottom and/or on such a bedding. It shall be laid in a winding line so that the cable will be by 2% longer than its route.

As a rule, a cable shall be covered with 0.3 m thick layers of excavated earth. The first layer next to the cable and the cable bedding shall consist of fine grained earth. If, however, the excavated material contains lots of stone, debris, mud, earth contaminated with chemicals, then fine grained earth, sand or specially prepared material of good heat conductivity shall be brought to the place.

A plastic warning tape shall be placed on top of the cable in due time prior to backfilling. The tape shall be red with lettering warning of existence of a power cable beneath it. The tape shall be about 0.1 m wide and of the quality guaranteeing the same lifetime as the cable itself.

An open cable trench shall bear visible marks and ensure safety of pedestrians and vehicles.

16.2.4.3. Cables in conduits

Cable conduits shall be used for crossings under streets, roadways, tramway tracks, railway tracks, yards with vehicular passages and where permissible distances of power cables from other underground installations are exceeded.

Cable conduits shall be constructed from plastic, asbestos cement pipes or precast concrete products (ducts). Warning tapes shall be laid over conduits. As a rule, steel pipes shall be avoided.

Minimum inside diameter of pipes shall be at least 1.5 times the cable outside diameter.

Cable conduits shall be placed on a bedding of 10 cm thick lean concrete. The pipes shall be carefully joined and joints grouted with cement mortar or other suitable materials. Edges of concrete conduit openings shall be covered with sheet lead.

Unused pipe openings shall be closed with plastic plugs or in another similar way.

Where cable conduits cannot be placed in open trench, they shall be drawn into boring.

16.2.4.4. Convergence and Crossing with Power Cables and Other Installations

Minimum distance of 0.5 m shall be required wherever power cables run parallel with telecommunication cables.

They shall cross each other at the distance of 0.5 m. Crossing angle shall be as close to the right angle as possible and not less than 45°. As a rule, power cables shall be placed beneath telecommunication ones.

If the above distances cannot be achieved, power cable shall be placed in a protective pipe but the above distance shall never be less than 0.3 m.

Laying the cable lines parallel with, under or above water supply pipes and sewers is not permitted except at crossings.

Horizontal distance between power cables and water supply or sewerage pipes shall not be less than 0.4 m. If such a distance cannot be achieved, power cable shall be drawn through a protective pipe.

At points of crossing, cables may run above or under water supply pipes at a minimum distance of 0.3 m.

A trench shall be excavated by hand at the points where a power cable runs parallel to a water supply pipe or sewer (no mechanical means).

It is not permitted to guide power cables above or under heating ducts except at crossings.

At crossings, a cable shall as a rule pass above a heating line duct and only in exceptional cases it may pass under it. Minimum horizontal distance between a cable and the outer edge of a heating line duct shall be 0.6 m.

Spacing between parallel power cables in a trench shall be minimum 0.07m and 0.2m at crossing points.

If one trench has to accommodate cables of low and medium voltage or several cables of medium voltage, these shall be separated by a continuous row of bricks or some other insulating material.

The distance between a power cable and a gas pipe line at a crossing and in parallel running shall be minimum 0.8 m in urban area and 1.2 m in unbuilt area.

These distances may be reduced down to 0.3m if a cable is placed in a protective pipe 2 m long at each end of a crossing.

If a cable line crosses a road outside urban area it shall be laid in a protective pipe drawn through a bored passage under road without pavement breaking. Vertical distance of cable conduits from the road surface shall not be less than 0.8 m.

The distance between a cable line and a road running in parallel shall be:

- Minimum 5 m for a motorway or class I road, and minimum 3 m in case of convergence
- Minimum 3 m for below class I roads for parallel runs, and/or minimum 1 m in case of convergence

16.2.4.5. Cable accessories

Use of heat shrinking and cold shrinking cable accessories or prefabricated elements is recommended. It is permitted to use conventional cable accessories for paper insulated cables (IPO 13).

Conductors shall be joined by pressing as recommended (SRPS N.F4.101) although special bolted clamps are also permitted.

Cable joints and terminations shall be fitted by skilled persons.

A medium voltage cable termination shall be provided with accessories for simple fixing of metallic sheath and armour, and for connecting electrical safety elements to earth terminal of a transformer station or a mast.

A cable joint shall not be grounded on its own whether made of insulating materials or metal but electrical protection and/or the cable lead sheath shall be bridged.

Joints and terminations shall comply with the standards governing works of this kind and with the fitting recommendations and instructions issued by the manufacturer.

Each cable of selected type and cross sectional area, bolted clamps and jointing material to be pressed shall be accompanied with prototype Compliance certificates.

If aluminium cables are used then particular attention shall be paid to jointing quality. These shall be joined by soldering, welding and pressing according to a specific procedure. Aluminium cables shall be connected to copper terminal ends, rails and the like with tin plated bimetallic Al-Cu lugs. Aluminium cables shall be handled with special tools that were not in contact with copper. Special bolted clamps can also be used for low voltage cables.

A finished cable joint shall be covered with a sand layer not thinner than 10 cm at any point and bricks all over it. Cable joints in buildings or manholes need not be covered with sand.

Joints and terminations shall comply with SRPS N.F4 group of standards. In their absence, work shall proceed according to VDE regulations, manufacturer's instructions and "Elektro distribucija" Co. requirements.

Finished joints shall not be buried until their positions are surveyed by the Contractor and submitted for the approval of the Engineer.

The laid, spliced and buried power cable shall be subjected to voltage test.

Each cable joint and termination shall be provided with notices showing type, cross sectional area, voltage and name of the facility in which the cable is terminated at the other end.

16.2.4.6. Testing of Power Cables and Accessories

Power cables shall be tested by type according to SRPS N.C5.025, SRPS N.C5.235 and SRPS IEC 60502. Cables and cable accessories shall be subjected to obligatory (piece) tests, type tests, special tests and tests at acceptance.

Cables and cable accessories shall be accompanied with Compliance certificates issued by an accredited institution and submitted for the approval of the Engineer.

A laid, spliced and terminated cable shall be subjected to voltage test of the whole cable line.

16.2.4.7. Setting Out Cable Routes

Markers shall be placed along a cable route in built up urban environment at ground level to designate: cable in trench, curves and turns in the route, joints, conduits, crossing with water supply pipes, telecommunication cables and the like.

Markers shall be in the form of metallic plates and shall show cable type, cross sectional area and voltage. They shall be placed at ground level at about 100 m spacing.

In unbuilt area, these markers shall be in the form of concrete posts with engraved lightning sign and cable voltage, spaced at 25 - 30 m.

Cable markers in urban and unbuilt areas shall be placed:

- on top and along cable axis
- above each joint
- above each point of crossing
- above cable conduit ends and the like

16.2.4.8. Conversion of a cable line into an overhead power line

A 10 kV cable line may be converted into an overhead line over a special mast for the purpose subject to the approval of the Engineer.

As a rule this shall be done on the tensioning (end) mast in the overhead power line. Exceptionally it can be done on a support mast if it corresponds to the tensioning (end) mast by form and dimensions.

At the point of conversion into an overhead power line the cable shall be protected from mechanical damage along minimum length

of 1.70m above ground and 30 cm in it.

Cable mechanical protection shall be formed as a gutter (trough) of steel angles 100x50x10 (two welded sections forming 100x100x10 channel section), total length minimum 2m with at least two attachments to a mast. Alternatively, the cable may be protected with a gutter of min 3 mm thick sheet metal.

At the ends of a cable line converted into an overhead power line, termination boxes, outdoor type, of the size corresponding by type, cross sectional area and voltage shall be fitted.

A termination box shall be fitted on a support mast of the overhead power line and shall be easily accessible for visual inspection. It shall correspond to cable type, cross sectional area and voltage.

Safety clearances of the live parts of a cable termination box from a mast, cantilevers and other parts which are not under voltage shall not be less than 20cm.

Surge diverters are mandatory at the point where a 10kV cable line is to be converted into an overhead power line.

Surge diverters shall be earthed fully in compliance with the applicable regulations.

Supports for termination boxes as well as the boxes need not be earthed on their own as it will be sufficient to bond them to earthing terminals of surge diverters or masts. Switching device- disconnecter shall be fitted on a mast in horizontal position.

In specific cases a three pole disconnecter may be fitted but in vertical position.

A switching device shall be assembled of such components and quality which comply with Yugoslav standards and Rules on technical norms for erection of overhead power lines.

Steel parts in a switching device shall be protected against corrosion by hot-dip galvanizing.

The switching device design shall conform to SRPS N.K3.301.

The switching device shall meet the following specific requirements:

- Insulators shall be specific by type in compliance with SRPS IFC 273
- Insulator metal supports shall be in a reliable galvanic bond with mast earthing.

Contacts in a switching device shall enable smooth switch-off under ice load.

A switching device may be controlled by hand levers.

A switching device will be provided with an option to be relieved from mechanical load due to conductors in the overhead power line:

- At the base of the switching device
- On a special console.

The parts of a switching device and screwware shall be accessible from underneath.

A hand control device shall be fixed to concrete mast as shown on the typical fixing detail.

Control lever shall be fitted in the following way:

- With lever axis about 1.5m above ground level
- Under the right angle to the route and/or on corner masts in the direction of the line of symmetry in the area of obtuse angle.

Contacts in a switching device shall solely serve to conduct and switch off the currents envisaged.

Clamps shall ensure a reliable galvanic bond of Al/C conductors in the overhead power line and disconnecter terminals.

A switching device shall be fitted with a notice according to standard SRPS N.K3.301. It shall be placed by the switching device manufacturer. The plate shall be visible and legible from underneath.

An earthing electrode in the form of two rings according to TP-9 issued by EPS, Electricity Distribution Directorate shall be obligatorily provided for the mast in the overhead power line that will carry a switching device.

16.2.5. Final requirements

Materials and components to be incorporated shall comply with the presently applicable SRPS standards, and in their absence with the applicable IEC standards.

The equipment shall be tested according to applicable regulations prior to incorporation.

Erection and mounting shall comply with presently applicable SRPS standards and in their absence with the applicable IEC standards.

In the course of work the Contractor shall ensure normal traffic conditions by positioning adequate signs and make excavations that may cause trouble to pedestrians safe.

Tests and trial operation shall be performed upon completion of the works and prior to startup. Upon completion of all the works the Contractor and the Employer's Engineer shall make an accurate layout plan of the installations and overhead power line entering all modifications in one copy and shall thus enable preparation of precise 'as built' drawings for submission, via the Employer, to a

future operator of the installations and overhead power line

Measurement and payment

The exact quantity of installed material and payment are determined based on the construction book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications

16.3. Overhead Electric Mains 35 kV

When erecting a 35 kV overhead power line the Contractor shall observe the approved technical regulations and standards, technical documentation, the equipment manufacturer's technical requirements and drawings.

These Technical Specifications constitute an integral part of the contract and design documentation for which the Contractor shall ensure full compliance in the erection of a 35 kV overhead power line.

16.3.1 General specifications

The Contractor shall observe and apply during the execution of the works,

- a) Applicable SRPS, IEC regulations and standards;
- b) Rules on technical norms for electrical installations operating at nominal voltage over 1000 V, Off. Journal of SFRY No 4/74, amended in Off. Journal of SFRY No.13/78, Off. Journal of FRY No.61/95;
- c) Rules on technical norms for grounding electrical installations operating at nominal voltage over 1000V Off. Journal of FRY No.61/95;
- d) Rules on technical measures for operation and maintenance of electrical installations and power lines, Off. Journal of FRY No.41/93;
- e) Law on Occupational Health and Safety, Off. Gazette of RS, No.101/2005, 21.11.2005;
- f) Rules on general measures for safety at work and protection against dangerous current in rooms intended and used for operating electrical facility and on sites Off. Gazette of SRS No. 21/89;
- g) The equipment manufacturer's requirements ;
- h) Technical documentation;
- i) Rules and recommendations of EPS and FDB.

The first and main obligation of the Contractor is to peruse the technical documentation, prepare a schedule of works and execute them in accordance with the technical documentation. In case of ambiguities in the technical documentation the Contractor shall ask the Designer to clarify.

The Employer shall nominate an expert (the Engineer) to supervise the execution of works, their quality, quantities and resolve unclear issues. Modifications and deviations of any kind affecting the technical concept and choice of materials shall be permitted solely upon a written consent of the Engineer appointed by the Employer. Prior to giving such a consent the Engineer shall obtain the Designer's approval. The Engineer and/or the Employer shall be responsible for any consequences of a design modification if made without the Designer's approval.

The Design Reviewing Commission that has approved this design documentation shall be responsible for major deviations from the approved design.

In executing the works the Contractor shall use planned equipment and materials in the way described in the design in compliance with standards and regulations governing works of this kind.

The equipment and materials to be incorporated shall comply with IEC, ISO, SRPS standards and recommendations unless otherwise provided in the design specification.

The equipment and materials to be incorporated shall be controlled and tested by the Buyer's inspectors in the course of production, packing and transport.

Fitting of electrical equipment may start upon the receipt of the Engineer's written statement that the equipment has arrived in orderly condition and that it complies with design characteristics. Materials for transmission lines shall be new and unused.

The equipment to be incorporated shall be supplied by approved manufacturers and be provided with Compliance certificates which shall be submitted to the Engineer for approval.

The Contractor shall check the current situation along the designed route and look for any impediments that may prevent the execution of the works in accordance with the design documentation. In the period after completion of design and before commencement of works the situation on the designed route earlier surveyed by the Designer may worsen. In case of any obstructions the Engineer shall be consulted.

The Contractor shall take care to avoid damage in places where works are executed. Any such damage, either due to insufficient care or carelessness at work shall be compensated by the Contractor to the Employer or to any other Contractor working there at the same time and necessary repairs shall be done by the Contractor at his own cost. The Contractor shall take care to minimize damage to any existent works and installations. He shall also coordinate the works to avoid disruptions and improper deviations. Reinforced concrete structures may be demolished, cut or punctured only with a written consent of the Designer and the Engineer.

Use of installations may start only upon completion of the works and tests by the relevant authorities and subject to the final approval of the Engineer.

16.3.2 Masts

The Contractor and the Engineer shall mark support points for new concrete masts before their erection. Mast spacing shall conform

to the tension lengths shown on the layout drawing and in the longitudinal profile unless there are justified reasons for deviating from them

The geological design indicating the load bearing capacity of soil along cable route shall be consulted for the purpose of a proper choice and design of foundations which shall be subject to the approval of the Engineer

The allocated support points shall be:

- In road land strip
- On the property line
- Easily accessible to vehicles for the purpose of erection of equipment
- Easily accessible to vehicles for the purpose of replacement of fittings
- Free from danger of ground collapse
- Free from danger of landslide
- Free from danger of torrents
- Free from danger of ground water
- Free from danger of snow drifts.

Masts shall be vertical and aligned on the tangent section of the route. The verticality of each mast shall be checked from two directions at the right angle.

Lattice masts shall be calculated as space lattice structures. If they are not calculated as space lattice structures, then forces acting on each mast shall be divided into components parallel to mast sides.

Angle bracing in lattice masts shall be calculated applying the arithmetic sum of forces in it caused by the relevant components.

Diagonal brace in lattice masts shall be calculated assuming forces caused by the component which is parallel to the relevant mast side.

Moment of torsion of external forces acting on rectangular masts may be substituted by two equal pairs of forces in the plane subjected to the action of the moment of torsion. Such calculation shall apply if the ratio of the sides in mast cross section does not exceed 1.5, if the mast is in the form of a truncated cone and if there are horizontal stiffeners in its cross sectional area in the plane subjected to moment of torsion.

Where chords are exposed to strain under axial compressive force, eccentricity of these forces can be ignored.

Where bars in bracing are subjected to axial compressive forces eccentricity of these forces can be ignored if a bar consists of one angle iron attached by one of its sides to angle rods or a gusset plate.

Coefficient of safety assumed in mast structural analysis depending on loading cases shall be:

- 1) 1.50 - for normal loads
- 2) 1.10 - for extra loads (a break in conductor or protective wire).

Mast sections shall be designed according to Yugoslav standards for steel structures.

Steel tubes may be used for mast construction.

Restrained masts (single tubular or of appropriate polygonal cross section) shall be calculated with the following coefficients of safety depending on loading cases:

- 1) 1.65 - normal loads
- 2) 1.30 - extra loads.

Sections of steel masts above ground shall be protected against corrosion with an anti-corrosive coat or metal plating.

Zinc coating shall be applied in a hot-dip galvanizing process if shapes of steel parts would allow that. Metal-plating can also be applied.

Hot dip galvanized threads and nuts may be machined provided their smooth tightening is not impaired.

Buried steel parts shall be coated with bitumen or other appropriate agent.

Steel parts embedded in concrete do not require any anti-corrosive protection. It is not permitted to coat steel parts with any protective agent that may reduce adherence of concrete and steel unless such a possibility was considered in the calculation.

Welds on steel tubular masts shall be waterproofed to avoid penetration of moisture and humidity in tubes. If tubes are not waterproofed, their inside wall faces shall be coated with bitumen or other protective agent of similar effect.

Where mast components are fitted in such a pattern (in which the pitch of diagonal and horizontal braces exceeds 60cm) that climbing may be difficult, step irons shall be provided and the first step iron shall not be lower than 2.5 m above ground.

Masts shall be designed so that stresses in material do not exceed permissible stress limit in any loading case. Each mast section shall be calculated assuming load that causes the highest force in it. The Contractor shall prepare documents showing the kind of earthing for each mast on its own.

Each support point shall bear a number from the common numbering system engraved in an aluminium plate.

Each support point shall be provided with a warning notice indicating the presence of voltage, at the level of 2.50 m above ground.

At least one plastic pipe, 40-50 mm dia. shall be inserted in foundation to make way for mast earthing cable through it.

16.3.3 Conductors

Conductors shall be steel-reinforced aluminium ones with maximum number of wires.

35 kV steel reinforced aluminium conductors are: Al/C 70/12 and Al/C 95/15 or exceptionally Al/C 150/25

Conductor route in unbuilt area shall be short and tangent, without turns, as much as possible.

Conductor route in built up urban environment shall not pass through yards and gardens unless unavoidable and subject to the approval of the Engineer.

The route shall be close to existent streets as this will lower the cost considerably.

In setting a conductor route grounds with possible additional ice load shall be avoided as well as galloping of phase conductors.

If an overhead power line has to cross arable land, support points shall be allocated along existing property lines.

The longitudinal profile shall indicate all structures/ buildings to be crossed by the line.

The distance between live parts and between live and earthed parts and masts assuming wind effect or additional loads shall be minimum equal to safety clearance.

Headroom below an overhead power line crossing or getting closer to buildings/structures shall be equal to safety clearance unless a specific value is indicated for it.

In the **area accessible to vehicles** (around built areas, above meadows and fields), headroom shall be 6 m and safe distance 5 m.

For **permanently accessible parts of buildings** (terraces, balconies), the headroom shall be 5 m and safety distance 4 m. Overhead power lines above buildings shall be provided with upgraded electrical insulation and those above residential buildings and buildings in which large numbers of people sojourn shall require upgraded mechanical insulation.

In **built up urban environment**, headroom shall be 7 m. Electrical insulation shall be upgraded as well as mechanical at the points of crossing with streets or roads.

On **regional and local roads** headroom shall be 7m. As a rule, the distance of any mast section from outer road edge shall not be less than 10m but may be reduced to 5 m in exceptional cases. Electrical insulation shall be upgraded. In a crossing tension length only one joint per conductor or a protective wire is permitted. As a rule the crossing angle between an overhead power line and a regional road shall be minimum 20°. The crossing angle will be limitless on local roads.

On **main roads** headroom shall be 7m. Horizontal distance of any mast section from outer road edge shall be 20m. The distance of any mast section may be smaller but not less than 10m. Both mechanical and electrical insulation shall be upgraded. In a crossing tension length no joints in conductors are permitted. As a rule, the crossing angle shall be minimum 30°.

On a **motorway** headroom shall be 7 m. The distance of any mast section from motorway edge shall be minimum 40 m. The distance of any mast section may be smaller but not less than and may be reduced but not below 10 m. Both mechanical and electrical insulation shall be upgraded. In a crossing tension length no splices in conductors are permitted. Crossing angle shall be minimum 30°. If overhead power lines are in parallel then their distance from the motorway, along 5 km and longer motorway sections may be minimum 50 m.

At the points where a **high voltage overhead power line crosses other high voltage lines** and at the points where they converge, safety vertical clearance shall be 2.5m, and safety horizontal clearance 1m. These requirements have to be fulfilled even in cases of additional load on the upper line and no load on the lower one. As a rule a higher voltage line shall be placed above a low voltage line. The upper line shall be provided with upgraded electrical insulation.

Running of a low voltage line over and above a high voltage line is not permitted.

When a **high voltage line crosses a low voltage one**, safety vertical clearance shall be 2.5 m and horizontal safety clearance 2 m. The upper line shall have upgraded electrical insulation.

At the point where an **overhead 35 kV line crosses a telecommunication line**, the height between bottom conductor in the power line and top conductor in the telecommunication line shall be 4m. A safety net shall not be placed above the telecommunication line at this point. At the point where an overhead 35 kV line crosses a telecommunication line mechanical and electrical insulation shall be upgraded and no joints will be permitted in that tension length. As a rule, the crossing angle between an overhead power line and a telecommunication line shall not be less than 45°, but it may be reduced to 30°.

It is not permitted to **take a telecommunication line over an overhead power line**.

Conductors, steel reinforced aluminium ones in our case shall be fitted through the following stages of work:

- action preceding pulling out of steel reinforced aluminium conductors
- pulling out of conductors along the route
- tensioning of steel reinforced aluminium conductor
- attaching steel reinforced aluminium conductors to string insulator units.

Steel reinforced aluminium conductors shall be pulled out over aluminium pulleys hung on a cantilever on a mast.

Pulleys on tension and end masts shall be stronger and bigger than those on supporting masts.

Tension masts at corners shall be anchored contrary to the direction of the tensile force acting during conductor pulling out and tensioning.

Conductors shall not be pulled over sharp objects, rocky ground, fences or fields sprinkled with fertilizers. If this is unavoidable, then wooden boards, joists, scaffolds and the like shall be placed over such obstructions.

A steel-reinforced aluminium strand shall be tensioned at the values shown in the sag table dependent on temperature and tension length.

The temperature shall be measured very carefully if tensioning is done by taking sight on levelling staff.

It is recommended to read the ambient temperature of the air on a thermometer placed on mast, 5m above the ground level.

In a tension length, the conductor shall be left to rest on pulleys for two days for the purpose of sag equalizing. Then conductors shall be attached to string insulators.

Conductors shall be joined with appropriate joints and/or clamps of the same material. Joints and steel clamps shall be hot dip galvanized or made of stainless steel.

No more than one joint per conductor shall be permitted in one tension length.

Conductors of different cross sectional area or of different materials may have joints only at the points where they do not withstand any mechanical load. Clamps shall serve for reliable prevention of electrolytic destruction.

In a tension length, conductor joints shall withstand 90% of conductor breaking load.

Post and hanging insulators shall be used. Post insulators shall be firmly fixed to masts. Hanging insulators shall be so fitted to a mast that they can freely swing around the point of fixing.

The positions of insulators and/or string insulator units shall not diminish the insulating properties of conductors.

Multiple insulator strings may be used provided that loads are equally distributed over them under normal circumstances.

Both mechanical and electrical insulation of each conductor may be upgraded, if necessary.

Upgraded electrical insulation means that the selected insulator will have longer creepage path.

Conductors shall be supported on puncture proof porcelain post or rod insulators.

Conductors in tension shall be attached to string insulators since mast cantilevers are not calculated to withstand torsion at the point of insulator suspension.

Conductors in tension shall be attached to puncture proof porcelain rod insulators.

A fitting used to attach a conductor to an insulator string shall be a support clamp for a steel reinforced aluminium conductor.

Support clamp for a steel reinforced aluminium conductor attached to an insulator string shall comply with SRPS N.F2.010.

Conductors in tension shall be attached to string insulators with wedge clamps or compressive clamps suitable for steel reinforced aluminium conductor.

Tension clamps for fixing steel reinforced aluminium conductor in tension to string insulators shall comply with SRPS N.F2.010.

Fittings for attaching post insulators to the skeleton shall be fork-and-eye clamps as specified in SRPS IEC 471 and SRPS N.F2.010.

Concrete cantilevers shall have 22 mm dia holes. String insulators shall be attached to *concrete cantilevers* on which flag supports and anchor bolts shall already be fitted. Flag and anchor bolt for string insulator suspension shall withstand nominal breaking force of 70 kN.

Joints in steel reinforced aluminium conductors shall be non-disconnecting. They shall be formed by plastic deformation of the body when pressed or by plastic deformation of the body when notched.

Electrical continuity of steel-reinforced aluminium conductors shall be preserved with at least two conductive clamps and a compressive joint with bolts or with one conductive clamp and an aluminium lug with M12 bolts at conductor unloaded ends.

The joint of a conductive clamp and an aluminium lug shall be formed by plastic deformation of clamp body effected by pressing. M12 bolts shall be fitted with two spring plate-shaped washers and a nut.

A branch circuit shall include at least two conducting clamps and a pressure bolted connection.

The circuit shall consist of a conductor of the same type and cross sectional area as branching conductor.

Branching conductive clamps for steel reinforced aluminium conductors shall be fitted on load-free conductor section.

Connections to various units in the equipment shall be made using conductors of the same type and cross sectional area as used for conductors in the overhead line.

BRACE
СЕРТИФИКАЦИЯ



- Lever in control mechanism for a disconnector or a switch disconnector shall be positioned:
- At the side of the overhead power line.
 - At the apex of an obtuse angle in overhead power line if the point of support is positioned at an angle
 - At the point where a mast can be most easily approached.

Steel reinforced aluminium and copper conductors may be joined only by bimetallic conductive clamps.

Masts may be fitted with step irons fixed to universal consoles. Step irons shall be made of hot dip galvanized steel.

16.3.4. Final requirements

Materials and components to be incorporated shall comply with the currently applicable SRPS standards, and in their absence with the applicable IEC standards.

The equipment shall be tested according to applicable regulations prior to incorporation.

All installation works shall comply with presently applicable SRPS standards and in their absence with the applicable IFC standards.

In the course of work the Contractor shall ensure normal traffic conditions with adequate signs as well as the safety of any excavation that may cause trouble to pedestrians.

Tests and trial operation shall be performed upon completion of the works and prior to startup.

Upon completion of all the works the Contractor and the Engineer shall make an accurate layout plan of the installations and network entering all modifications in one copy and shall thus enable preparation of precise 'as built' drawings for submission, via the Employer, to a future operator of the installations and network.

Measurement and payment

The exact quantity of installed material and payment are determined based on the construction book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications.

16.4. Overhead Installations 110kV and 400kV

Positions of stakes shall be checked before marking and excavating foundation pits to avoid error in case these are displaced by unauthorized persons.

Upon completion of foundations and ground levelling surplus spoil shall be removed to a suitable place because in case a mast is erected on arable land, the land owner may pile it up on top of the foundation and water and mud may pool and accumulate around foundation and bolts.

Instructions for manufacture, anti-corrosive protection and erection of masts/towers are given in the respective design documentation.

The earthing system shall be bonded upon erection of steel structure. Care shall be exercised to inflict as little damage as possible during the works. The quality of materials shall comply with applicable regulations, standards and design requirements. Materials shall be inspected and necessary laboratory testing carried out prior to shipment.

Due to real diversity of materials, it will be necessary to avoid confusion when ordering and erecting them.

Insulator strings shall be fitted with designed details.

Clamps for conductors shall be tightened with torque spanner as instructed by the manufacturer. The torque at which a bolt has to be tightened with a torque spanner is indicated on drawings. Precise tightening of bolts is compulsory for other parts (buffers and knuckles etc.)

Vibration suppressors shall be spaced as shown in the respective chart.

If the Supplier's written statement that the quality of insulators and fittings complies with the regulations is not available, such materials shall be tested.

All compliance statements and test results shall be submitted to the Engineer for approval.

Tension masts, which are not designed as end towers shall be additionally anchored before conductors and protective wires are erected.

Wires being pulled out shall not be dragged over ground or damaged in some other way.

Lengths shall be quoted when ordering conductors and protective wire, to avoid splicing. Data shall be taken from the construction specification.

Positions of drums from which protective conductors will be pulled out on site shall be allocated according to the applicable regulations and the following instructions shall be observed.

In tension lengths in which splicing is permitted it is strictly prohibited to use more than one compression splice per tension length



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though this option may be useful at the time of some later intervention. Therefore, more than one compression splice per wire and per tension length shall not be envisaged. The distance of the splice from support and tension clamps shall be minimum 20 m.

Splices shall be compressive by type and guarantee minimum 100% breaking force.

Thanks to a device for controlled pulling out of wire, formation of loops can be strictly monitored. It shall also be necessary to prevent contact between steel-aluminium and copper and avoid tools earlier used for copper strands as this will cause chemical corrosion of materials. The diameter of pulleys for conductor pulling-out shall not be smaller than 0.7 m.

Local manufacturers of conductors and protective wires still do not state values of permanent extension dependent upon the characteristics of materials, wire design and technology. Therefore only empirical value can be given for the compensation of sag increase due to permanent extension the one derived from the existing lines and earlier laboratory tests in "Dalekovod" Co.

For the above reason and for the purpose of safety and low cost a pretension method is here envisaged. While erecting conductors and protective wires they shall be immediately after pulling out be tensioned by a force 20% higher than indicated in erection charts and temperature values and keep them in tension for 3 hours. After that the tension force will be reduced as much as needed for sag equalization.

As most of lasting extension occurs in this process, it means that metallurgical elongation accounts for most of total permanent extension. As tests show it varies from 66% to 83% of total permanent extension.

The other minor part of permanent extension (mostly metallurgical elongation) is compensated with a reserve in safety vertical clearances at temperature side. Namely sag equalization shall be done for the temperature by 15 °C below the actual ambient temperature.

To facilitate erection the tables indicating sag values calculated for assumed ideal tension length of this kind and these sag values can be directly derived from them. If the temperature measured on site is not in accord with the values given in tables, the sag shall be interpolated for the actual temperature only.

Special care shall be taken in tightening conductors at the points where they cross high and low voltage lines, TT lines and important buildings.

As low and high voltage conductors can cross in this transmission line particular attention shall be paid to temporary grounding and general safety. Pulling out and tensioning of conductors and protective conductors at the points of crossing can be done only when the lines are shut off.

Grounds and bonds shall be removed for a short period before the transmission line is put under trial voltage.

If new buildings are noticed in the course of a transmission line erection, new points of crossing shall be subject to instructions and approvals of the Designer and the Engineer of such transmission line revisions.

Angle tensioning towers of the transmission line shall be related to state control network, and firmly defined in space by the coordinates and levels calculated. Whenever construction of newly planned buildings or installations without such data is pending, particular attention shall be paid to the observance of their positions in relation to the project transmission line.

If any underground installations not indicated in the technical documentation are possibly encountered or happen to be at a distance less than 10m from mast foundations, other buildings or archaeological sites, works shall be suspended, the site protected and the Engineer and the Designer informed thereabout.

Protective measures shall be implemented as regulated and subject to the approval of the Engineer.

Measurement and payment

The exact quantity of installed material and payment are determined based on the construction book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications.

16.5. Lighting

16.5.1. General specifications

These Technical Specifications constitute an integral part of the contract and design documentation for which the Contractor shall ensure full compliance.

Works shall be carried out fully complying with technical regulations and norms governing installations of this type.

Prior to commencement of the works, the Contractor shall peruse the design documentation, give his comments and observations, if any, and duly submit them to the Engineer through Building Journal.

Modifications or variations that may affect the design solution considerably shall be permitted solely upon a written consent of the Designer and subject to the approval of the Engineer.

During the execution of the works the Contractor shall keep daily records entering all required data (Building Journal).

During the execution of the works due care shall be exercised to avoid damage to other works and existing installations.

Breaking or chasing of reinforced concrete structures to make room for electrical works may be done only upon a written consent of the Engineer.

TRACE
TRACING SYSTEMS

The materials and equipment to be incorporated shall have the characteristics specified in the design documentation and applicable norms and standards. Working up and rearrangement of equipment and devices on site is not permitted.

The manufacturers declaration of quality and appropriate Compliance certificates shall be provided for such equipment and materials and submitted for the approval of the Engineer.

During execution of the works the Contractor shall undertake safety measures in compliance with the applicable rules and norms

16.5.2. Power supply installations

For these installations, cables, conductors and appropriate installation materials shall be used fully in compliance with the enclosed technical documents.

Only conductors, protective pipes, supports, boxes, joining and other small installation materials appropriate for the intended use and site conditions may be used.

The installation materials shall mean: distribution cabinets, screw anchors, anchors, screws, washers, clips, clamps, bonding material for wiring within distribution cabinets, insulating materials (insulators, insulating plates, ducts and tapes), cable inlets, inscription plates and other.

All wiring material shall be of copper. Neutral conductors shall not be protected and shall differ from phase conductors by colour. Conductors shall be continuous in electrical and mechanical sense.

Wires shall be installed in horizontal and vertical direction. Vertical cable section (conductor) up to the level of 2m above floor or ground shall be protected against mechanical damage. Wires shall be cut in situ to actual lengths to meet load requirements. Wires, cables and conductors shall be visibly fitted on wall supports or in pipes of adequate diameter. Wires may be spliced in distribution boxes and switchboards only. Cables changing direction shall not be bent sharply.

In floor construction, cables (conductors) shall be drawn through protective pipes or ducts.

For the purpose of coordination, the Contractor in charge of electrical installations shall duly and for the purpose of harmonization, warn the Contractor in charge of civil works of places and ways in which he will install his equipment and wiring. Prior to assembly of distribution panels - cabinets, the Contractor shall submit workshop drawings showing the distribution panels - cabinets and equipment to the Engineer for approval.

Before ordering equipment and wiring materials the Contractor shall determine electrical ratings for the equipment delivered (electric loads) and in case these differ from designed values he shall adjust them.

At the start end of wiring (circuit) in a distribution panel - cabinet, devices providing protection against both overload current and short circuit current shall be fitted, and marked and each panel/cabinet shall be provided with a single pole diagram, durable and legible.

Protection against dangerous voltages shall be executed as designed and the check of its functionality shall be checked before startup as requested in the regulations.

Bonding of steel skeleton and other metal masses in a building in order to form a whole of sufficient electrical conductivity shall be done by welding or other type of bonds (screws with fan like base plates SRPS M.32.151, riveting and the like.)

Upon completion of the Works the Contractor shall test insulation resistance, perform current and voltage tests, measure transient resistance of earthing and issue appropriate Compliance certificates in compliance with the technical regulations and norms governing wiring of this kind for the approval of the Engineer.

16.5.3. Cabinets for public lighting

Places where cabinets will be positioned shall be so allocated to enable the best possible cable connections to luminaires.

In unbuilt area they shall be masked with vegetation, bushes or in some other way so that their positions are not eye striking.

A free standing cabinet in the public lighting system shall be resistant to weather conditions, made of fibreglass armoured polyester or plasticized double pickled metal sheet. Mechanical protection shall be IP65 and shall include a door and special standard lock and universal key. The top of the switchgear block shall be detachable from inside and the door shall bear an inscription „public lighting“

A cabinet shall stand on a concrete base (foundation) protruding by min. 20 cm above the ground surface. It shall be so designed that cables can be led in and out at the underside.

A cabinet shall be fitted on a metal frame with holding down bolts on foundation top.

A cabinet in the public lighting system shall have:

- Entry compartment
- Measuring compartment
- Switchgear compartment

Cabinet components shall be fitted to an assembly frame or plate to enable easy dismantling and refitting of parts.

Cabinet elements shall be joined and bonded in the workshop. Conductors for the wiring system shall be neatly stacked in perforated PVC ducts with covers.



As a rule, a cable shall be covered with 0.3 m thick layers of excavated earth. The first layer next to the cable shall consist of fine grained earth excavated, same as cable bedding. If, however, the excavated material contains lots of stone, debris, mud, earth contaminated with chemicals, then fine grained earth, sand or specially prepared material of good heat conductivity shall be brought to the place.

An open cable trench shall bear visible marks and provide safety for pedestrians and vehicles.

16.5.5.3. Convergence and Crossing of Power Cables and Other Installations

Laying cable lines parallel to, under or above water supply pipes and sewers is not permitted except at crossings.

Horizontal distance between power cables and water supply or sewerage pipes shall not be less than 0.4 m. If such a distance cannot be achieved, power cable shall be drawn through a protective pipe.

At points of crossing cable may run above or under water supply pipes at a minimum distance of 0.3 m.

A trench shall be excavated by hand at the points where power cables run parallel to water supply pipe or sewer (no mechanical means).

The distance between parallel power cables in a trench shall be minimum 0.07 m and 0.2 m at crossing points.

16.5.5.4. Cable Accessories

Use of heat shrinking and cold shrinking cable accessories or prefabricated elements is recommended. Special bolted clamps are also permitted for paper insulated cables (JPO 13).

Cable joint shall not be grounded on its own whether made of insulating materials or metal.

Joints and terminations shall comply with the standards governing works of this kind and with recommendations and instructions issued by the manufacturer.

Each cable of selected type and cross sectional area, bolted clamps and jointing material to be pressed shall be accompanied with prototype Compliance certificates particularly concerning "speedy ageing".

If aluminium cables are used then particular attention shall be paid to joints. They shall be joined by soldering, welding and pressing according to a specific procedure. Aluminium cables shall be connected to copper terminal ends, rails and the like via tin plated copper lugs. Aluminium and copper cables shall not be joined in a cable splice but only in transformer stations, distribution boards and termination boxes. Aluminium cables shall be handled with special tools which were not in contact with copper. Special bolted clamps can be also be used for low voltage cables.

Finished joints shall not be buried until their positions are surveyed by the Contractor and submitted for the approval of the Engineer.

The laid, spliced and buried power cable shall be subjected to voltage test.

Each joint and termination shall be provided with a plate showing type, cross sectional area, voltage and name of a facility in which the cable is terminated at the other end.

16.5.5.5. Testing of Power Cables and Accessories

Power cables shall be tested by type according to SRPS N.CS.025, SRPS N.CS.235 and SRPS IEC 60502

Cables and cable accessories shall be subjected to obligatory (piece) test, type test, special tests and tests at acceptance.

Cables and cable accessories shall come with Compliance certificates issued by an accredited institution.

A laid, spliced and terminated cable shall be subjected to voltage test of the whole cable line.

All test results and compliance certificates shall be submitted to the Engineer for approval.

16.5.5.6 Poles and foundations

As a rule, poles in a public lighting system are made of metal, tapered, octagonal or tubular segmental prefabricated. Poles shall be fabricated according to detailed drawings contained in the technical design documentation.

Each pole shall have an inspection compartment and cable inlets.

Bottom edge of a compartment door in which connecting gear, fuses and wiring for luminaires are accommodated shall be min 600 mm above the foundation top surface (SRPS EN 40-2).

The lid shall adhere well to the edges of the opening. The opening shall be bolted in a good anti-burglar way.

Pole faces shall be metal plated in a hot-dip galvanizing process against corrosion. Inner and outer faces shall be prepared according to national standards and ISO 1461, ISO 14713, and SRPS EN 40-4.

The manufacturer shall guarantee durability of protection not shorter than 10 years for corrosion category C4 according to ISO 12944.

All poles shall be erected to a vertical line and aligned on each tangent section. The verticality of each column shall be checked from two directions at the right angle.

Poles in a public lighting system shall not be earthed individually as their section in the ground stands for sufficient earth except in cases then they are erected at specific places (metallic bridges, overbridges, specific ground etc).

The Contractor shall submit a pole design that shall meet the requirements of the terms of reference the technical design and these Technical Specifications and subject to the approval of the Engineer

Foundations shall be cast in situ according to detailed drawings

Pits shall be excavated by cutting vertical sides and supporting them. A gravel subgrade (10 cm) shall be placed on a flattened bottom and/or a bedding of MB 10 concrete if the soil abounds in ground water.

Foundations shall be provided with holding down bolts (anchor bolts) embedded in concrete for the erection of poles. Foundations shall be cast of min MB 15 class of concrete. Concrete from a mixing plant is recommended for use.

The dimensions of "holding down bolts" (centre to centre spacing and bolt thickness) shall suit the dimensions of the pole base plate.

Foundation top shall protrude by 10cm above the level of the surrounding ground considered in the design

Foundation top shall be finished so that water pooling around the pole base plate will not be possible.

Each foundation shall contain two PVC pipes Ø 70 mm for cable inlets. Their positions shall depend on cable route.

16.5.5.7. Final requirements

The Contractor shall submit to the Employer a completed and tested facility with adjusted protection and control devices after a technical acceptance by the Engineer.

The Contractor shall incorporate comments of the Technical acceptance commission without any right to compensation.

For the purpose of technical acceptance the Contractor shall submit the following documents to the relevant Commission and to the Employer on the occasion of commissioning the facility:

- Two copies of as built drawings
- Compliance certificates and quality statements for incorporated equipment or functional parts (assemblies) of devices and equipment containing:
 - Results of light engineering measurements
 - Compliance certificate on insulation resistance measurement
 - Compliance certificate on the continuity of all conductors
 - Compliance certificate on measurement of loop resistance in wiring (where applicable)
 - Compliance certificate for protection by electrical separation (where applicable)
 - Compliance certificate on the efficiency of protection against electric shock
 - Compliance certificate on earthing and bonding measurement
 - Diagrams, operating and maintenance instructions, warnings and the like, data for functional maintenance

The period of guarantee shall start on the date of commissioning

Measurement and payment

The exact quantity of installed material and payment are determined based on the construction book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications.

16.6. Technical Specifications for Electricity Substations

16.6.1. General specifications

These Technical Specifications constitute an integral part of the contract and design documentation for which the Contractor shall ensure full compliance.

Works shall be carried out fully complying with texts and drawings in the technical documentation and the regulations and norms governing installations of this type.

Prior to commencement of the works, the Contractor shall peruse the design documentation give his comments and observations, if any, and duly submit them to the Engineer through Building Journal

Modifications or deviations that may affect the design solution considerably shall be permitted solely upon a written consent of the Designer and subject to the approval of the Engineer.

During the execution of the works the Contractor shall keep daily records entering all required data (Building Journal).

During the execution of works due care shall be exercised to avoid damage to other works and existing installations.

Breaking or chasing of reinforced concrete structures to make room for electrical works may be done only upon a written consent of the Engineer

TRACE
ТУРК ИСАВИ ХОМПАА



The materials and equipment to be incorporated shall have the characteristics specified in the design documentation and in the applicable norms and standards.

The Manufacturer's declaration of quality and appropriate Compliance certificates shall be provided for such equipment and materials.

During the execution of the works the Contractor shall undertake safety measures in compliance with the applicable rules and norms.

16.6.2 Power transformers

A transformer shall comply with the standards governing the "Nova konstrukcija" power transformers, applicable since 01.01.1998.

A transformer shall be provided with an inscription plate with essential data legible and reliable inscribed. It shall be in such a place that the inscribed data can be safely read at any time during operation.

A transformer shall be in such a position that contact thermometer readings can be safe and easy.

A transformer shall be so designed that it can withstand all dynamic and thermal stresses in operation without any damage or impairment of operating capacity.

A transformer shall be so positioned in a plant that no external influences may impede its regular operation, performance and durability and that it will not be harmful to the environment either.

A transformer shall be so positioned that harmful vibrations cannot occur in the adjacent parts of the plant nor any structure may suffer damage.

Cooling shall be sufficient during erection and fixing and ingress of alien particles that may damage the components shall be prevented.

An option for electrical separation of a transformer from other live parts shall exist.

Appliances for protection against overload current and internal and external faults shall correspond to transformer size and equipment.

Sound level of a power transformer shall comply with SRPS.H1.005 standard.

16.6.3 High and low voltage switchgear

Doors and windows shall be metallic and open outwards.

Opening door from inside shall be easy without a tool or a key.

No pipes for heating, water supply and sewerage and similar may be taken into transformer station.

Supports of devices and appliances shall be made of metal or other non-flammable material.

The distance of protective partitions and ledges of some live parts behind them shall not be less than 500 mm.

Notice boards and warning plates "High voltage – danger" shall be placed in the transformer station.

High voltage cubicles shall be provided with blind diagram and a front window.

Operating levers for isolators and circuit breaker shall be fitted outside of the cubicles or on its front fixed wall.

Metallic parts (doors, structural supports) shall be first coated with red lead and then painted with oil paint. High voltage blocks and low voltage distribution board shall be painted in the same colour.

Colour identification of electrical installations such as: busbars, connecting wires for appliances and equipment shall comply with applicable regulations, L1 phase – yellow, L2 phase – green, L3 phase – violet, N wire – white and the earth wire black with white stripes askew.

Inscription plates indicating cubicle use shall be fixed above door to each cubicle. The 0.4 kV distribution board shall be provided with plates giving names of each tapping and measuring instruments.

Switchgear bays, cubicles and other elements shall be provided with appropriate inscription plates and marks as designed by the Contractor and submitted for the approval of the Engineer.

All incoming and outgoing high and low voltage cables shall bear a lead plate, clip-shaped to show use, kind and voltage of a particular cable.

Instrument measuring range shall by 20% be greater than their nominal rating.

Each phase conductor shall be provided with durable markers in all cables.

Secondary circuits in metering transformers shall be earthed direct on transformer clamps.



Section 16: Electrical installations

Metal parts in cubicles, support structures, control levers, housing, appliances and other parts that may be unintentionally touched in operation, not normally under voltage shall be visibly marked with special strip used for protective earthing in the transformer station.

Metal levers, wheels and the like need not be separately earthed if they are bonded to earthed devices.

Gear transmissions if any shall be connected to protective earthing in the transformer station.

For the purpose of periodical checking of earth resistance, test joints shall be envisaged for disconnection.

Earth wires in building shall be laid visibly on walls, on supports at a specified distance from live parts. They shall be black with cross white stripes.

All buried earthing bonds shall be protected against corrosion with reliable agents.

Upon completion of the works, transient earth propagation resistance shall be measured.

Rubber gloves, boots, insulating bases and rod tested under 20 kV voltage are obligatory.

16.6.4 Cables in transformer station

High voltage cables shall be laid and joined in compliance with applicable regulations and the manufacturer's instructions.

Cable sheaths and armour shall be earthed at both ends.

Each cable in transformer station shall be fitted with clips inscribed with working voltage, cable cross sectional area and year of laying.

Each phase conductor shall bear durable marks since a dangerous event such as change in rotary field direction may occur.

16.6.5. Other equipment

In a transformer station at a suitable and visible place the following documents shall be available:

- Single pole diagram for the substation with general data for the equipment,
- Operating and maintenance instructions,
- Instructions for administering first aid to injured people due to electricity,
- Fire fighting instructions,
- Protection against dangerous touch voltage,
- Warning notices,
- Records of reviews and audits.

16.6.6. Final requirements

During the technical inspection the Contractor shall hand over fully completed and tested electric facility with adjusted protective and control devices to the Engineer.

The Contractor shall get the electrical facility ready for proper operation by incorporating comments of the Technical inspection Commission without right to any compensation.

For the purpose of technical acceptance the Contractor shall submit the following documents to the relevant Commission and during commissioning of the facility to the Employer:

- Two copies of as built drawings
- Compliance certificates and quality statements for the incorporated equipment or functional parts (assemblies) of devices and equipment,
- Set of documents containing:
 - Compliance certificates (typical and particular) for the equipment and bonding in transformer station
 - Test certificate on adjusting protection for safety in transformer station, inspection of equipment and bonding for the purpose of issuing a compliance statement
 - Compliance certificate for measurement of loop resistance in wiring (where applicable)
 - Compliance certificate for the efficiency of protection against electric shock
 - Compliance certificate for earthing and bonding measurement
 - Diagrams, operation and maintenance manuals, warnings and the like, information necessary for functional operation and maintenance.

The period of guarantee shall start on the date of commissioning.

Anything unspecified in these Technical Specifications but related to the structure shall be defined in the conditions of contract between the Employer and the Contractor and shall be subject to the approval of the Engineer.

Measurement and payment

The exact quantity of installed material and payment are determined based on the construction book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications.

Section 17 Mechanical systems

Contents

- 17.1. Diesel generator set
- 17.2. Roof fan
- 17.3. Jet fan

17.1. Diesel generator set

- 1.- Electrical machines with accessories shall meet state-of-the-art requirements governing their building and safety at work.
- 2.- Each machine shall have an inscription plate showing durable and legible main ratings. It shall be placed in such a position as to be easy to read during machine operation.
- 3.- Each machine shall be so designed to withstand stresses that may occur in the plant in which it is incorporated, without damage or deterioration of its operating capacity.
- 4.- Each machine shall be so positioned and fitted to eliminate any harmful impacts from its environment on its operation and service life, and to prevent harmful impacts of the machine (vibrations, noise, heat, sparks, fire) on adjacent parts in the plant and environment.
- 5.- Each machine shall be isolated from the environment to prevent transfer of mechanical vibration that may interfere with plant operation or affect its parts. Any connections to it shall withstand stresses due to machine operation without damage.
- 6.- Proper cooling shall result from the machine position and fitting. Cooling devices shall be designed and positioned so that no alien particles borne with cooling agents can get in its sensitive parts and compromise operation.
- 7.- Smooth and safe access shall exist to all mechanical devices that will need adjustment, maintenance or monitoring during operation.
- 8.- No parts of the plant whether appurtenant to the machine or its environment may adversely affect and reduce the necessary electrical insulation of the machine.
- 9.- Devices ensuring safety from electrical and mechanical overload shall prevent machine stress in over and above permitted limits. Therefore devices shall exist that will automatically switch off or short circuit the machine to limit the extent of its destruction in case of a defect.
- 10.- Live and rotary parts shall be protected from accidental touch. If such safety has not been provided in the machine design then its position shall be properly chosen or specific additional measures shall be undertaken.
- 11.- It will be possible to gain an insight into the operating condition of each machine via signalling, metering and controlling components and regulate machine startup and shutdown.
- 12.- The type and range of the components mentioned in the preceding article shall meet the plant requirements and correspond to the size and importance of the machine.
- 13.- The components shall be so positioned and fitted that monitoring, handling and maintenance can be done during operation without difficulties and with full safety.
- 14.- Power and voltage for service components as well as constant and peak power at the moment of switching on the driving gear and emergency lighting shall have the values required.
- 15.- Voltage of service components shall neither be above nor below permitted limit value required for startup and operation of switching and other units. Conductors shall be selected after a consideration of voltage drops in electrical lines.
- 16.- Cables outgoing to loads that do not belong to service components in the plant but are fed with power from the same power source shall be fitted with own fuses.
- 17.- First startup of an internal combustion engine and restart after inspection and overhaul shall be supervised by a qualified supervisor.
- 18.- If not otherwise stipulated in the instructions an internal combustion engine shall be inspected after 2000 to 3000 hours of operation.
- 19.- An internal combustion engine in cool reserve shall be maintained in working order and shall be put in trial operation from time to time. If the engine will stay ineffective for a long period it will have to be conserved as instructed by the Manufacturer.
- 20.- The instruments, handling units and the like shall bear visible inscription plates or numbers which correspond to the identification pattern and diagrams contained in the instructions.
- 21.- Prior and after each inspection and overhaul of an internal combustion engine, all critical clearances shall be measured and checked.
- 22.- During the operation of a generator or a synchronous condenser the values that enable constant monitoring of operation and condition of the machine shall be monitored and recorded.
- 23.- Machine axle vibrations (doubled amplitude of position changing) shall not exceed maximum permitted vibrations specified by the Manufacturer.
- 24.- Generators and synchronous condensers may continually operate under asymmetrical voltage within maximum permissible asymmetry range specified by the Manufacturer.
- 25.- Insulation resistance of the excitation winding in a generator or synchronous condenser shall not be below the value specified by the Manufacturer. The Manufacturer will also state insulation resistance measurement method, time intervals,

megohmmeter voltage and minimum insulation resistance values at required winding temperature. These data shall be available in the manual for operation and overhaul of machines.

- 26.- Insulation resistance of the stator winding in a generator or synchronous condenser shall be periodically checked against the data indicated in the operation manual provided by the Manufacturer. In the absence of such data, measured resistance values shall be compared to results obtained earlier at the winding temperatures nearly identical, and at the moment when the machine was started for the first time. If the insulation resistance drops significantly the machine shall be inspected and possibly overhauled as well.
- 27.- If internal safety system responded and an automatic shutdown took place the machine will not be restarted before the cause of such safety response was examined and defect found and remedied. A restart order shall be given by a skilled person nominated by the user. If safety from external faults (overcurrent, overload current, overvoltage and the like.) responded, the machine can be restarted only after a detailed check of the causes such response and after a conclusion that the safety system properly responded as secondary protection, except in the case when there is a risk that the safety system will respond again or the machine is damaged.
- 28.- Generators or synchronous condensers in cold reserve shall be inspected and maintained in proper working conditions as if they are in operation.

STANDARD FEATURES

- Manufacturer / Model
- Cylinder Arrangement
- Displacement
- Bore and Stroke
- Compression ratio
- Rated RPM
- Piston Speed
- Max. stand by Power at rated RPM
- Frequency regulation, steady state
- BMEP
- Governor : type

EXHAUST SYSTEM

- Exhaust temperature
- Exhaust gas flow
- Max back pressure

FUEL SYSTEM

- 110% (Stand By power)
- 100% (of the Prime Power)
- 75% (of the Prime Power)
- 50% (of the Prime Power)
- Max. fuel pump flow

OIL SYSTEM

- Total oil capacity w/filters
- Oil Pressure low idle
- Oil Pressure rated RPM
- Oil consumption 100% load
- Oil capacity carter

THLRMAL BALANCE

- Heat rejection to exhaust
- Radiated heat to ambient
- Heat rejection to coolant

AIR INTAKE

- Max. intake restriction
- Engine air flow

COOLANT SYSTEM

- Radiator & engine capacity
- Max water temperature
- Outlet water temperature
- Fan power
- Fan air flow w/o restriction
- Available restriction on air flow
- Type of coolant
- Thermostat

EMISSIONS LEVEL

- PM
- CO
- Nox
- HC

ACCEPTANCE CERTIFICATION

Delivery shall be in accordance of

- Diesel generator set technical Data & Alternator Data Sheet
- Diesel generator set Drawings
- EC declaration of conformity
- Certificate of Performance
- Certificate of Capability
- Certificate of Generator Set Test
- Certificate of Balance/Vibration
- Warranty certificate and
- Certificate of Origin

MEASUREMENT

Delivery in accordance of contract and number of delivered pieces.

All characteristic must be tested in accordance of Certificate of Generator Set Test.

The exact quantity of installed material are determined based on the construction book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications.

PAYMENT

Equipment are to be paid in accordance with the contract and number of delivered pieces, as approved by the Engineer.

Works are to be paid in accordance with the contract and number of mounted pieces as approved by the Engineer.

17.2. Roof fan

Fans shall be fire resistant and have the designed capacity, efficiency and number of revolutions that will enable their operation in all conditions, of the size adequate for incorporation in the space foreseen.

Roof fans shall be constructed from steel plates and be assembled of a base, impeller, support and cap with an electromotor

Steel parts shall be made of C0361 steel, plasticized or galvanized after manufacture.

Impellers in radial fans have backward curved vanes (250 to 1000 mm dia). Impellers are in a dynamic balance class G-2.5 pursuant to ISO 1940-1.

Fans are fitted with electro motors according to IEC standards, mechanical protection IP 54, insulation class F.

The components other than from mass production shall be manufactured of best materials in the best possible way foreseen for this group of works.

The Contractor shall make a statement about his knowledge and capacities expected from contractors of these plants confirming.

- His understanding of the design and technical solutions
- His ability to purchase, delivery, mount, connect with other elements in the plant, adjust and start operation of the entire plant designed.
- The knowledge and capacities to work out, amend and adjust various designed parts during the installation works doing that at an appropriate technical and esthetic level (suspension of ducts, placing of insulation, fitting of fan etc.)

PERFORMANCE SPECIFICATION

As specified in the Design

ACCEPTANCE CERTIFICATION

Delivery shall be in accordance of

- Roof Fan technical Data Sheet
- Roof Fan Drawings
- EC declaration of conformity
- Certificate of Performance
- Certificate of Capability
- Certificate of Roof Fan Test
- Certificate of Balance/Vibration
- Warranty certificate and
- Certificate of Origin

MEASUREMENT

Delivery in accordance of contract and number of delivered pieces.

All characteristic must be tested in accordance of Certificate of Roof Fan Test

The exact quantity of installed material are determined based on the construction book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications.

PAYMENT

Equipment are to be paid in accordance with the contract and number of delivered pieces, as approved by the Engineer.

Works are to be paid in accordance with the contract and number of mounted pieces as approved by the Engineer.

17.3. Jet fan

Fans shall be resistant to increased temperatures 250 °C in a 2-hour period.

Fans shall be reversible, so that the direction of air flow changes with a change in the direction of motor rotation.

Fans shall be delivered with supports for horizontal mounting and hanging from a flat or vaulted tunnel arch. Hanger design shall prevent stress mounting over $\sigma \leq 6 \text{ N/mm}^2$.

Fans shall be fitted with anti-vibration pads and fixing components.

Vanes shall be made of aluminium alloy and subjected to 100 % radiographic test before being fitted pursuant to ASTM E155.

The rotor shall be in static balance to G6.3 level pursuant to ISO 1940.

The housing, central support, motor holders, hangers and protective mesh shall be made of medium carbonized steel, 3-6 mm thick, welded.

Steel parts shall be hot dip galvanized with the coat thickness 60-65 μm ($\approx 450 \text{ g/m}^2$)

Fans shall be fitted with noise suppressors at suction and delivery sides, each two fan diameter long. Suppressor housings shall be made of galvanically protected steel. Mineral wool can serve as absorbing material. Flashing shall be of perforated stainless steel.

Fans shall be fitted with suction lines on both sides and covered with protective mesh.

Monitoring of imbalance, vibration level, temperature of bearings shall be possible.

Power supply voltage to electro motors shall be 380V/ 50Hz.

Electro motors shall be enclosed, cage, insulation class "F".

Electro motor and connecting box shall meet the requirements in IEC 34-5, class IP 55.

Motor bearings shall be designed for minimum 20,000 hours of operation, criterion L10, namely for an average lifetime of 100,000 hours, pursuant to ISO 281.

Fans shall fulfill or exceed the required parameters (flow, height of head, noise, power etc.).

Fans shall come with test certificates confirming the above characteristics, issued by an accredited institution.

The period of guarantee shall not be shorter than 2 years after start up and confirmation of performances.

This work item shall include the price all tests and confirmation of performance parameters after fan installation.

If any of the envisaged characteristics are to be modified, the Designer shall be asked to approve, and the Engineer shall issue the required instructions to the Contractor accordingly.

PERFORMANCE SPECIFICATION

Performance data must be derived from tests carried out in accordance with ISO13350 and is specifically applicable to the fan, attenuator and motor combination.

- Fan Code
- Fan Diameter / Size
- Fan Speed
- Blade Angle
- Percentage Duty
- Requested Duty
- Actual Duty
- Velocity
- Duty Shaft Power
- Motor Frame
- Motor Rating
- Full Load Current
- Starting Current
- Motor Mounting
- Electrical Supply
- Start Type
- Sound Pressure Level

- Air Density
- Smoke Venting

Acoustic data has been derived from tests carried out in accordance with ISO 13350.

Performance

All tests shall be performed on complete units with the appropriate silencers or bellmouth(s) fitted.

The fan shall deliver the volume or velocity specified in accordance with ISO 5801 (2007) with a flow measuring inlet fitted in place of the inlet bellmouth.

The fan shall give the sound power level specified when tested in accordance with ISO 13350 (1999) and ISO 3741 (2000). Inlet and outlet sound levels shall be measured and in the case of reversible fans, the sound level shall be measured in both directions of airflow.

The fan shall give the thrust specified when tested on a test rig which constrains the longitudinal axis of the fan. The test measurements shall be made after the fan has reached steady operating conditions.

Jetfoils are designed emergency operation at elevated temperatures, up to 400 °C for 2 hrs

Construction

The impeller shall have aerofoil section blades fitted to a hub in a manner that allows simple adjustment of blade pitch angle. Blades and hubs will be cast from aluminium-silicon alloy in accordance with EN 1676 (1997) - similar to ISO 3522 (2006) and ISO 7720 (1997). Grades EN AB 44100 or EN AB 42100. The hub shall be fitted with a cast iron or steel insert bored and keywayed. All cast aluminium impeller components shall be X-rayed to show compliance with the specified grade of ASTM E155 - 05. X-ray records shall be traceable to the components and retained for a period of 10 years.

The fan casing shall be manufactured from mild steel to EN 10111 (2008) - similar to ISO 3574 (2008). Grade HR14 with integral spun flanges. The casing assembly shall be hot dip galvanised in accordance with ISO 460 (1992) and ISO 1461 (1999).

The silencers shall be standard construction with pre-galvanised steel outer skin fastened to hot dip galvanised ends and bellmouths, fitted with internal galvanised steel perforated liner and galvanised aerodynamic pod.

Motor

The motor shall be pad mounted, continuously air stream rated and complying fully with IEC 34-1, with minimal Class F insulation. The fan shall be fitted with an external terminal box connected to the motor via high temperature rated 'Adaptaflex'/'Kopex' flexible conduit suitable for use in fire hazard areas. Both motor and terminal box shall comply with IEC 34-5 Grade IP55.

The motor bearings shall have L10 life of not less than 20,000 hours when calculated in accordance with ISO 281 (2007). For emergency operation at 250°C for 2 hours the insulation shall be Class H. Bearings shall have grease suitable for this operation and be fitted with extended lubricators mounted on the fan casing.

Fan Balance and Vibration

The impeller shall be statically balanced to give a fan vibration level of G6.3 in accordance with ISO 1940-1 (2003)

Vibration at the fan feet shall be in accordance with the requirements of ISO 14694 (2003) a test performed with the fan supported on anti-vibration mounts, during which the vibration level shall be measured at rotational frequency in the vertical, horizontal and axial directions at a point on the front and rear feet adjacent to the mounting hole.

Finish

The fan shall be supplied with the manufacturer's standard finish.

ACCEPTANCE CERTIFICATION

Delivery shall be in accordance of:

- Fan technical Data & Motor Data Sheet
- Fan Drawings
- EC declaration of conformity
- Certificate of Performance, ISO 13350, 13347 part 2 and ISO 3741
- Certificate of Capability - Quality Assurance to BS EN ISO 9001
- Certificate of Fan Test
- Certificate of Balance/Vibration - ISO 14694 & BS848 Pt.7 2003, or ISO 13350:1999
- Warranty certificate and
- Certificate of Origin

MEASUREMENT

Delivery in accordance of contract and number of delivered pieces.

All characteristic must be tested in accordance of Certificate of Fan Test

The exact quantity of installed material are determined based on the construction book and the construction journal signed by the supervisor, in accordance with the Bills of Quantities and as approved by the Engineer in accordance with the Design and these Technical Specifications

PAYMENT

Equipment are to be paid in accordance with the contract and number of delivered pieces as approved by the Engineer.

Works are to be paid in accordance with the contract and number of mounted pieces as approved by the Engineer.



(13) Drawings

The following Design Books make part of the Contract.

List of Design Books:

Book /ID	Name
1 Civil Engineering Design (6 Volumes)	
1.1	Highway Alignment Design - Textual Part
2.1	Highway Alignment Design - Graphical Part 1/2
2.2	Highway Alignment Design - Graphical Part 2/2
3	Design for intersection Predejane
4	Detour of parallel and local roads
5	Pipe culverts on highway
2 Report on Geological and Geotechnical Investigations, Testing and Analysis (4 Volumes)	
1	Report on Geotechnical Investigations of terrain for highway alignment - textual and graphical part
2	Report on Geotechnical Investigations for structures - textual and graphical part, and geostatic analysis
4	Report on Geotechnical Investigations of terrain for engineering structures of highway - textual and graphical part
5	Report on Geotechnical Investigations of terrain for alignment, structures, tunnel and engineering structures of highway - documentation
3 Design for Borrow Pits and Deposit areas (1 Volume)	
4 Pavement Design (1 Volume)	
5 Drainage Design (1 Volume)	
6 Regulation of water streams Design (1 Volume)	
7 Engineering Structures Design (2 Volumes)	
1	from km 873+719.941 to km 883+500.00
2	from km 883+500.00 to km 885+522.776
8 Bridge and other structures Design (25 Volumes)	
9.1	Bridge on km 881+101.843, Textual Part
9.2	Bridge on km 881+101.843, Graphical Part 1/2
9.3	Bridge on km 881+101.941, Graphical Part 2/2
9.4	Bridge on km 881+101.941, Material Specification
10.1	Bridge on km 881+705.810, Textual Part
10.2	Bridge on km 881+705.810, Graphical Part
11.1	Bridge on km 883+067.252, Textual Part
11.2	Bridge on km 883+067.252, Graphical Part 1/2
11.3	Bridge on km 883+067.252, Graphical Part 2/2
11.4	Bridge on km 883+067.252, Material Specification
12	Bridge on km 883+576.495
13.1	Bridge on km 884+958.430, Textual Part
13.2	Bridge on km 884+958.430, Graphical Part
14	Bridge on km 885+445.066
16	Culvert on km 884+067.303
17	Culvert on km 884+815.865
18	Underpass on km 885+335.85
19	Overpass on km 0+719,11 on intersection Predejane - branch 1
20	Overpass on km 0+038,46 on intersection Predejane - branch 2
21	Underpass on km 0+030.00 on intersection Predejane
22	Culvert on km 0+112.53 on intersection Predejane
23	Bridge on parallel road on km 0+264.88
24	Bridge on local road on km 0+115.365

УТВЕРЖДЕНО
ИЗДАТЕЛЬСТВО "АА"



Book /ID	Name
25	Inlet structures for pipe culverts
26	Bridge (on km 0+185,52 - local chainage) on I rank state road M1 in the zone of intersection
10 Environmental Protection Design (2 Volumes)	
1	Environmental Protection Design
2	Design for noise protection of engineering structures
11 Traffic Signalization and Equipment Design (1 Volume)	
12 Design of Technical Infrastructure (8 Volumes)	
1	Design of lighting for Predejane intersection and power supply for toll stations
2	Design of TS 10/04kV Predejane intersection and 10kV power supply line
3	Design for displacement and protection of 10 kV and 1 kV power lines
4	Design for displacement and protection of 35 kV transmission line
5	Design for displacement and protection of the existing telecommunication system
6	Design for reconstruction of railway catenary and grounding at overpass
7	Design for displacement and protection of the existing water supply network
8	Civil engineering Design for telecommunication installations
9	Relocation and protection of railway cables
14 Landscaping Design/ Right-of-Way Arrangement (1 Volume)	
15 Design of survey works (2 Volumes)	
1	Design of survey marking
2	Main traverse
18 Design of Preventive measures (1 Volume)	

(14) Completed Schedules

Priced Bill of Quantities

Price Analyses



Priced Bill of Quantities



Grand summary		Amount
GENERAL ITEMS	(A)	38,838,692.89
Civil engineering design	(1)	558,262,921.69
Stormwater sewage system	(2)	124,471,528.39
Regulation of water streams	(3)	161,679,589.94
Engineering structures	(4)	341,417,192.43
Bridges	(5)	1,755,310,837.69
Protection walls	(6)	48,465,736.50
Traffic-technical and service equipment for roads	(7)	114,796,188.40
Technical infrastructure	(8)	108,961,787.38
Landscaping	(9)	8,929,178.58
SUBTOTAL OF BILLS	$\Sigma[(1)-(9)]=(B)$	3,222,294,961.01
UNFORSEEN WORKS 5%	$0.05(B)=(C)$	161,114,748.05
TOTAL FOR DAYWORK	(D)	58,231,809.64
TOTAL OF BILLS	$(A+B+C+D)=(E)$	3,480,480,211.59
CONTINGENCY ALLOWANCE 10%	$0.1x(E)=(F)$	348,048,021.16
BID PRICE	$(E)+(F)=(G)$	3,828,528,232.75
VAT (Nil-Since the Project is financed by the EIB, the payment of VAT is exempted)	$0=(H)$	
FINAL BID PRICE	$(G)+(H)=(I)$	3,828,528,232.75

No.	Description	Unit	Quantity	Unit price	Amount
1	Site offices building	ls	1	2,949,307.49	2,949,307.49
2	Site offices furniture and equipment	ls	1	1,751,151.32	1,751,151.32
3	Supply of computers and software for Site offices	ls	1	1,935,483.04	1,935,483.04
4	Compound, paving, fencing, lighting and provision of utilities	ls	1	3,041,473.35	3,041,473.35
5	Vehicles (offroad)	pcs	3	1,382,487.89	4,147,463.67
6	Vehicles (C class)	pcs	1	3,225,805.07	3,225,805.07
7	Vehicles (pick up)	pcs	2	1,013,824.45	2,027,648.90
8	Provisions and consumables for the Engineer	ls	1	5,917,048.15	5,917,048.15
9	Supply of additional equipment for the Engineer and Employer's representative	ls	1	1,843,317.18	1,843,317.18
10	Maintain facilities in compound for the Engineer and Employer's representative during works and up to the issue of the Taking over Certificate	month	24	211,981.47	5,087,555.28
11	Maintenance, fueling and insurance of vehicles of the Engineer and Employer's representative	month	24	288,018.31	6,912,439.44
Total General Items					38,838,692.89

CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
PRELIMINARY WORKS						
01.01.01.		Geotechnical investigations	lump sum		1,875,575.23	1,875,575.23
01.01.01.01	2.1					
01.01.01.02	2.4	Removal of bushes and trees a) cutting bushes up to Ø10 cm: 10064 m ² b) cutting bushes Ø10 - Ø25 cm: 8405 m ² c) cutting trees Ø10 - Ø20 cm: 2275 pcs d) cutting trees Ø20 - Ø40 cm: 1040 pcs e) uprooting stumps Ø10 - Ø20 cm: 2275 pcs f) uprooting stumps Ø20 - Ø40 cm: 1040 pcs	cm ³	4.60	1,189,126.67	5,469,982.68
01.01.01.03	2.5	Demolition of buildings	m ²	1,549.00	4,257.90	6,595,487.10
01.01.01.04	2.7	Demolition of the existing pavement	m ²	5,145.00	160.37	825,103.65
TOTAL PRELIMINARY WORKS:						14,766,148.66
EARTH WORKS						
01.01.02.01	3.1	Topsoil stripping	<i>(price included in the price of excavation and embankment)</i>			
01.01.02.02	3.2	Bulk excavation and transport (including topsoil stripping and stockpiling, excavation of soil of low bearing capacity, topsoiling and grassing) - Excavation in III and IV category soil with loading, transport and unloading of material from the excavation or borrow pit - up to 60 m - up to 500 m - 500 m - 1000 m - 1000 m - 3000 m - Excavation in V and VI category soil with loading, transport and unloading of material from the excavation or borrow pit - up to 60 m - up to 500 m - 500 m - 1000 m - 1000 m - 3000 m	m ³	7,365.00	56.22	414,060.30
			m ³	31,614.00	60.83	1,923,079.62
			m ³	71,963.00	66.36	4,775,464.68
			m ³	39,671.00	76.50	3,034,831.50
			m ³	6,259.00	172.35	1,078,738.65
			m ³	21,554.00	172.35	3,714,831.90
			m ³	62,116.00	177.88	11,049,194.08
			m ³	33,025.00	182.48	6,026,402.00
01.01.02.03	3.3	Subsoil finishing	m ²	99,707.00	26.73	2,665,168.11
01.01.02.04	3.4	Construction of embankment (including topsoil stripping, construction of stepped side cuts, shoulder central part, leveling, topsoiling and grassing of embankment slopes) a) topsoil stripping: 22659 m ² b) surplus topsoil: 11737 m ² c) stepped side cuts: 3461 m ² d) shoulder central part: 2528 m ² e) topsoiling of slopes: 45674 m ² f) topsoiling and grassing of shoulders: 8934 m ² g) lining with stone the embankment slopes: 1889 m ² h) lining of slope with stone: 620 m ²	m ²	178,902.00	78.35	14,016,971.70
01.01.02.05	3.6.1	Substitution of soil of low bearing capacity with sandy gravel layer	m ³	444.00	1,277.42	567,174.48
TOTAL EARTH WORKS:						49,265,917.02
DRAINAGE AND DEWATERING						
01.01.03.01	4.3	Drainage channels - Excavation - Lining of channels of MB 30 concrete onto 5-10 cm thick sandy gravel bed - Segmented lined channel - Trapezoidal channel - Procurement and installation of drain channels for controlled drainage of run-off. Drain channel dimensions: 100x100x20 cm. It shall be installed onto sandy gravel bed, fully in accordance with designed details. - Procurement and installation of drain channels for controlled water drainage down the embankment slope	m ³	3,092.00	405.53	1,253,898.76
			m ²	2,595.00	3,244.24	8,418,802.80
			m ²	3,577.00	3,294.93	11,785,964.61
			m ²	880.00	3,021.20	2,658,656.00
01.01.03.02	4.3	- Casting of 20 cm thick layer of MB 20 concrete over shoulder onto 5-10 cm thick sandz gravel bed.	m ²	436.00	2,513.37	1,095,829.32
			m ²	3,943.00	1,744.70	6,879,352.10
TOTAL DRAINAGE AND DEWATERING:						32,092,503.59
SUB-BASES						
01.01.04.01	AS-3.4 additional specifications	Sandy gravel materials - placing subgrade layer	m ²	94,075.00	289.40	27,225,305.00
01.01.04.02	6.2 AS-6.2.2 additional specifications	Procurement and placing of 0/63 mm crushed stone as rolled sub-base of pavement structure. Broken stone layer shall be placed onto finished subgrade accepted by the Supervising Engineer. Stone of this size shall meet requirements of SRPS U.E 9020. Payment per 1 m ³ of placed material including procurement and transport. • d=70 cm	m ³	61,982.00	679.27	42,102,513.14
01.01.04.03	AS-6.2.2 additional specifications	Placing and rolling the sub-base of 0/31.5 mm crushed stone onto rolled subgrade accepted by the Engineer. Rolling shall be performed until even surface is achieved according to designed gradients and crossfalls with tolerance of ± 1 cm. Thickness: d=10 cm, d=18 cm, d=30 cm, d=38 cm	m ³	27,743.00	679.27	18,844,987.61
TOTAL SUB-BASES:						88,172,805.75
SUPERSTRUCTURE						
01.01.05.01	7.1	Procurement and placing of 18/24 cm curbs	m ²	2,933.00	1,470.04	4,311,627.32
01.01.05.02	7.2	Procurement and installation of 90 cm concrete gutters	m ²	3,641.00	2,384.33	8,681,345.53
TOTAL SUPERSTRUCTURE:						12,992,972.85

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
01.01.06.		ASPHALT PAVEMENT				
01 01 06 01	9.3.	Placing of bituminous base course BNS 22sA (Bit 60) consisting of stone aggregate d= 8 cm	m ²	17,719.00	800.92	14,191,501.48
		d= 8+8= 16 cm	m ²	53,509.00	1,601.85	85,713,391.65
01 01 06 03	9.5.	Placing of 4 cm thick wearing course made of skeleton mastic asphalt SMA 11s	m ²	71,227.00	635.02	45,230,569.54
01 01 06 04	9.6.	Placing of 6 cm thick wearing course made of asphalt concrete AB 11. Shoulder shall be stabilized at lower pavement side d=6 cm	m ²	529.00	658.99	348,605.71
TOTAL ASPHALT PAVEMENT:						145,484,068.38
01.01.08.		ROAD EQUIPMENT				
01 01 07 01	12 6 7	Procurement and installation of 1.5 m high road fence made of galvanized mesh on poles of 40x40 mm steel boxes	m	6,681.00	958.53	6,403,938.93
TOTAL ROAD EQUIPMENT:						6,403,938.93

01.01. SUMMARY - HIGHWAY ALIGNMENT						
01 01 01		PRELIMINARY WORKS				14,766,148.66
01 01 02		EARTH WORKS				49,265,917.02
01 01 03		DRAINAGE AND DEWATERING				32,092,503.59
01 01 04		SUB-BASES				88,172,805.75
01 01 05		SUPERSTRUCTURE				12,992,972.85
01 01 06		ASPHALT PAVEMENT				145,484,068.38
01 01 08		ROAD EQUIPMENT				6,403,938.93
SUB-TOTAL						349,178,355.18
Unforeseen work (5% of sub-total)						17,458,917.76
TOTAL HIGHWAY ALIGNMENT (01.01.):						366,637,272.94

01.02. "PREDEJANE" GRADE-SEPARATED JUNCTION

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
01.02.01.		PRELIMINARY WORKS				
01 02 01 01	2 1	Geotechnical investigations	lump sum		1,216,589.34	1,216,589.34
01 02 01 02	2 4	Removal of bushes and trees a) cutting bushes up to Ø10 cm: 11720 m ² b) cutting bushes Ø10 - Ø25 cm: 17570 m ² c) cutting trees Ø10 - Ø20 cm: 3405 pcs d) cutting trees Ø20 - Ø40 cm: 1702 pcs e) uprooting stumps Ø10 - Ø20 cm: 3405 pcs f) uprooting stumps Ø20 - Ø40 cm: 1702 pcs	km ²	3.35	2,516,312.29	8,429,646.17
01 02 01 03	2 5	Demolition of buildings	m ²	956.00	4,258.06	4,070,705.36
01 02 01 04	2 6	Finishing of the existing pavement	m ²	508.00	202.76	103,002.08
01 02 01 05	2 7	Demolition of the existing pavement	m ²	95.00	160.37	15,235.15
TOTAL PRELIMINARY WORKS:						13,835,178.10
01.02.02.		EARTH WORKS				
01 02 02 01	3 2.	Bulk excavation and transport (including topsoil stripping and stockpiling, excavation of soil of low bearing capacity, topsoiling and terracing) - Excavation in III and IV category soil with loading, transport and unloading of material from the excavation or borrow pit - up to 60 m - up to 500 m - 1000 m - 3000 m	m ³	1,003.00	50.69	50,842.07
			m ³	3,984.00	76.50	304,776.00
			m ³	99,503.00	86.63	8,619,944.89
01 02 02 02	3 3.	Subsoil finishing	m ²	43,820.00	26.73	1,171,308.60
01 02 02 03	3 4.	Construction of embankment (including topsoil stripping, construction of stepped side cuts, shoulder central part, leveling, topsoiling and terracing of embankment slopes) a) topsoil stripping: 10642 m ² b) surplus topsoil: 4653 m ³ c) stepped side cuts: 656 m ³ d) shoulder central part: 915 m ³ e) topsoiling of slopes: 23500 m ² f) topsoiling and grassing of shoulders: 6433 m ² g) lining with stone the embankment slopes: 803 m ³	m ³	104,490.00	81.11	8,475,183.90
01 02 02 04	3 5.	Wedges next to structures	m ³	938.00	628.57	589,598.66
01 02 02 05	3 8	Monitoring instruments (soil settlement gauges, inclinometers, piezometers)	lump sum		6,082,946.69	6,082,946.69
TOTAL EARTH WORKS:						25,294,600.81
01.02.03.		DRAINAGE AND DEWATERING				
01 02 03 01	4.1	Drainage and dewatering of road base - Excavation - Procurement and laying of plastic half-perforated drain pipes for drainage of subgrade and central reserve. Pipes shall be laid onto 5-10 cm thick layer of clay or lean concrete. - Ø 150	m ³	14.00	492.17	6,890.38
			m ³	149.00	1,005.53	149,823.97
		- Filling of drainage channels with filter material - sandy gravel material or chippings of 1-6 cm in size, including fitting of fat clay plug in the drain pipe	m ³	14.00	2,076.50	29,071.00
01 02 03 02	4 3	Drainage channels - Excavation - Procurement and installation of drain channels for controlled water drainage down the embankment slope	m ³	528.00	492.17	259,865.76
			m ³	246.00	1,874.66	461,166.36
TOTAL DRAINAGE AND DEWATERING:						906,817.47

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
01.02.04.		SUB-BASES				
01.02.04.01.	6.1 AS-3.4 additional specifications	Sandy gravel materials - rolling sub-grade layer	m ³	23,713.00	289.40	6,862,542.20
01.02.04.02		Procurement and placing of 0/63 mm crushed stone as rolled sub-base of pavement structure. Broken stone layer shall be placed onto finished subgrade accepted by the Engineer. Stone of this size shall meet requirements of SRPS U E9 020.	m ²	227.00	121.66	27,616.82
01.02.04.03	6.2	• d=15 cm	m ²	804.00	212.90	171,171.60
		• d=30 cm				
		Placing and rolling the sub-base of 0/31.5 mm crushed stone onto rolled subgrade accepted by the Engineer. Rolling shall be performed until even surface is achieved according to designed gradients and crossfalls with tolerance of ± 1 cm				
		• d=18 cm	m ²	2,583.00	127.19	328,531.77
		• d=20 cm	m ²	880.00	137.33	120,850.40
		• d=30 cm	m ²	17,265.00	212.90	3,675,718.50
		• d=34 cm	m ²	333.00	233.18	77,648.94
TOTAL SUB-BASES:						11,264,080.23
01.02.05.		SUPERSTRUCTURE				
01.02.05.01.	7.1	Verges, curbs and prefabricated elements				
		• curbs 18/24	m ³	900.00	1,470.04	1,323,036.00
		• curbs 20/30	m ³	288.00	2,041.47	587,943.36
01.02.05.02	7.2	Gutters 90 cm	m	418.00	2,384.33	996,649.94
TOTAL SUPERSTRUCTURE:						2,907,629.30
01.02.06.		ASPHALT PAVEMENT				
01.02.06.01.	9.3	Placing of bituminous base course BNS 22sA (Bit 60) consisting of stone aggregate	m ²	508.00	800.92	406,867.36
		• d=8 cm	m ²	9,247.00	1,003.69	9,281,121.43
01.02.06.02.	9.3	Placing of bituminous base course BNS 22A (Bit 60) consisting of stone aggregate				
		• d=6 cm	m ²	2,250.00	603.68	1,358,280.00
01.02.06.03.	9.3	Placing of bituminous base course BNHS 16 consisting of stone aggregate	m ²	227.00	610.14	138,501.78
01.02.06.04	9.6	Placing of wearing course made of asphalt concrete AB 11s (Bit 60)				
		• d=4 cm	m ²	508.00	435.94	221,457.52
		• d=6 cm	m ²	9,247.00	658.99	6,093,680.53
TOTAL ASPHALT PAVEMENT:						17,499,908.62
01.02.07.		CONCRETE PAVEMENT				
01.02.07.01.	10.1.	Pavement made of MB 40 concrete, 22 cm thick	m ²	2,250.00	4,014.75	9,033,187.50
TOTAL CONCRETE PAVEMENT:						9,033,187.50
01.02.08.		STRUCTURES, CULVERTS				
01.02.08.01.	11.3	Small slab-top and pipe culverts				
01.02.08.02		- Excavation	m ³	829.00	405.53	336,184.37
01.02.08.03.	11.3	- Bed of sandy gravel materials, 20 cm thick - price includes procurement and placing of sandy gravel material under the pipes.	m ³	80.00	1,267.28	101,382.40
01.02.08.04.	11.3	- Concrete work, MB 30	m ³	294.00	7,235.95	2,127,369.30
01.02.08.05.	11.3	Prefabricated concrete pipe culverts:				
		- Ø1000 mm	m ³	48.00	24,331.79	1,167,925.92
		- Ø1600 mm	m ³	45.00	45,042.38	2,026,907.10
01.02.08.06.	11.3	- Ø2000 mm	m ³	47.00	70,275.55	3,302,950.85
		- Waterproofing of top surfaces of pipe culverts with two paper layers and three coats of bitumen solution over bituminized paper. Payment per 1 m ² of unfolded area	m ²	758.00	861.75	653,206.50
01.02.08.07.	11.3	- Construction of 20 cm thick paving made of broken stone onto 10 cm thick sand layer with infill of 1:3 cement mortar mix near culverts				
		Payment per 1 m ² of finished paving	m ²	49.00	2,847.92	139,548.08
TOTAL STRUCTURES, CULVERTS:						9,855,474.52
01.02.09.		ROAD EQUIPMENT				
01.02.09.01.	12.6.7.	Procurement and installation of 1.5 m high road fence made of galvanized mesh on poles of 40x40 mm steel boxes	m ³	2,265.00	993.55	2,250,390.75
TOTAL ROAD EQUIPMENT:						2,250,390.75
01.02. SUMMARY - "PREDEJANE" GRADE-SEPARATED JUNCTION						
01.02.01. PRELIMINARY WORKS						13,835,178.10
01.02.02. EARTH WORKS						25,294,600.81
01.02.03. DRAINAGE AND DEWATERING						906,817.47
01.01.04. SUB-BASES						11,264,080.23
01.02.05. SUPERSTRUCTURE						2,907,629.30
01.02.06. ASPHALT PAVEMENT						17,499,908.62
01.02.07. CONCRETE PAVEMENT						9,033,187.50
01.02.08. STRUCTURES, CULVERTS						9,855,474.52
01.02.09. ROAD EQUIPMENT						2,250,390.75
SUB-TOTAL						92,847,267.30
Unforeseen work (5% of sub-total)						4,642,363.37
TOTAL "PREDEJANE" GRADE-SEPARATED JUNCTION (01.02.):						97,489,630.67

01.03.05. Detour of M1 road

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
PRELIMINARY WORKS						
01.03.05.01	2.1	Geotechnical investigations				
			lump sum		405,529.78	405,529.78
01.03.05.02	2.4	Removal of bushes and trees a) cutting bushes up to Ø10 cm: 2025 m ² b) cutting bushes Ø10 - Ø25 cm: 2475 m ² c) cutting trees Ø10 - Ø20 cm: 495 pcs. d) cutting trees Ø20 - Ø40 cm: 248 pcs. e) uprooting stumps Ø10 - Ø20 cm: 495 pcs. f) uprooting stumps Ø20 - Ø40 cm: 248 pcs.	km ²	1.45	875,678.89	1,269,734.39
01.03.05.03	2.6	Finishing of the existing pavement	m ²	760.00	111.52	84,755.20
01.03.05.04	2.7	Demolition of the existing pavement	m ²	4,525.00	160.37	725,674.25
TOTAL PRELIMINARY WORKS:						2,485,693.62
EARTH WORKS						
01.03.05.02.01	3.2	Bulk excavation and transport (including topsoil stripping and stockpiling, excavation of soil of low bearing capacity, topsoiling and grassing) - Excavation in III and IV category soil with loading, transport and unloading of material from the excavation or borrow pit - up to 500 m a) topsoil stripping: 3291 m ³ b) surplus topsoil: 1391 m ³ -3000m - 5000m	m ³	10,301.00	138.25	1,424,113.25
			m ³	6,355.00	182.48	1,159,660.40
01.03.05.02.02	3.3	- Excavation in V and VI category soil with loading, transport and unloading of material from the excavation or borrow pit - 3000 - 5000 m	m ³	19,912.00	202.76	4,037,357.12
		Subsoil finishing	m ²	4,781.00	26.73	127,796.13
01.03.05.02.03	3.4	Construction of embankment (including topsoil stripping, construction of stepped side cuts, shoulder central part, leveling, topsoiling and grassing of embankment slopes) b) shoulder central part: 388 m ³ c) topsoiling of slopes: 7094 m ² d) topsoiling and grassing of shoulders: 2403 m ² e) lining with stone the embankment slopes: 2137 m ³	m ³	10,301.00	81.11	835,514.11
01.03.05.02.04	3.5	Wedges next to structures	m ³	1,004.00	628.57	631,084.28
TOTAL EARTH WORKS:						8,215,525.29
DRAINAGE AND DEWATERING						
01.03.05.03	4.3	Drainage channels - Excavation	m ³	690.00	405.53	279,815.70
TOTAL DRAINAGE AND DEWATERING:						279,815.70
SUB-BASES						
01.03.05.04.01	6.1	Sandy gravel materials - placing subgrade layer	m ²	13,121.00	289.40	3,797,217.40
01.03.05.04.02	6.2	Procurement and placing of 0/63 mm crushed stone as rolled sub-base of pavement structure. Broken stone layer shall be placed onto finished subgrade accepted by the Engineer. Stone of this size shall meet requirements of SRPS U.E9.020. • d=30 cm	m ²	16,130.00	212.90	3,434,077.00
01.03.05.04.03	6.2	Placing and rolling the sub-base of 0/31.5 mm crushed stone onto rolled subgrade accepted by the Engineer. Rolling shall be performed until even surface is achieved according to designed gradients and crossfalls with tolerance of ± 1 cm. • d=20 cm	m ²	10,175.00	137.33	1,397,332.75
TOTAL SUB-BASES:						8,628,627.15
SUPERSTRUCTURE						
01.03.05.05	7.2	Procurement and placing of 90 cm concrete gutters	m ³	989.00	2,384.33	2,358,102.37
TOTAL SUPERSTRUCTURE:						2,358,102.37
ASPHALT PAVEMENT						
01.03.05.06.01	9.3	Placing of bituminous base course BNS 22A (Bit 60) consisting of stone aggregate • d=8 cm	m ²	9,240.00	800.92	7,400,500.80
01.03.05.06.02	9.6	Placing of wearing course made of asphalt concrete AB 11s (Bit 60) • d=4 cm	m ²	10,186.00	456.22	4,647,056.92
TOTAL ASPHALT PAVEMENT:						12,047,557.72
STRUCTURES, CULVERTS						
Small slab-top and pipe culverts						
01.03.05.07.01	11.3	- Excavation	m ³	2,828.00	405.53	1,146,838.84
01.03.05.07.02	11.3	- Bed of sandy gravel materials, 20 cm thick - price includes procurement and placing of sandy gravel material under the pipes	m ³	66.00	1,267.28	83,640.48
01.03.05.07.03	11.3	Concrete work, MB 30	m ³	282.00	7,235.95	2,040,537.90
01.03.05.07.04	11.3	Prefabricated concrete pipe culverts: - Ø1600 mm	m ³	145.00	45,042.38	6,531,145.10
01.03.05.07.05	11.3	- Waterproofing of top surfaces of pipe culverts	m ²	831.00	861.75	716,114.25
TOTAL STRUCTURES, CULVERTS:						10,518,276.57



01.03.05. Detour of M1 road		
01.03.05.01	PRELIMINARY WORKS	2,485,693.62
01.03.05.02	EARTH WORKS	8,215,525.29
01.03.05.03	DRAINAGE AND DEWATERING	279,815.70
01.03.05.04	SUB-BASES	8,628,627.15
01.03.05.05	SUPERSTRUCTURE	2,358,102.37
01.03.05.06	ASPHALT PAVEMENT	12,047,557.72
01.03.05.07	STRUCTURES, CULVERTS	10,518,276.57
TOTAL Detour of M1 road (01.03.05.):		44,533,598.42

01.03.06. Detour of local road No.4

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
PRELIMINARY WORKS						
01.03.06.01.		Geotechnical investigations	lump sum		86,175.08	86,175.08
01.03.06.01.01	2.1	Removal of bushes and trees	km ²	0.30	792,719.48	237,815.84
01.03.06.01.02	2.4	a) cutting bushes up to Ø10 cm: 382 m ² b) cutting bushes Ø10 - Ø25 cm: 468 m ² c) cutting trees Ø10 - Ø20 cm: 93 pcs d) cutting trees Ø20 - Ø40 cm: 46 pcs e) uprooting stumps Ø10 - Ø20 cm: 93 pcs f) uprooting stumps Ø20 - Ø40 cm: 46 pcs	km ²			
TOTAL PRELIMINARY WORKS:						323,990.92
EARTH WORKS						
01.03.06.02.		Bulk excavation and transport (including topsoil stripping and stockpiling, excavation of soil of low bearing capacity, topsoiling and grassing)				
01.03.06.02.01	3.2	- Excavation in III and IV category soil with loading, transport and unloading of material from the excavation or borrow pit - up to 60 m a) topsoil stripping: 513 m ³ - 500 m - 1000 m a) surplus topsoil: 319 m ³	m ³	444.00	81.11	36,012.84
01.03.06.02.02	3.3	Subsoil finishing	m ²	1,524.00	26.73	40,736.52
01.03.06.02.03	3.4	Construction of embankment (including topsoil stripping, excavation of stepped side cuts, shoulder central part, leveling, topsoiling and grassing of embankment slopes) b) shoulder central part: 22 m ³ c) topsoiling of slopes: 675 m ² d) topsoiling and grassing of shoulders: 295 m ²	m ³	2,027.00	81.11	164,409.97
01.03.06.02.04	3.5	Wedges next to structures	m ³	41.00	628.57	25,771.37
TOTAL EARTH WORKS:						404,065.99
DRAINAGE AND DEWATERING						
01.03.06.03.		Drainage channels				
01.03.06.03.01	4.3	- Excavation - Lining of channels with prefabricated elements of MB 30 concrete onto 5 cm thick sandy gravel bed.	m ³	13.00	405.53	5,271.89
			m ²	50.00	3,511.52	175,576.00
TOTAL DRAINAGE AND DEWATERING:						180,847.89
SUB-BASES						
01.03.06.04.		Sandy gravel materials - placing subgrade layer	m ²	1,697.00	289.40	491,111.80
01.03.06.04.02	6.2	Procurement and placing of 0/63 mm crushed stone as rolled sub-base of pavement structure. Broken stone layer shall be placed onto finished subgrade accepted by the Engineer. Stone of this size shall meet requirements of SRPS U.E9.020. • d=20 cm	m ²	1,340.00	137.33	184,022.20
01.03.06.04.03	6.2	Placing and rolling the sub-base of 0/31.5 mm crushed stone onto rolled subgrade accepted by the Engineer. Rolling shall be performed until even surface is achieved according to designed gradients and crossfalls with tolerance of ± 1 cm • d=15 cm	m ²	1,040.00	111.52	115,980.80
TOTAL SUB-BASES:						791,114.80
SUPERSTRUCTURE						
01.03.06.05.		Procurement and placing of 70 cm concrete gutters 70 cm	m ¹	180.00	1,992.63	358,673.40
01.03.06.05.01	7.2					
TOTAL SUPERSTRUCTURE:						358,673.40
STRUCTURES, CULVERTS						
01.03.06.06.		Small slab-top and pipe culverts				
01.03.06.06.01	11.3	- Excavation	m ³	35.00	405.53	14,193.55
01.03.06.06.02	11.3	- Bed of sandy gravel materials, 20 cm thick - price includes procurement and placing of sandy gravel material under the pipes.	m ³	4.00	1,267.28	5,069.12
01.03.06.06.03	11.3	Concrete work, MB 30	m ³	13.00	7,235.95	94,067.35
01.03.06.06.04	11.3	Prefabricated concrete pipe culverts - Ø400 mm	m ¹	10.00	4,663.59	46,635.90
01.03.06.06.05	11.3	- Ø1000 mm - Waterproofing of top surfaces of pipe culverts	m ¹	8.00	24,331.79	194,654.32
			m ²	30.00	861.75	25,852.50
TOTAL STRUCTURES, CULVERTS:						380,472.74



01.03.06. SUMMARY - Detour of local road No.4		
01.03.06.01	PRELIMINARY WORKS	323,990.92
01.03.06.02	EARTH WORKS	404,065.99
01.03.06.03	DRAINAGE AND DEWATERING	180,847.89
01.03.06.04	SUB-BASES	791,114.80
01.03.06.05	SUPERSTRUCTURE	358,673.40
01.03.06.06	STRUCTURES, CULVERTS	380,472.74
TOTAL Detour of local road No.4 (01.03.06.):		2,439,165.74

01.03.07. Detour of local road No.5						
Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
PRELIMINARY WORKS						
01.03.07.01.01	2.1	Geotechnical investigations	lump sum		60,829.47	60,829.47
01.03.07.01.02	2.4	Removal of bushes and trees a) cutting bushes up to Ø10 cm: 90 m ² b) cutting bushes Ø10 - Ø25 cm: 110 m ² c) cutting trees Ø10 - Ø20 cm: 22 pcs. d) cutting trees Ø20 - Ø40 cm: 11 pcs. e) uprooting stumps Ø10 - Ø20 cm: 22 pcs. f) uprooting stumps Ø20 - Ø40 cm: 11 pcs.	km ²	0.20	281,954.72	56,390.94
TOTAL PRELIMINARY WORKS:						117,220.41
EARTH WORKS						
01.03.07.02.01	3.2	Bulk excavation and transport (including topsoil stripping and stockpiling, excavation of soil of low bearing capacity, topsoiling and grassing) - Excavation in III and IV category soil with loading, transport and unloading of material from the excavation or borrow pit - 500 m - 1000 m	m ³	346.00	86.63	29,973.98
01.03.07.02.02	3.3	a) topsoil stripping: 318 m ³ b) surplus topsoil: 261 m ³ c) topsoiling and grassing of shoulders: 286 m ²	m ³	113.00	26.73	3,020.49
01.03.07.02.03	3.4	Subsoil finishing Construction of embankment (including topsoil stripping, excavation of stepped side cuts, shoulder central part, leveling, topsoiling and grassing of embankment slopes) b) shoulder central part: 56 m ³	m ³	1.00	12,774.19	12,774.19
TOTAL EARTH WORKS:						45,768.66
DRAINAGE AND DEWATERING						
01.03.07.03.01	4.3	Drainage channels - Excavation	m ³	49.00	405.53	19,870.97
TOTAL DRAINAGE AND DEWATERING:						19,870.97
SUB-BASES						
01.03.07.04.01	6.1	Sandy gravel materials - placing subgrade layer	m ²	833.00	289.40	241,070.20
01.03.07.04.02	6.2	Procurement and placing of 0/63 mm crushed stone as rolled sub-base of pavement structure. Broken stone layer shall be placed onto finished subgrade accepted by the Engineer. Stone of this size shall meet requirements of SRPS U.E9.020. * d=20 cm	m ³	770.00	162.22	124,909.40
01.03.07.04.03	6.2	Placing and rolling the sub-base of 0/31.5 mm crushed stone onto rolled subgrade accepted by the Engineer. Rolling shall be performed until even surface is achieved according to designed gradients and crossfalls with tolerance of ± 1 cm. * d=15 cm	m ²	574.00	111.52	64,012.48
TOTAL SUB-BASES:						429,992.08
STRUCTURES, CULVERTS						
01.03.07.05.01	11.3	Small slab-top and pipe culverts Prefabricated concrete pipe culverts. - Ø400 mm	m ³	23.00	4,663.59	107,262.57
TOTAL STRUCTURES, CULVERTS:						107,262.57

01.03.07. SUMMARY - Detour of local road No.5		
01.03.07.01	PRELIMINARY WORKS	117,220.41
01.03.07.02	EARTH WORKS	45,768.66
01.03.07.03	DRAINAGE AND DEWATERING	19,870.97
01.03.07.04	SUB-BASES	429,992.08
01.03.07.05	STRUCTURES, CULVERTS	107,262.57
TOTAL Detour of local road No.5 (01.03.07.):		720,114.69

01.03.08. Detour of local road No.6						
Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
PRELIMINARY WORKS						
01.03.08.01.01	2.1	Geotechnical investigations	lump sum		60,829.47	60,829.47
01.03.08.01.02	2.4	Removal of bushes and trees a) cutting bushes up to Ø10 cm: 54 m ² b) cutting bushes Ø10 - Ø25 cm: 66 m ² c) cutting trees Ø10 - Ø20 cm: 13 pcs. d) cutting trees Ø20 - Ø40 cm: 6 pcs. e) uprooting stumps Ø10 - Ø20 cm: 13 pcs. f) uprooting stumps Ø20 - Ø40 cm: 6 pcs.	km ²	0.20	162,637.72	32,527.54
TOTAL PRELIMINARY WORKS:						93,357.01

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
01.03.08.02.		EARTH WORKS				
01.03.08.02.01	3.2	Bulk excavation and transport (including topsoil stripping and stockpiling, excavation of soil of low bearing capacity, topsoiling and grassing) - Excavation in III and IV category soil with loading, transport and unloading of material from the excavation or borrow pit - up to 60 m	m ³	81.00	81.11	6,569.91
		a) topsoil stripping 240 m ³				
		- 500 m - 1000 m	m ³	282.00	86.63	24,429.66
01.03.08.02.02	3.3	a) surplus topsoil 199 m ³				
01.03.08.02.03	3.4	Subsoil finishing	m ²	598.00	26.73	15,984.54
		Construction of embankment (including topsoil stripping, excavation of stepped side cuts, shoulder central part, leveling, topsoiling and grassing of embankment slopes)				
		b) shoulder central part 12 m ³	m ³	363.00	81.11	29,442.93
		c) topsoiling of slopes 10 m ²				
		d) topsoiling and grassing of shoulders 194 m ²				
01.03.08.02.04	3.5	Wedges next to structures	m ³	41.00	628.57	25,771.37
TOTAL EARTH WORKS:						102,198.41
01.03.08.03.		DRAINAGE AND DEWATERING				
01.03.08.03.01	4.3	Drainage channels - Excavation	m ³	26.00	405.53	10,543.78
TOTAL DRAINAGE AND DEWATERING:						10,543.78
01.03.08.04.		SUB-BASES				
01.03.08.04.01	6.1	Sandy gravel materials - placing subgrade layer	m ²	1,311.00	289.40	379,403.40
01.03.08.04.02	6.2	Procurement and placing of 0/63 mm crushed stone as rolled sub-base of pavement structure. Broken stone layer shall be placed onto finished subgrade accepted by the Engineer. Stone of this size shall meet requirements of SRPS U E9.020. - d=20 cm	m ²	645.00	137.33	88,577.85
01.03.08.04.03	6.2	Placing and rolling the sub-base of 0/31.5 mm crushed stone onto rolled subgrade accepted by the Engineer. Rolling shall be performed until even surface is achieved according to designed gradients and crossfalls with tolerance of ± 1 cm. - d=15 cm	m ²	540.00	111.52	60,220.80
TOTAL SUB-BASES:						528,202.05
01.03.08.05.		STRUCTURES, CULVERTS				
	11.3	Small slab-top and pipe culverts				
01.03.08.05.01	11.3	- Excavation	m ³	20.00	405.53	8,110.60
01.03.08.05.02	11.3	- Bed of sandy gravel materials, 20 cm thick - price includes procurement and placing of sandy gravel material under the pipes.	m ³	4.00	1,267.28	5,069.12
01.03.08.05.03	11.3	Concrete work, MB 30	m ³	14.00	7,235.95	101,303.30
01.03.08.05.04	11.3	Prefabricated concrete pipe culverts: - Ø1000 mm	m ³	8.00	24,331.79	194,654.32
01.03.08.05.05	11.3	- Waterproofing of top surfaces of pipe culverts	m ²	30.00	861.75	25,852.50
TOTAL STRUCTURES, CULVERTS:						334,989.84
01.03.08. SUMMARY - Detour of local road No. 6						
01.03.08.01		PRELIMINARY WORKS				93,357.01
01.03.08.02		EARTH WORKS				102,198.41
01.03.08.03		DRAINAGE AND DEWATERING				10,543.78
01.03.08.04		SUB-BASES				528,202.05
01.03.08.05		STRUCTURES, CULVERTS				334,989.84
TOTAL Detour of local road No. 6 (01.03.08.):						1,069,291.09
01.03. SUMMARY - LOCAL ROADS						
01.03.05		DETOUR OF M1 ROAD				44,533,598.42
01.03.06		DETOUR OF LOCAL ROAD NO. 4				2,439,165.74
01.03.07		DETOUR OF LOCAL ROAD NO. 5				720,114.69
01.03.08		DETOUR OF LOCAL ROAD NO. 6				1,069,291.09
SUB-TOTAL						48,762,169.95
Unforeseen work (5% of sub-total)						2,438,108.50
TOTAL LOCAL ROADS (01.03.):						51,200,278.45
01.04. PIPE CULVERTS						
01.04.01.		EARTH WORKS				
01.04.01.01	3.5	Wedges next to structures	m ³	3,175.50	628.57	1,996,024.04
TOTAL EARTH WORKS:						1,996,024.04
01.04.02.		STRUCTURES, CULVERTS				
	11.3	Small slab-top and pipe culverts				
01.04.02.01	11.3	- Excavation in III and IV category soil for culverts				
		a) 30% hand excavation	m ³	2,790.00	506.92	1,414,306.80
		b) 70% mechanical excavation	m ³	6,510.00	405.53	2,640,000.30
01.04.02.02	11.3	a) demolition of the existing pipes/structure	m ³	222.00	3,911.52	868,357.44
01.04.02.03	11.3	- Bed of sandy gravel materials, 20 cm thick - price includes procurement and placing of sandy gravel material under the pipes	m ³	257.00	1,267.28	325,690.96

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
01.04.02.04	11.3	- Concrete work, MB 30	m ³	946.00	7,235.95	6,845,208.70
01.04.02.05	11.3	Prefabricated concrete pipe culverts				
		- Ø1600 mm	m ²	412.50	45,042.38	18,579,981.75
		- Ø2000 mm	m ²	77.00	70,275.55	5,411,217.35
01.04.02.06	11.3	- Waterproofing of top surfaces of pipe culverts with two paper layers and three coats of bitumen solution over bituminized paper. Payment per 1 m ² of unfolded area	m ²	2,889.00	861.75	2,489,595.75
01.04.02.07	11.3	- Construction of 20 cm thick paving made of broken stone onto 10 cm thick sand layer with infill of 1:3 cement mortar mix near culverts. Payment per 1 m ² of finished paving	m ²	100.00	2,847.92	284,792.00
01.04.02.08	11.3	- Procurement and fitting of metallic gratings on manholes	pcs	3.00	12,001.84	36,005.52
TOTAL STRUCTURES, CULVERTS:						38,895,156.57

01.04. SUMMARY - PIPE CULVERTS		
01.04.01	EARTH WORKS	1,996,024.04
01.04.02	STRUCTURES, CULVERTS	38,895,156.57
SUB-TOTAL		40,891,180.61
Unforeseen work (5% of sub-total)		2,044,559.03
TOTAL PIPE CULVERTS (01.04.):		42,935,739.64

01. SUMMARY - CIVIL ENGINEERING DESIGN		
01.01	HIGHWAY ALIGNMENT	366,637,272.94
01.02	"PREDEJANE" GRADE-SEPARATED JUNCTION	97,489,630.67
01.03	LOCAL ROADS	51,200,278.45
01.04	PIPE CULVERTS	42,935,739.64
TOTAL CIVIL ENGINEERING DESIGN (01.):		558,262,921.69

02.01. STORMWATER SEWAGE SYSTEM
8.5.1/2 Stormwater sewage system and pipe drainage

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/2.01	8.5.1/2.01	Geodetic marking the route	m ¹	4,331.00	47.93	207,584.83
8.5.1/2.02	4.4.1	Mechanical and hand trench excavation in III and IV category soil for placing of sewers in the road structure 0-2 m				
		mechanical excavation (90%)	m ³	4,932.00	370.50	1,827,306.00
		hand excavation (10%)	m ³	548.00	385.25	211,117.00
8.5.02.01.03	4.4.1.2	Placing of sand around pipes	m ³	2,844.00	1,155.76	3,286,981.44
8.5.02.01.04	4.4.1.2	Filling trenches above pipes with gravel	m ³	2,925.00	1,203.69	3,520,793.25
8.5.1/2.01.05	4.1.2	Filling of drainage channels with filter material	m ³	530.00	1,203.69	637,955.70
8.5.02.01.06	4.4.1.2	Transport of the excavated material	m ²	2,875.00	158.53	455,773.75
8.5.02.01.07	4.4.2	Pumping water from the trench	Lump sum		87,645.12	87,645.12
8.5.1/2.01.08	11.1.6	Procurement and laying of rubber mat below the pave road	m ²	15,900.00	274.65	4,366,935.00
8.5.1/2.01.09	4.1.3.4 4.4.6	-Procurement and laying of plastic half-perforated drain pipes for subgrade and median drainage -Ø110 mm	m ¹	3,180.00	289.40	920,292.00
8.5.1/2.10	4.4.6	Procurement, transport, distribution along the trench and assembly of sewer pipes in the trench Ø160 mm PVC SN8 (gully connections)	m ¹	181.00	577.88	104,596.28
8.5.1/2.11	4.4.7	Procurement, transport, distribution along the trench and assembly of sewer pipes in the trench Ø 300 mm PEHD SN8 class	m ¹	3,436.00	1,926.27	6,618,663.72
		Ø 400 mm PEHD SN8 class	m ¹	354.00	2,889.40	1,022,847.60
8.5.1/2.12	4.1.3.6	Cast iron covers	pcs	109.00	30,820.27	3,359,409.43
		Ø600 mm gutter grating	pcs	149.00	27,930.86	4,161,698.14
8.5.1/2.13	8.5.1/2.13	Cast iron rungs	pcs	1,073.00	551.15	591,383.95
8.5.1/2.14	8.5.1/2.14	Street gutters with grating	pcs	133.00	80,633.14	10,724,207.62
8.5.2/2.15	8.5.2/2.15	Construction of recipient structure with wing walls of impervious reinforced concrete MB 40	m ¹	6.00	41,222.11	247,332.66
8.5.1/2.16	4.4.4	Construction of Ø 100cm round manholes by using prefabricated elements of impervious reinforced concrete MB 40.	m ¹	391.00	58,201.82	22,756,911.62
8.5.1/2.17	8.5.1/2.17	Construction of outlet structures of MB 30 concrete at points of rainwater sewer discharge to water stream	pcs	5.00	48,176.02	240,880.10
8.5.02.01.18	4.1.3.3	Concreting the trench below the pipe drainage	m ³	349.80	8,187.09	2,863,844.08
8.5.02.01.19	4.4.1.1	Trench strutting	m ²	8,183.00	385.25	3,152,500.75
8.5.02.01.20	4.4.3.2	Pipeline testing	m ¹	3,790.00	58.07	220,085.30
8.5.02.01.21	4.4.1.1	Securing of the existing installations	Lump sum		1,926,266.45	1,926,266.45
8.5.02.01.22	4.4.3.2	Washing of channel and removal of all rough segments and dirt. Flushing shall be performed through the use of water tankers.	m ¹	4,333.00	14.75	63,911.75
8.5.1/2.23	8.5.1/2.23	Geodetic survey of stormwater sewage system including report preparation	m ¹	4,333.00	22.12	95,845.96
SUB-TOTAL						73,672,769.50
Unforeseen work (5% of sub-total)						3,683,638.48
TOTAL STORMWATER SEWAGE SYSTEM (8.5.1/2):						77,356,407.98



8.5.1/8. Bridge runoff interception on Južna Morava river at km 881+006.705 of highway

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/8.01	4.4.1.	Mechanical and hand excavation in II and III category material for laying of sewer pipes. 0-2m				
		Mechanical excavation (90%)	m ³	62.50	370.50	23,156.25
		Excavation by hand (10%)	m ³	7.00	385.25	2,696.75
8.5.1/8.02	4.4.6.	Procurement, transport, carrying along the trench and assembly of sewers in trench.				
		Ø 400 mm GRP-Polyester (pressure pipes)	m ¹	45.00	8,590.78	386,585.10
8.5.1/8.03	8.5.1/8.03. Special spec.	Procurement, transport, carrying and assembly pipes on BRIDGE				0.00
		Ø 250 mm GRP-Polyester (pressure pipes)	m ¹	301.00	5,566.82	1,675,612.82
		Ø 300 mm GRP-Polyester (pressure pipes)	m ¹	240.00	6,722.58	1,613,419.20
		Ø 400 mm GRP-Polyester (pressure pipes)	m ¹	315.00	8,590.78	2,706,095.70
8.5.1/8.04	8.5.1/8.04.	Procurement, transport and installation of compensator units at bridge expansion joints. Payment per one installed compensator unit depending on diameter.				
		For polyester pipe of Ø400 mm	pcs.	2.00	888,490.86	1,776,981.72
8.5.1/8.05	8.5.1/8.05.	Procurement, transport and installation of pipe supports (hangers). The price includes procurement and installation of base plates, screws, clips and hangers made of stainless steel. Payment per one installed hanger depending on pipe diameter.				
		Pipe hanger DN250 mm	pcs.	105.00	1,445.16	151,741.80
		Pipe hanger DN300 mm	pcs.	120.00	1,445.16	173,419.20
		Pipe hanger DN400 mm	pcs.	155.00	1,445.16	223,999.80
8.5.1/8.06	8.5.1/8.06.	Procurement, transport and installation of polyester pipe fittings depending on diameter (HOBAS type or similar). Payment per one installed pipe fitting.				
		T fitting Ø250/150	pcs.	17.00	14,517.05	246,789.85
		T fitting Ø300/150	pcs.	14.00	14,517.05	203,238.70
		T fitting Ø400/150	pcs.	18.00	18,376.95	330,785.10
		Bend 45° Ø400 mm	pcs.	4.00	19,926.26	79,705.04
8.5.1/8.07	8.5.1/8.07. Special spec.	Geodetic survey of rainwater sewage system including report preparation.	m ¹	905.00	22.12	20,018.60
SUB-TOTAL						9,614,245.63
Unforeseen work (5% of sub-total)						480,712.28
TOTAL FOR RAIN WATER SEWAGE SYSTEM ON BRIDGE (8.5.1/8.):						10,094,957.91

8.5.1/9. Bridge runoff interception on Južna Morava river at km 881+693.488 of highway

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/9.01	4.4.1.	Mechanical and hand excavation in II and III category material for laying of sewer pipes. 0-2m				
		Mechanical excavation (90%)	m ³	98.40	370.50	36,457.20
		Excavation by hand (10%)	m ³	11.00	385.25	4,237.75
8.5.1/9.02	4.4.6.	Procurement, transport, carrying along the trench and assembly of sewers in trench.				
		Ø 400 mm GRP-Polyester (pressure pipes)	m ¹	71.00	8,590.78	609,945.38
8.5.1/9.03	8.5.1/9.03. Special spec.	Procurement, transport, carrying and assembly pipes on BRIDGE				
		Ø 250 mm GRP-Polyester (pressure pipes)	m ¹	80.00	5,566.82	445,345.60
		Ø 300 mm GRP-Polyester (pressure pipes)	m ¹	60.00	6,722.58	403,354.80
		Ø 400 mm GRP-Polyester (pressure pipes)	m ¹	206.00	8,590.78	1,769,700.68
8.5.1/9.04	8.5.1/9.04.	Procurement, transport and installation of compensator units at bridge expansion joints. Payment per one installed compensator unit depending on diameter.				
		For polyester pipe of Ø400 mm	pcs.	2.00	389,876.33	779,752.66
8.5.1/9.05	8.5.1/9.05.	Procurement, transport and installation of pipe supports (hangers). The price includes procurement and installation of base plates, screws, clips and hangers made of stainless steel. Payment per one installed hanger depending on pipe diameter.				
		Pipe hanger DN250 mm	pcs.	28.00	1,445.16	40,464.48
		Pipe hanger DN300 mm	pcs.	30.00	1,445.16	43,354.80
		Pipe hanger DN400 mm	pcs.	104.00	1,445.16	150,296.64
8.5.1/9.06	8.5.1/9.06.	Procurement, transport and installation of polyester pipe fittings depending on diameter (HOBAS type or similar). Payment per one installed pipe fitting.				
		T fitting Ø250/150	pcs.	6.00	14,517.05	87,102.30
		T fitting Ø300/150	pcs.	4.00	14,517.05	58,068.20
		T fitting Ø400/150	pcs.	15.00	18,376.95	275,654.25
		Bend 45° Ø400 mm	pcs.	4.00	19,926.26	79,705.04
8.5.1/9.07	8.5.1/9.07. Special spec.	Geodetic survey of rainwater sewage system including report preparation.	m ¹	477.00	22.12	10,551.24
SUB-TOTAL						4,793,991.02
Unforeseen work (5% of sub-total)						239,699.55
TOTAL FOR RAIN WATER SEWAGE SYSTEM ON BRIDGE (8.5.1/9.):						5,033,690.57

8.5.1/10. Bridge runoff interception on Južna Morava river at km 883+256.496 of highway

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/10.01	4.4.1	Mechanical and hand excavation in II and III category material for laying of sewer pipes 0-2m				
		Mechanical excavation (90%)	m ³	242.00	370.50	89,661.00
		Excavation by hand (10%)	m ³	27.00	385.25	10,401.75
8.5.1/10.02	4.4.6	Procurement, transport, carrying along the trench and assembly of sewers in trench Ø 300 mm GRP-Polyester (pressure pipes)	m ¹	174.00	6,722.58	1,169,728.92
8.5.1/10.03	8.5.1/10.03 Special spec	Procurement, transport, carrying and assembly pipes on BRIDGE				
		Ø 250 mm GRP-Polyester (pressure pipes)	m ¹	580.00	5,566.82	3,228,755.60
		Ø 300 mm GRP-Polyester (pressure pipes)	m ¹	394.00	6,722.58	2,648,696.52
8.5.1/10.04	8.5.1/10.04	Procurement, transport and installation of compensator units at bridge expansion joints. Payment per one installed compensator unit depending on diameter For polyester pipe of Ø300 mm	pcs	2.00	25,041.47	50,082.94
8.5.1/10.05	8.5.1/10.05	Procurement, transport and installation of pipe supports (hangers). The price includes procurement and installation of base plates, screws, clips and hangers made of stainless steel. Payment per one installed hanger depending on pipe diameter Pipe hanger DN250 mm	pcs	194.00	1,445.16	280,361.04
		Pipe hanger DN300 mm	pcs	158.00	1,445.16	228,335.28
		Procurement, transport and installation of polyester pipe fittings depending on diameter (HOBAS type or similar). Payment per one installed pipe fitting T fitting Ø250/150	pcs	41.00	14,517.05	595,199.05
8.5.1/10.06	8.5.1/10.06	T fitting Ø300/150	pcs	28.00	14,517.05	406,477.40
		Bend 45° DN300	pcs	12.00	19,926.26	239,115.12
		Geodetic survey of rainwater sewage system including report preparation	m ¹	1,148.00	22.12	25,393.76
SUB-TOTAL						8,972,208.38
Unforeseen work (5% of sub-total)						448,610.42
TOTAL FOR RAIN WATER SEWAGE SYSTEM ON BRIDGE (8.5.1/10.):						9,420,818.80

8.5.1/11. Bridge runoff interception on Južna Morava river at km 885+150.585 of highway

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/11.01	4.4.1	Mechanical and hand excavation in II and III category material for laying of sewer pipes 0-2m				
		Mechanical excavation (90%)	m ³	46.00	370.50	17,043.00
		Excavation by hand (10%)	m ³	5.10	385.25	1,964.78
8.5.1/11.02	4.4.6	Procurement, transport, carrying along the trench and assembly of sewers in trench Ø 250 mm GRP-Polyester (pressure pipes)	m ¹	33.00	5,566.82	183,705.06
8.5.1/11.03	8.5.1/11.03 Special spec	Procurement, transport, carrying and assembly pipes on BRIDGE Ø 250 mm GRP-Polyester (pressure pipes)	m ¹	278.00	5,566.82	1,547,575.96
8.5.1/11.04	8.5.1/11.04 Special spec	Procurement, transport and installation of compensator units at bridge expansion joints. Payment per one installed compensator unit depending on diameter For polyester pipe of Ø250 mm	pcs	2.00	28,894.00	57,788.00
8.5.1/11.05	8.5.1/11.05 Special spec	Procurement, transport and installation pipe hangers Pipe hanger DN250 mm	pcs	94.00	1,445.16	135,845.04
8.5.1/11.06	8.5.1/11.06 Special spec	Procurement, transport and installation of polyester pipe fittings depending on diameter (HOBAS type or similar). Payment per one installed pipe fitting T fitting Ø250/150	pcs	12.00	14,517.05	174,204.60
		Bend 45° Ø250 mm	pcs	4.00	19,926.26	79,705.04
		Geodetic survey of rainwater sewage system including report preparation	m ¹	190.00	22.12	4,202.80
SUB-TOTAL						2,202,034.28
Unforeseen work (5% of sub-total)						110,101.71
TOTAL FOR RAIN WATER SEWAGE SYSTEM ON BRIDGE (8.5.1/11.):						2,312,135.99

8.5.1/12. Devices for water protection against pollution – separators

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/2.01	8.5.1/2.01	Geodetic marking the route	m ¹	202.00	47.93	9,681.86
8.5.1/2.01	4.4.1	Mechanical and hand excavation in III and IV category material for laying of sewer pipes 0-2m				
		Mechanical excavation (90%)	m ³	320.40	370.50	118,708.20
		Excavation by hand (10%)	m ³	35.60	385.25	13,714.90
8.5.02.01.04	4.4.1.2	Placing of sand around pipes	m ³	119.05	1,155.76	137,591.73
8.5.02.01.05	4.4.1.2	Filling trenches above pipes with excavated material	m ³	236.95	409.21	96,962.84
8.5.02.01.06	4.4.1.2	Transport of the excess material from excavation	m ³	133.32	158.53	21,135.22

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.02.01.07	4.4.2	Pumping water from the trench	Lump sum		17,336.39	17,336.39
8.5.1/12.08	4.4.7	Procurement, transport, carrying along the trench and assembly of sewer pipes.				
		Ø 300 mm PEHD SN4, class	m ¹	114.30	1,926.27	220,172.66
		Ø 400 mm PEHD SN4, class	m ¹	18.00	2,889.40	52,009.20
		Ø 500 mm PEHD SN4, class	m ¹	70.00	4,334.56	303,419.20
8.5.1/12.09	8.5.1/12.09. Special spec.	Procurement, transport and installation of mineral oil separators provided with integrated BY-PASS, Purgator type or equivalent with the following capacities:				
		Qn/Qmax 10/100	pcs	7.00	359,248.70	2,514,740.90
		Qn/Qmax 15/150	pcs	6.00	416,073.56	2,496,441.36
		Qn/Qmax 20/200	pcs	2.00	472,898.41	945,796.82
		Qn/Qmax 30/300	pcs	3.00	529,723.28	1,589,169.84
		Qn/Qmax 50/500	pcs	2.00	654,930.59	1,309,861.18
8.5.1/12.10	4.1.3.6	Cast-iron covers	pcs	25.00	30,820.27	770,506.75
8.5.1/12.11	4.1.3.6	Cast-iron rungs	pcs	107.00	551.15	58,973.05
8.5.1/12.12	4.4.4	Construction of Ø 100cm round manholes by using prefabricated elements of impervious reinforced concrete MB 40	m ¹	8.00	58,201.82	465,614.56
8.5.1/12.13	03.02.05.04 Special spec.	Construction of recipient structure with wing walls of impervious reinforced concrete MB 40	m ¹	20.00	41,222.11	824,442.20
8.5.1/12.14	8.5.1/12.14	Construction of outlet structures of MB 30 concrete at points of rainwater sewer discharge to water stream.	pcs	20.00	48,176.02	963,520.40
8.5.1/12.15	8.5.1/12.15	Flat check valves provided with flanges.				
		Ø 300 mm	pcs	12.00	18,396.31	220,755.72
		Ø 400 mm	pcs	3.00	23,211.97	69,635.91
		Ø 500 mm	pcs	5.00	28,027.64	140,138.20
8.5.02.01.16	4.4.1.1	Trench strutting	m ³	686.80	385.25	264,589.70
8.5.02.01.17	4.4.3.2	Pipeline testing	m ¹	202.00	58.07	11,730.14
8.5.02.01.18	4.4.3.2	Washing of channel and removal of all rough segments and dirt. Flushing shall be performed through the use of water tankers	m ¹	202.00	14.75	2,979.50
8.5.1/12.19	8.5.1/12.19	Geodetic survey and preparation as-built design.	m ¹	202.00	22.12	4,468.24
SUB-TOTAL						13,644,096.67
Unforeseen work (5% of sub-total)						682,204.83
TOTAL FOR DEVICES FOR WATER PROTECTION AGAINST POLLUTION – SEPARATORS (8.5.1/12.):						14,326,301.50

02.01. STORMWATER SEWAGE SYSTEM – SUMMARY		
8.5.1/2	Stormwater sewage system and pipe drainage	77,356,407.98
8.5.1/8	Bridge runoff interception on Južna Morava river at km 881+006.705 of highway	10,094,957.91
8.5.1/9	Bridge runoff interception on Južna Morava river at km 881+693.488 of highway	5,033,690.57
8.5.1/10	Bridge runoff interception on Južna Morava river at km 883+256.496 of highway	9,420,818.80
8.5.1/11	Bridge runoff interception on Južna Morava river at km 885+150.585 of highway	2,312,135.99
8.5.1/12	Devices for water protection against pollution – separators	14,326,301.50
SUB-TOTAL		118,544,312.75
Unforeseen work (5% of sub-total)		5,927,215.64
TOTAL STORMWATER SEWAGE SYSTEM (02.01.):		124,471,528.39

Regulation of water streams

06.09. Regulation of the Južna Morava River at km 881+002.79

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
PRELIMINARY WORKS						
06.09.01.01	2.4	For river bed regulation: clear ground from brushwood, cut trees up to 10 cm thick and uproot stumps and transport them to dump area specified by the Investor and/or the Engineer. The price includes loading into vehicles, transport to distance of 5 km, unloading and leveling of dump area. Prior to commencement of works, the Contractor in cooperation with the Engineer shall measure quantities and make record into the book. Payment per m ² of cleared area.	m ²	7,644.00	413.83	3,163,316.52
06.09.01.02	2.2	Geodetic surveying. Recovery of apex and traverse in length of river regulated section prior to start of works.	m ¹	182.00	22.12	4,025.84
TOTAL PRELIMINARY WORKS:						3,167,342.36
EARTH WORKS						
06.09.02.01	3.1	Stripping topsoil to depth of 25 cm with clearing weeds and other plants. Topsoil shall be stockpiled at distance up to 5 km. Payment per m ³ of transported material.	m ³	360.25	413.83	149,082.26
06.09.02.02	11.7.1	For new river bed regulation: mechanical excavation in dry and moist earth of II and III category by dredgers or other suitable machines with direct loading into vehicles. Measurement includes excavation, loading, transport, unloading and leveling of stockpiling area after completion of works. Price includes any dewatering operations during works. Excavation shall be performed to accuracy of 10 cm in relation to designed levels. Measurement will be made per cross sections surveyed before and after excavation, transport included (excavation table).				
		a) Work in naturally moist earth (70%)	m ³	2,836.66	413.83	1,173,893.35
		b) Work in wet earth (30%)	m ³	1,215.71	485.71	590,482.50

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
06.09.02.03	11.7.1	For construction of supporting structure mechanical excavation in dry and moist earth of II and III category by dredgers or other suitable machines with direct loading into vehicles. Measurement includes excavation, loading, transport, unloading and leveling of stockpiling area after completion of works. Price includes any dewatering operations during works. Excavation shall be performed to accuracy of 10 cm in relation to designed levels. Measurement will be made per cross sections surveyed before and after excavation, transport included (excavation table).				
		a) Work in naturally moist earth (70%)	m ³	30.84	413.83	12,762.52
		b) Work in wet earth (30%)	m ³	13.22	485.71	6,421.09
06.09.02.04	11.7.1.4	Hand excavation in earth of II and III category for supporting structures. Material shall be transported to stockpiling area specified by the Engineer. Measurement includes any dewatering operation during works. Payment per m ³ of excavated earth.	m ³	138.40	910.60	126,027.04
06.09.02.05	11.7.1.4	Additional excavation by hand including fine and rough leveling of bed. After mechanical excavation bed bottom and slopes shall be additionally excavated by hand. Excavated material shall be transported to the stockpiling area or used for embankment construction. Leveling shall be performed to accuracy of 2 cm in relation to designed levels. Price includes any dewatering operation during works. Measurement per m ³				
		a) Work in naturally moist earth (70%)	m ³	407.94	910.60	371,470.16
		b) Work in wet earth (30%)	m ³	174.83	1,523.50	266,353.51
06.09.02.06	11.7.3.2	Procurement and spreading of 15 cm thick sandy gravel layer under the regulated bed. Payment per m ³ of spread gravel.	m ³	408.40	2,320.74	947,790.22
06.09.02.07	11.7.2.2	Filling of bank slopes prior to making stone revetment according to cross sections from the design. Slopes shall be filled with excavated material along with spreading and leveling in 30 cm thick layers and mechanical compaction to the required compactness. Payment per m ³ of filled material.	m ³	2,886.73	478.34	1,380,838.43
		NOTE: Use excavated earth to fill ground and backfill the old river bed.				
06.09.02.08	3.4.1.5.4	Protection of slope section from the end point of stone revetment to the existing ground by topsoiling and grassing. Measurement per m ² of topsoiled and grassed area.	m ²	1,498.76	389.86	584,306.57
06.09.02.09	11.7.1.7	All material remained from excavation not used for filling shall be transported to the stockpiling area specified by the Engineer. Price includes loading, transport, unloading and rough spreading of material. Payment per m ³ of transported material.	m ³	1,930.86	768.66	1,484,174.85
TOTAL EARTH WORKS:						7,093,602.49
06.09.03. STONE WORKS						
06.09.03.01	11.7.3.4	Formation of slope bases and slopes of regulated river bed section by using d=30 cm hammer-dressed stone embedded in 1:3 cement mortar. For formation of slope bases (2.00x1.00 m) and river bed slopes use only high-quality limestone so that front side edges are parallel. Joints shall be filled with 1:2 cement mortar. Payment per m ² of placed stone.	m ²	938.51	6,754.83	6,339,475.50
06.09.03.02	11.7.3.5	Construction of supporting structures of d=30 cm stone embedded in cement mortar according to the enclosed design drawings. Payment per m ² of placed stone.	m ²	176.65	6,754.83	1,193,240.72
TOTAL STONE WORKS:						7,532,716.22
06.09.SUMMARY - REGULATION OF THE JUZNA MORAVA RIVER AT KM 881+002.79						
06.09.01	PRELIMINARY WORKS					3,167,342.36
06.09.02	EARTH WORKS					7,093,602.49
06.09.03	STONE WORKS					7,532,716.22
TOTAL REGULATION OF THE JUZNA MORAVA RIVER AT KM 881+002.79 (06.09.):						17,793,661.07
06.10. Regulation of the Juzna Morava River at km 881+763.53						
Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
06.10.01. PRELIMINARY WORKS						
06.10.01.01	2.4	For river bed regulation: clear ground from brushwood, cut trees up to 10 cm thick and uproot stumps and transport them to dump area specified by the Investor and/or the Engineer. The price includes loading into vehicles, transport to distance of 5 km, unloading and leveling of dump area. Prior to commencement of works, the Contractor in cooperation with the Engineer shall measure quantities and make record into the book. Payment per m ² of cleared area.	m ²	23,940.00	252.53	6,045,568.20
06.10.01.02	2.2	Geodetic surveying: Recovery of apex and traverse in length of river regulated section prior to start of works.	m ¹	570.00	22.12	12,608.40
TOTAL PRELIMINARY WORKS:						6,058,176.60

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
EARTH WORKS						
06.10.02.01	3.1	Stripping topsoil to depth of 25 cm with clearing weeds and other plants. Topsoil shall be stockpiled at distance up to 5 km. Payment per m ³ of transported material.	m ³	1,200.00	413.83	496,596.00
06.10.02.02	11.7.1	For new river bed regulation: mechanical excavation in dry and moist earth of II and III category by dredgers or other suitable machines with direct loading into vehicles. Measurement includes excavation, loading, transport, unloading and leveling of stockpiling area after completion of works. Price includes any dewatering operations during works. Excavation shall be performed to accuracy of 10 cm in relation to designed levels. Measurement will be made per cross sections surveyed before and after excavation, transport included (excavation table).				
		a) Work in naturally moist earth (70%)	m ³	44,488.49	413.83	18,410,673.57
		b) Work in wet earth (30%)	m ³	19,066.50	485.71	9,260,788.51
06.10.02.03	11.7.1	For construction of supporting structure: mechanical excavation in dry and moist earth of II and III category by dredgers or other suitable machines with direct loading into vehicles. Measurement includes excavation, loading, transport, unloading and leveling of stockpiling area after completion of works. Price includes any dewatering operations during works. Excavation shall be performed to accuracy of 10 cm in relation to designed levels. Measurement will be made per cross sections surveyed before and after excavation, transport included (excavation table).				
		a) Work in naturally moist earth (70%)	m ³	651.66	413.83	269,675.63
		b) Work in wet earth (30%)	m ³	279.28	485.71	135,650.06
06.10.02.04	11.7.1.4	Hand excavation in earth of II and III category for supporting structures. Material shall be transported to stockpiling area specified by the Engineer. Measurement includes any dewatering operation during works. Payment per m ³ of excavated earth.				
			m ³	311.40	910.60	283,560.84
06.10.02.05	11.7.1.4	Additional excavation by hand including fine and rough leveling of bed. After mechanical excavation bed bottom and slopes shall be additionally excavated by hand. Excavated material shall be transported to the stockpiling area or used for embankment construction. Leveling shall be performed to accuracy of 2 cm in relation to designed levels. Price includes any dewatering operation during works. Measurement per m ³ .				
		a) Work in naturally moist earth (70%)	m ³	1,797.63	910.60	1,636,921.33
		b) Work in wet earth (30%)	m ³	770.41	1,523.50	1,173,723.60
06.10.02.06	11.7.3.2	Procurement and spreading of 15 cm thick sandy gravel layer under the regulated bed. Payment per m ³ of spread gravel.	m ³	1,831.81	2,320.74	4,251,154.74
06.10.02.07	11.7.2.2	Filling of bank slopes prior to making stone revetment according to cross sections from the design. Slopes shall be filled with excavated material along with spreading and leveling in 30 cm thick layers and mechanical compaction to the required compactness. Payment per m ³ of filled material.				
		NOTE: Use excavated earth to fill ground and backfill the old river bed.	m ³	6,611.66	478.34	3,162,620.37
06.10.02.08	3.4.1.5.4	Protection of slope section from the end point of stone revetment to the existing ground by topsoiling and grassing. Measurement per m ² of topsoiled and grassed area.	m ²	2,183.58	389.86	851,291.18
06.10.02.09	11.7.1.7	All material remained from excavation not used for filling shall be transported to the stockpiling area specified by the Engineer. Price includes loading, transport, unloading and rough spreading of material. Payment per m ³ of transported material.	m ³	60,753.72	768.66	46,698,951.34
TOTAL EARTH WORKS:						86,631,607.17
STONE WORKS						
06.10.03.01	11.7.3.4	Formation of slope bases and slopes of regulated river bed section by using d=30 cm hammer-dressed stone embedded in 1:3 cement mortar. For formation of slope bases (2.00x1.00 m) and river bed slopes use only high-quality limestone so that front side edges are parallel. Joints shall be filled with 1:2 cement mortar. Payment per m ³ of placed stone.	m ³	5,348.05	6,754.83	36,125,145.62
06.10.03.02	11.7.3.5	Construction of supporting structures of d=30 cm stone embedded in cement mortar according to the enclosed design drawings. Payment per m ³ of placed stone.	m ³	471.33	6,754.83	3,183,754.02
TOTAL STONE WORKS:						39,308,899.64
06.10.SUMMARY - REGULATION OF THE JUZNA MORAVA RIVER AT KM 881+763.53						
06.10.01	PRELIMINARY WORKS					6,058,176.60
06.10.02	EARTH WORKS					86,631,607.17
06.10.03	STONE WORKS					39,308,899.64
TOTAL REGULATION OF THE JUZNA MORAVA RIVER AT KM 881+763.53 (06.10.):						131,998,683.40

06.11. Regulation of Caricin brook at km 885+445.07

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
PRELIMINARY WORKS						
06.11.01.						
06.11.01.01	2.4	For river bed regulation: clear ground from brushwood, cut trees up to 10 cm thick and uproot stumps and transport them to dump area specified by the Investor and/or the Engineer. The price includes loading into vehicles, transport to distance of 5 km, unloading and leveling of dump area. Prior to commencement of works, the Contractor in cooperation with the Engineer shall measure quantities and make record into the book. Payment per m ² of cleared area.	m ²	725.00	252.53	183,084.25
06.11.01.02	2.2	Geodetic surveying. Recovery of apex and traverse in length of river regulation prior to starting of works.	m ¹	73.00	22.12	1,614.76
TOTAL PRELIMINARY WORKS:						184,699.01
EARTH WORKS						
06.11.02.						
06.11.02.02	11.7.1	For new river bed regulation: mechanical excavation in dry and moist earth of II and III category by dredgers or other suitable machines with direct loading into vehicles. Measurement includes excavation, loading, transport, unloading and leveling of stockpiling area after completion of works. Price includes any dewatering operations during works. Excavation shall be performed to accuracy of 10 cm in relation to designed levels. Measurement will be made per cross sections surveyed before and after excavation, transport included (excavation table).				
		a) Work in naturally moist earth (70 %)	m ³	841.00	413.83	348,029.71
		b) Work in wet earth (30%)	m ³	360.43	485.71	175,063.10
06.11.02.03	11.7.1	For construction of supporting structure: mechanical excavation in dry and moist earth of II and III category by dredgers or other suitable machines with direct loading into vehicles. Measurement includes excavation, loading, transport, unloading and leveling of stockpiling area after completion of works. Price includes any dewatering operations during works. Excavation shall be performed to accuracy of 10 cm in relation to designed levels. Measurement will be made per cross sections surveyed before and after excavation, transport included (excavation table).				
		a) Work in naturally moist earth (70 %)	m ³	76.66	413.83	31,724.21
		b) Work in wet earth (30%)	m ³	32.86	485.71	15,960.43
06.11.02.04	11.7.1.4	Hand excavation in earth of II and III category for supporting structures. Material shall be transported to stockpiling area specified by the Engineer. Measurement includes any dewatering operation during works. Payment per m ³ of excavated earth.	m ³	27.38	910.60	24,932.23
06.11.02.05	11.7.1.4	Additional excavation by hand including fine and rough leveling of bed. After mechanical excavation bed bottom and slopes shall be additionally excavated by hand. Excavated material shall be transported to the stockpiling area or used for embankment construction. Leveling shall be performed to accuracy of 2 cm in relation to designed levels. Price includes any dewatering operation during works. Measurement per m ³				
		a) Work in naturally moist earth (70 %)	m ³	210.25	910.60	191,453.65
		b) Work in wet earth (30%)	m ³	90.11	1,523.50	137,282.59
06.11.02.06	11.7.3.2	Procurement and spreading of 15 cm thick sandy gravel layer under the regulated bed. Payment per m ³ of spread gravel.	m ³	69.57	2,320.74	161,453.88
06.11.02.07	11.7.2.2	Filling of bank slopes prior to making stone revetment according to cross sections from the design. Slopes shall be filled with excavated material along with spreading and leveling in 30 cm thick layers and mechanical compaction to the required compactness. Payment per m ³ of filled material.	m ³	189.78	478.34	90,779.37
		NOTE: Use excavated earth to fill ground and backfill the old river bed.				
06.11.02.08	3.4.1.5.4	Protection of slope section from the end point of stone revetment to the existing ground by topsoiling and grassing. Measurement per m ² of topsoiled and grassed area.	m ²	99.89	389.86	38,943.12
06.11.02.09	11.7.1.7	All material remained from excavation not used for filling shall be transported to the stockpiling area specified by the Engineer. Price includes loading, transport, unloading and rough spreading of material. Payment per m ³ of transported material.	m ³	1,448.90	768.66	1,113,711.47
TOTAL EARTH WORKS:						2,329,333.74
STONE WORKS						
06.11.03.						
06.11.03.01	11.7.3.4	Lining of regulated river bed section by using d=30 cm hammer-dressed stone embedded in 1:3 cement mortar. For formation of slope bases (2.00x1.00 m) and river bed slopes use only high-quality limestone so that front side edges are parallel. Joints shall be filled with 1:2 cement mortar. Payment per m ³ of placed stone.	m ³	179.26	6,754.83	1,210,870.83
06.11.03.02	11.7.3.5	Construction of supporting structures of d=30 cm stone embedded in cement mortar according to the enclosed design drawings. Payment per m ³ of placed stone.	m ³	58.59	6,754.83	395,765.49
06.11.03.03	11.7.3.3	Rip-rap over the existing river bed, upstream (l=5.0+5.0 m) from the regulated bed. Payment per m ³ of placed stone.	m ³	10.00	6,754.83	67,548.30
TOTAL STONE WORKS:						1,674,184.62



06.11. SUMMARY - PREGULATION OF CARICIN BROOK AT KM 885+445.07		
06.11.01. PRELIMINARY WORKS		184,699.01
06.11.02. EARTH WORKS		2,329,333.74
06.11.03. STONE WORKS		1,674,184.62
TOTAL REGULATION OF CARICIN BROOK AT KM 885+445.07 (06.11.):		4,188,217.36

06. REGULATION OF WATER STREAMS - SUMMARY		
06.09. REGULATION OF THE JUZNA MORAVA RIVER AT km 881+002.79		17,793,661.07
06.10. REGULATION OF THE JUZNA MORAVA RIVER AT km 881+763.53		131,998,683.40
06.11. REGULATION OF CARICIN BROOK AT km 885+445.07		4,188,217.36
SUB-TOTAL		153,980,561.84
Unforeseen work (5% of sub-total)		7,699,028.09
TOTAL REGULATION OF WATER STREAMS (06.):		161,679,589.94

**07.16. Supporting structure of reinforced earth 16 leftwards,
from km 881+332.32 to km 881+450 L=114.81 m**

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.16.06.		PRELIMINARY WORKS				
07.16.06.01	2.4.1	PRELIMINARY WORKS Works shall be paid in a lump sum	lump sum		354,838.55	354,838.55
TOTAL PRELIMINARY WORKS:						354,838.55
07.16.07.		EARTH WORKS				
07.16.07.01	3.1.1	Topsoil stripping This item includes stripping of 20 cm thick topsoil layer and stockpiling of material on the site. Measurement unit is m ² Measurement is made in the LOT 2 Civil engineering design	m ²			
07.16.07.02	11.1.1	Excavation of earth Price includes excavation of II and III category earth, loading and transport of surplus material to stockpiling area specified by the Engineer. Measurement unit is m ³ . Measurement is made in the LOT 2 Civil engineering design	m ³			
07.16.07.03	07.16.07.03	Construction of embankment This item includes construction of earth embankment with min. 30% of 0-125 mm stone fractions. Measurement unit is m ³	m ³	21,852.94	320.73	7,008,893.45
TOTAL EARTH WORKS:						7,008,893.45
07.16.08.		CONCRETE WORKS				
07.16.08.01	11.1.2	Construction of foundation with MB20 plain concrete This item includes procurement, transport of necessary material, work on concrete mixing and placing, quality proof and other related works. Measurement unit is m ³	m ³	14.47	8,516.12	123,228.26
07.16.08.02	11.1.2	Construction of top section of retaining wall This item includes concreting of top section of retaining wall with MB 30 concrete, fully in accordance with designed detail. Measurement unit is m ³	m ³	6.43	10,454.37	67,221.60
TOTAL CONCRETE WORKS:						190,449.86
07.16.09.		REINFORCEMENT WORKS				
07.16.09.01	11.1.3	RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works. Measurement unit is kg	kg	377.72	70.97	26,806.79
TOTAL REINFORCEMENT WORKS:						26,806.79
07.16.10.		WORKS WITH GEOSYNTHETIC MATERIALS				
07.16.10.01	07.16.10.01	Placing of geogrids This item includes procurement, cutting and placing of geogrids as designed. Measurement unit is m ² a) geogrid M1 with Tdop= 8,21KN/m	m ²	2,040.00	309.68	631,747.20
		a) geogrid M2 with Tdop= 18,14KN/m	m ²	2,735.00	400.92	1,096,516.20
07.16.10.02	07.16.10.02	Procurement and installation of connectors This item includes procurement and installation of polyethylene connectors to connect geogrids and concrete blocks. Measurement unit is m	m	1,299.00	70.97	92,190.03
TOTAL WORKS WITH GEOSYNTHETIC MATERIALS:						1,820,453.43
07.16.11.		MASONRY WORKS				
07.16.11.01	8.3.6	Building wall face of concrete blocks This item includes procurement, transport and building wall face of concrete blocks MB30, V4, M150, 40x 15x22 in size. Measurement unit is piece	pcs	7,913.00	274.65	2,173,305.45
TOTAL MASONRY WORKS:						2,173,305.45

07.16. SUMMARY Supporting structure of reinforced earth 16-leftwards, from km 881+332.32 to km 881+450, L=114.81m		
07.16.06. PRELIMINARY WORKS		354,838.55
07.16.07. EARTH WORKS		7,008,893.45
07.16.08. CONCRETE WORKS		190,449.86
07.16.09. REINFORCEMENT WORKS		26,806.79
07.16.10. WORKS WITH GEOSYNTHETIC MATERIALS		1,820,453.43
07.16.11. MASONRY WORKS		2,173,305.45
TOTAL Supporting structure of reinforced earth 16-leftwards, from km 881+332.32 to km 881+450, L=114.81m(07.16.):		11,574,747.52

07.17. Retaining wall 17 in the central reserve
from km 882+203 to km 882+675 L=472.71 m

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.17.01.		PRELIMINARY WORKS				
07.17.01.01	2.4.1	PRELIMINARY WORKS Works shall be paid in a lump sum.	lump sum		1,439,630.72	1,439,630.72
TOTAL PRELIMINARY WORKS:						1,439,630.72
07.17.02.		EARTH WORKS				
07.17.02.01	3.1.1.	Topsoil stripping This item includes stripping of 20 cm thick topsoil layer and stockpiling of material on the site. Measurement unit is m ² Measurement is made in the LOT 2 Civil engineering design.	m ²			
07.17.02.02	11.1.1	Excavation of earth for walls Price includes excavation of III and IV category earth, loading and transport of surplus material to stockpiling area specified by the Engineer. Measurement unit is m ³ Measurement is made in the LOT 2 Civil engineering design.	m ³			
TOTAL EARTH WORKS:						
07.17.03.		CONCRETE WORKS				
07.17.03.01	11.1.2	Construction of concrete cap Price includes construction of reinforced concrete cap ring by ring, fully in accordance with designed details Measurement unit is m ³	m ³	184.36	10,454.37	1,927,367.65
07.17.03.02	11.1.2	Construction of concrete wall foundation This item includes concreting of wall foundation with MB 30 plain concrete, d=50 cm Measurement unit is m ³ .	m ³	366.35	9,124.42	3,342,731.27
TOTAL CONCRETE WORKS:						5,270,098.92
07.17.04.		MASONRY WORKS				
07.17.04.01	07.17.04.01	Construction of stone wall Price includes construction of stone wall of 20-40 cm fractions in cement mortar, fully in accordance with designed details. Measurement unit is m ³ .	m ³	2,736.99	1,885.72	5,161,196.78
TOTAL MASONRY WORKS:						5,161,196.78
07.17.05.		REINFORCEMENT WORKS				
07.17.05.01	1.1.3	RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works Measurement unit is kg.	kg	8,944.32	70.97	634,778.39
TOTAL REINFORCEMENT WORKS:						634,778.39
07.17.06.		SUNDRIES				
07.17.06.01	11.1	Plastic pipes f100 mm for weepholes Price includes procurement and laying of f100 mm plastic pipes for weepholes including all related works. Measurement unit is m.	m	228.00	425.81	97,084.68
TOTAL SUNDRIES:						97,084.68

07.17. SUMMARY Retaining wall 17-in the central reserve from km 882+203 to km 882+675, L=472m						
07.17.01.		PRELIMINARY WORKS				1,439,630.72
07.17.02.		EARTH WORKS				
07.17.03.		CONCRETE WORKS				5,270,098.92
07.17.04.		MASONRY WORKS				5,161,196.78
07.17.05.		REINFORCEMENT WORKS				634,778.39
07.17.06.		SUNDRIES				97,084.68
TOTAL Retaining wall 17-in the central reserve from km 882+203 to km 882+675, L=472.71m (07.17.):						12,602,789.49

07.18. Supporting structure of reinforced earth 18 leftwards,
from km 882+320 to km 882+480 L=160 m

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.18.06.		PRELIMINARY WORKS				
07.18.06.01	2.4.1	PRELIMINARY WORKS Works shall be paid in a lump sum.	lump sum		486,635.73	486,635.73
TOTAL PRELIMINARY WORKS:						486,635.73
07.18.07.		EARTH WORKS				
07.18.07.01	3.1.1.	Topsoil stripping This item includes stripping of 20 cm thick topsoil layer and stockpiling of material on the site. Measurement unit is m ² Measurement is made in the LOT 2 Civil engineering design.	m ²			
07.18.07.02	11.1.1	Excavation of earth Price includes excavation of II and III category earth, loading and transport of surplus material to stockpiling area specified by the Engineer. Measurement unit is m ³ Measurement is made in the LOT 2 Civil engineering design.	m ³			
07.18.07.03.		Construction of embankment This item includes construction of earth embankment with min. 30% of 0-125 mm stone fractions. Measurement unit is m ³ .	m ³	4,486.17	320.73	1,438,849.30
TOTAL EARTH WORKS:						1,438,849.30

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.18.08.		CONCRETE WORKS				
07.18.08.01.	11.1.2	Construction of foundation with MB20 plain concrete This item includes procurement, transport of necessary material, work on concrete mixing and placing, quality proof and other related works. Measurement unit is m ³	m ³	20.16	8,516.12	171,684.98
07.18.08.02.	11.1.2	Construction of top section of retaining wall This item includes concreting of top section of retaining wall with MB 30 concrete, fully in accordance with designed detail Measurement unit is m ³	m ³	8.96	10,454.37	93,671.16
TOTAL CONCRETE WORKS:						265,356.13
07.18.09.		REINFORCEMENT WORKS				
07.18.09.01.	11.1.3	RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works Measurement unit is kg	kg	526.40	70.97	37,358.61
TOTAL REINFORCEMENT WORKS:						37,358.61
07.18.10.		WORKS WITH GEOSYNTHETIC MATERIALS				
07.18.10.01.	07.18.10.01.	Placing of geogrids This item includes procurement, cutting and placing of geogrids as designed. Measurement unit is m ² a) geogrid M1 with Tdop= 8,21KN/m	m ²	4,666.00	309.68	1,444,966.88
07.18.10.02.	07.18.10.02.	a) geogrid M2 with Tdop= 18,14KN/m Procurement and installation of connectors This item includes procurement and installation of polyethylene connectors to connect geogrids and concrete blocks. Measurement unit is m	m ²	5,611.00	400.92	2,249,562.12
			m	2,423.00	70.97	171,960.31
TOTAL WORKS WITH GEOSYNTHETIC MATERIALS:						3,866,489.31
07.18.11.		MASONRY WORKS				
07.18.11.01.	8.3.6	Building wall face of concrete blocks This item includes procurement, transport and building wall face of concrete blocks MB30, V4, M150, 40x 15x22 in size Measurement unit is piece	pes	14,602.00	274.65	4,010,439.30
TOTAL MASONRY WORKS:						4,010,439.30

07.18. SUMMARY Supporting structure of reinforced earth 18 -leftwards, from km 882+320 to km 882+480, L=160m		
07.18.06.	PRELIMINARY WORKS	486,635.73
07.18.07.	EARTH WORKS	1,438,849.30
07.18.08.	CONCRETE WORKS	265,356.13
07.18.09.	REINFORCEMENT WORKS	37,358.61
07.18.10.	WORKS WITH GEOSYNTHETIC MATERIALS	3,866,489.31
07.18.11.	MASONRY WORKS	4,010,439.30
TOTAL Supporting structure of reinforced earth 18 -leftwards, from km 882+320 to km 882+480, L=160m(07.18.):		10,105,128.39

07.19. Retaining wall 19 leftwards, from km 883+250 to km 883+515 L=267 m

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.19.01.		PRELIMINARY WORKS				
07.19.01.01.	2.4.1	PRELIMINARY WORKS Works shall be paid in a lump sum	lump sum		811,059.56	811,059.56
TOTAL PRELIMINARY WORKS:						811,059.56
07.19.02.		EARTH WORKS				
07.19.02.01.	3.1.1.	Topsoil stripping This item includes stripping of 20 cm thick topsoil layer and stockpiling of material on the site Measurement unit is m ² Measurement is made in the LOT 2 Civil engineering design.	m ²			
07.19.02.02.	11.1.1	Excavation of earth for walls Price includes excavation of III and IV category earth, loading and transport of surplus material to stockpiling area specified by the Engineer Measurement unit is m ³ Measurement is made in the LOT 2 Civil engineering design.	m ³			
07.19.02.03.	3.4.1.4	Filling and compaction Price includes the following machine operations: filling and spreading, fine and rough leveling, wetting and compaction of locally excavated material. Measurement unit is m ³	m ³	1,110.72	314.29	349,088.19
07.19.02.04.	3.4.1.1	Embankment slope topsoiling This item includes embankment topsoiling above the filter filling in 15 cm thick layer Measurement unit is m ²	m ²	507.30	70.97	36,003.08
TOTAL EARTH WORKS:						385,091.27
07.19.03.		CONCRETE WORKS				
07.19.03.01.	11.1.2	Construction of retaining walls Price includes concreting of retaining walls ring by ring with MB30, V4, M150 reinforced concrete, fully in accordance with designed details. Measurement unit is m ³	m ³	1,957.11	9,884.79	19,345,621.36
07.19.03.02.	11.1.2	Construction of concrete cap on the wall This item includes construction of cap of MB 30 plain concrete, fully in accordance with designed detail. Measurement unit is m ³	m ³	72.09	10,454.37	753,655.53
TOTAL CONCRETE WORKS:						20,099,276.89

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.19.04. 07.19.04.01	11.1.3	REINFORCEMENT WORKS RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works. Measurement unit is kg.	kg	64,694.39	70.97	4,591,360.86
TOTAL REINFORCEMENT WORKS:						4,591,360.86
07.19.05. 07.19.05.01	11.1.4	SUNDRIES Placing of drainage filter This item includes placing of gravel filter behind the wall including procurement and transport, fully as designed. Measurement unit is m ³ .	m ³	568.71	1,013.82	576,569.57
07.19.05.02	11.1	Plastic pipes 1100 mm for weepholes Price includes procurement and laying of 1100 mm plastic pipes for weepholes including all related works. Measurement unit is m.	m	107.00	425.81	45,561.67
TOTAL SUNDRIES:						622,131.24

07.19. SUMMARY Retaining wall 19-leftwards, from km 883+250 to km 883+515, L=267m						
07.19.01	PRELIMINARY WORKS					811,059.56
07.19.02	EARTH WORKS					385,091.27
07.19.03	CONCRETE WORKS					20,099,276.89
07.19.04	REINFORCEMENT WORKS					4,591,360.86
07.19.05	SUNDRIES					622,131.24
TOTAL Retaining wall 19-leftwards, from km 883+250 to km 883+515, L=267m (07.19.):						26,508,919.82

**07.20. Supporting structure of reinforced earth 20
in the central reserve from km 883+582,42 to km 883+685,14 L=102,60 m**

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.20.06. 07.20.06.01	2.4.1	PRELIMINARY WORKS PRELIMINARY WORKS Works shall be paid in a lump sum	lump sum		314,285.58	314,285.58
TOTAL PRELIMINARY WORKS:						314,285.58
07.20.07. 07.20.07.01	3.1.1	EARTH WORKS Topsoil stripping This item includes stripping of 20 cm thick topsoil layer and stockpiling of material on the site. Measurement unit is m ² . Measurement is made in the LOT 2 Civil engineering design.	m ²			
07.20.07.02	11.1.1	Excavation of earth Price includes excavation of II and III category earth, loading and transport of surplus material to stockpiling area specified by the Engineer. Measurement unit is m ³ . Measurement is made in the LOT 2 Civil engineering design.	m ³			
TOTAL EARTH WORKS:						
07.20.08. 07.20.08.01	11.1.2	CONCRETE WORKS Construction of foundation with MB20 plain concrete This item includes procurement, transport of necessary material, work on concrete mixing and placing, quality proof and other related works. Measurement unit is m ³ .	m ³	12.93	8,516.12	110,113.43
07.20.08.02	11.1.2	Construction of top section of retaining wall This item includes concreting of top section of retaining wall with MB 30 concrete, fully in accordance with designed detail. Measurement unit is m ³ .	m ³	37.96	10,454.37	396,847.89
TOTAL CONCRETE WORKS:						506,961.32
07.20.09. 07.20.09.01	11.1.3	REINFORCEMENT WORKS RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works. Measurement unit is kg.	kg	350.00	70.97	24,839.50
TOTAL REINFORCEMENT WORKS:						24,839.50
07.20.10. 07.20.10.01	07.20.10.01	WORKS WITH GEOSYNTHETIC MATERIALS Placing of geogrids This item includes procurement, cutting and placing of geogrids as designed. Measurement unit is m ² a) geogrid M1 with T _{dop} = 8,21KN/m	m ²	1,295.00	309.68	401,055.60
07.20.10.02	07.20.10.02	a) geogrid M2 with T _{dop} = 18,14KN/m Procurement and installation of connectors. This item includes procurement and installation of polyethylene connectors to connect geogrids and concrete blocks. Measurement unit is m.	m ²	1,750.00	400.92	701,610.00
			m	1,015.00	70.97	72,034.55
TOTAL WORKS WITH GEOSYNTHETIC MATERIALS						1,174,680.15
07.20.11. 07.20.11.01	8.3.6	MASONRY WORKS Building wall face of concrete blocks This item includes procurement, transport and building wall face of concrete blocks MB30, V4, M150, 40x 15x22 m size. Measurement unit is piece	pcs	6,325.00	274.65	1,737,161.25
TOTAL MASONRY WORKS:						1,737,161.25

07.20. SUMMARY Supporting structure of reinforced earth 20 -in the central reserve, from km 883+582.42 to km 883+685.14, L=102,60m		
07.20.06	PRELIMINARY WORKS	314,285.58
07.20.07	EARTH WORKS	
07.20.08	CONCRETE WORKS	506,961.32
07.20.09	REINFORCEMENT WORKS	24,839.50
07.20.10	WORKS WITH GEOSYNTHETIC MATERIALS	1,174,680.15
07.20.11	MASONRY WORKS	1,737,161.25
TOTAL Supporting structure of reinforced earth 20 -in the central reserve, from km 883+582.42 to km 883+685.14,		3,757,927.80

07.21. Supporting structure of reinforced earth 21 rightwards,
from km 883+591.72 to km 883+810 L=220 m

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.21.06.		PRELIMINARY WORKS				
07.21.06.01	2.4.1	PRELIMINARY WORKS Works shall be paid in a lump sum.	lump sum		669,124.13	669,124.13
TOTAL PRELIMINARY WORKS:						
669,124.13						
07.18.07.		EARTH WORKS				
07.21.07.01	3.1.1	Topsoil stripping This item includes stripping of 20 cm thick topsoil layer and stockpiling of material on the site Measurement unit is m ² Measurement is made in the LOT 2 Civil engineering design	m ²			
07.21.07.02	1.1.1	Excavation of earth Price includes excavation of II and III category earth, loading and transport of surplus material to stockpiling area specified by the Engineer. Measurement unit is m ³ Measurement is made in the LOT 2 Civil engineering design	m ³			
07.21.07.03	07.21.07.03	Construction of embankment This item includes construction of earth embankment with min. 30% of 0-125 mm stone fractions Measurement unit is m ³	m ³	26,850.00	320.73	8,611,600.50
TOTAL EARTH WORKS:						
8,611,600.50						
07.21.08.		CONCRETE WORKS				
07.21.08.01	1.1.2	Construction of foundation with MB20 plain concrete This item includes procurement, transport of necessary material, work on concrete mixing and placing, quality proof and other related works Measurement unit is m ³	m ³	27.72	8,516.12	236,066.85
07.21.08.02	1.1.2	Construction of top section of retaining wall This item includes concreting of top section of retaining wall with MB 30 concrete, fully in accordance with designed detail Measurement unit is m ³	m ³	13.20	10,454.37	137,997.68
TOTAL CONCRETE WORKS:						
374,064.53						
07.21.09.		REINFORCEMENT WORKS				
07.21.09.01	1.1.3	RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works. Measurement unit is kg	kg	760.00	70.97	53,937.20
TOTAL REINFORCEMENT WORKS:						
53,937.20						
07.21.10.		WORKS WITH GEOSYNTHETIC MATERIALS				
07.21.10.01	07.21.10.01	Placing of geogrids This item includes procurement, cutting and placing of geogrids as designed Measurement unit is m ² a) geogrid M1 with Tdop= 8,21KN/m	m ²	6,480.00	309.68	2,006,726.40
07.21.10.02	07.21.10.02	a) geogrid M2 with Tdop= 18,14KN/m Procurement and installation of connectors This item includes procurement and installation of polyethylene connectors to connect geogrids and concrete blocks. Measurement unit is m ¹	m ¹	7,840.00	400.92	3,143,212.80
TOTAL SUNDRIES:						
5,384,140.20						
07.21.11.		MASONRY WORKS				
07.21.11.01	8.3.6	Building wall face of concrete blocks This item includes procurement, transport and building wall face of concrete blocks MB30, V4, M150, 40x 15x22 in size Measurement unit is piece	pcs	18,270.00	274.65	5,017,855.50
TOTAL MASONRY WORKS:						
5,017,855.50						

07.21. SUMMARY Supporting structure of reinforced earth 21 -rightwards, from km 883+591.72 to km 883+810, L=220m		
07.21.06	PRELIMINARY WORKS	669,124.13
07.21.07	EARTH WORKS	8,611,600.50
07.21.08	CONCRETE WORKS	374,064.53
07.21.09	REINFORCEMENT WORKS	53,937.20
07.21.10	WORKS WITH GEOSYNTHETIC MATERIALS	5,384,140.20
07.21.11	MASONRY WORKS	5,017,855.50
TOTAL Supporting structure of reinforced earth 21 -rightwards, from km 883+591.72 to km 883+810, L=220m(07.21.):		20,110,722.06

07.22. Supporting structure made of walls and piles - 22 leftwards, stone walls- from km 883+630 to km 883+725 and from km 883+868,74 to km 883+896,59 L=95,21+28,55 =123,76 m

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.22.01.		PRELIMINARY WORKS				
07.22.01.01.	2.4.1	PRELIMINARY WORKS Works shall be paid in a lump sum	lump sum		385,253.10	385,253.10
TOTAL PRELIMINARY WORKS:						385,253.10
07.22.02.		EARTH WORKS				
07.22.02.01.	3.1.1	Topsoil stripping This item includes stripping of 20 cm thick topsoil layer and stockpiling of material on the site Measurement unit is m ² Measurement is made in the LOT 2 Civil engineering design	m ²			
07.22.02.02.	11.1.1	Excavation of earth for walls Price includes excavation of III and IV category earth, loading and transport of surplus material to stockpiling area specified by the Engineer Measurement unit is m ³ Measurement is made in the LOT 2 Civil engineering design	m ³			
TOTAL EARTH WORKS						
07.22.03.		CONCRETE WORKS				
07.22.03.01.	11.1.2	Construction of concrete cap Price includes construction of reinforced concrete cap ring by ring, fully in accordance with designed details. Measurement unit is m ³	m ³	48.27	10,454.37	504,632.44
07.22.03.02.	11.1.2	Construction of concrete wall foundation This item includes concreting of wall foundation with MB 30 plain concrete. d=50 cm Measurement unit is m ³	m ³	103.96	9,124.42	948,574.70
TOTAL CONCRETE WORKS						1,453,207.14
07.22.04.		MASONRY WORKS				
07.22.04.01.	07.22.04.01.	Construction of stone wall Price includes construction of stone wall of 20-40 cm fractions in cement mortar, fully in accordance with designed details. Measurement unit is m ³	m ³	650.00	1,885.72	1,225,718.00
TOTAL MASONRY WORKS						1,225,718.00
07.22.05.		REINFORCEMENT WORKS				
07.22.05.01.	11.1.3	RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works Measurement unit is kg	kg	2,345.00	70.97	166,424.65
TOTAL REINFORCEMENT WORKS						166,424.65
07.22.06.		SUNDRIES				
07.22.06.01.	11.1	Plastic pipes 110 mm for weepholes Price includes procurement and laying of 110 mm plastic pipes for weepholes including all related works Measurement unit is m ¹	m	60.00	425.81	25,548.60
TOTAL SUNDRIES						25,548.60
07.22. SUMMARY Supporting structure made of walls and piles 22, stone walls from km 883+630 to km 883+725 and from km 883+868,74 to km 883+896,59, L=95,21+28,55=123,76m						
07.22.01		PRELIMINARY WORKS				385,253.10
07.22.02		EARTH WORKS				
07.22.03		CONCRETE WORKS				1,453,207.14
07.22.04		MASONRY WORKS				1,225,718.00
07.22.05		REINFORCEMENT WORKS				166,424.65
07.22.06		SUNDRIES				25,548.60
TOTAL Supporting structure of walls and piles 22, stone walls from km 883+630 to km 883+725 and from km 883+868,74 to km 883+896,59, L=95,21+28,55=123,76m (07.22.):						3,256,151.49

07.22. Supporting structure made of walls and piles - 22 and piles from km 883+725 to km 883+868,74 L=146,70 m

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.22.12.		PRELIMINARY WORKS				
07.22.12.01.	2.4.1	PRELIMINARY WORKS Works shall be paid in a lump sum	lump sum		446,361.76	446,361.76
TOTAL PRELIMINARY WORKS:						446,361.76
Supporting structure MADE OF PILES						
07.22.13.		CONCRETE WORKS				
07.22.13.01.	11.1.7	Casting Ø 100 cm piles of MB30 reinforced concrete, RA 400/500 - 2 Price includes all works and materials required for concreting of piles. Reinforcement shall be paid separately.				
		a) long piles l=11m, (12pcs.)	m ³	103.62	20,172.34	2,090,257.87
		b) long piles l=10m, (54pcs.)	m ³	423.90	20,172.34	8,551,054.93
		c) long piles l=9.5m, (1pcs.)	m ³	7.46	20,172.34	150,485.66
		d) long piles l=9m, (1pcs.)	m ³	7.06	20,172.34	142,416.72
		e) long piles l=8.5m, (2pcs.)	m ³	6.67	20,172.34	134,549.51
		f) long piles l=8m, (1pcs.)	m ³	6.28	20,172.34	126,682.30
		g) long piles l=7.5m, (1pcs.)	m ³	5.89	20,172.34	118,815.08
		h) long piles l=7m, (1pcs.)	m ³	5.50	20,172.34	110,947.87
		Measurement unit is m ³ .				

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.22.13.02	11.1.8	Casting pile cap of MB30 reinforced concrete Price includes all works and materials required for concreting of pile cap Reinforcement shall be paid separately. Measurement unit is m ³ .	m ³	125.87	10,454.37	1,315,891.55
07.22.13.03	11.2	Making drainage filling of single-size aggregate concrete Measurement unit is m ³ .	m ³	273.00	1,013.82	276,772.86
07.22.13.04	11.1.2	Casting reinforced concrete carcass of MB30 and MA 500/560 concrete Measurement unit is m ³ .	m ³	153.92	32,442.38	4,993,531.13
TOTAL CONCRETE WORKS:						18,011,405.47
REINFORCEMENT WORKS						
07.22.14.01	11.1.7	Pile reinforcement a) RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works. Measurement unit is kg.	kg	69,346.00	70.97	4,921,485.62
07.22.14.02	11.1.8	Pile cap reinforcement a) RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works. Measurement unit is kg.	kg	5,478.00	70.97	388,773.66
07.22.14.03	11.1.3	RC carcass reinforcement a) MAG 500/560 mesh reinforcement Price includes procurement, cutting, bending and fixing of all necessary material including all related works. Measurement unit is kg.	kg	1,916.00	81.11	155,406.76
07.22.14.04	11.1.3	a) RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works. Measurement unit is kg.	kg	1,443.00	70.97	102,409.71
TOTAL REINFORCEMENT WORKS:						5,568,075.75
SUNDRIES						
07.22.15.01	11.5	Installation of active prestressed anchors, l ^a =17.0 m. Anchors consist of Ø16 mm three-wire cables. Strength of one anchor: Stač=442 kN. Price includes cable formation, drilling Ø16 mm holes, installation of anchors, grouting all phases, prestressing of anchors and formation of protection cap. Price also includes manufacture of experimental anchors which quantity shall be 3% of the total number of Measurement unit is piece	piece	37.00	429,456.03	15,889,873.11
TOTAL SUNDRIES:						15,889,873.11
07.22. SUMMARY Supporting structure made of walls and piles - 22 -leftwards, piles from km 883+725 to km 883+868.74, L=146,70m						
07.05.12. PRELIMINARY WORKS						446,361.76
07.05.13. CONCRETE WORKS						18,011,405.47
07.05.14. REINFORCEMENT WORKS						5,568,075.75
07.05.15. SUNDRIES						15,889,873.11
TOTAL Supporting structure made of walls and piles - 22 -leftwards, unnoosand from km 883+725 to km 883+868.74, L=146,70m(07.22.):						39,915,716.09

07.23. Retaining wall 23 in the central reserve

from km 883+685.14 to km 884+570.00 L=886 m

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.23.01.	2.4.1	PRELIMINARY WORKS				
07.23.01.01		PRELIMINARY WORKS Works shall be paid in a lump sum	lump sum		2,737,326.02	2,737,326.02
TOTAL PRELIMINARY WORKS:						2,737,326.02
EARTH WORKS						
07.23.02.01	3.1.1	Topsoil stripping This item includes stripping of 20 cm thick topsoil layer and stockpiling of material on the site. Measurement unit is m ² .	m ²			
07.23.02.02	11.1.1	Excavation of earth for walls Price includes excavation of III and IV category earth, loading and transport of surplus material to stockpiling area specified by the Engineer. Measurement unit is m ³ Measurement is made in the LOT 2 Civil engineering design	m ³			
TOTAL EARTH WORKS:						
CONCRETE WORKS						
07.23.03.01	11.1.2	Construction of concrete cap Price includes construction of reinforced concrete cap ring by ring, fully in accordance with designed details. Measurement unit is m ³	m ³	345.54	10,454.37	3,612,403.01
07.23.03.02	11.1.2	Construction of concrete wall foundation This item includes concreting of wall foundation with MB 30 plain concrete, d=50 cm. Measurement unit is m ³	m ³	762.00	9,124.42	6,952,808.04
TOTAL CONCRETE WORKS:						10,565,211.05

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.23.04. 07.23.04.01	07.23.04.01	MASONRY WORKS Construction of stone wall Price includes construction of stone wall of 20-40 cm fractions in cement mortar, fully in accordance with designed details. Measurement unit is m ³	m ³	3,800.00	1,885.72	7,165,736.00
TOTAL MASONRY WORKS:						7,165,736.00
07.23.05. 07.23.05.01	11.1.3	REINFORCEMENT WORKS RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works Measurement unit is kg	kg	16,700.00	70.97	1,185,199.00
TOTAL REINFORCEMENT WORKS:						1,185,199.00
07.23.06. 07.23.06.01	11.1	SUNDRIES Plastic pipes 1100 mm for weepholes Price includes procurement and laying of 1100 mm plastic pipes for weepholes including all related works Measurement unit is m	m	420.00	425.81	178,840.20
TOTAL SUNDRIES:						178,840.20

07.23. SUMMARY Retaining wall 23-in the central reserve from km 883+685.14 to km 884+570.00, L=886m						
07.23.01	PRELIMINARY WORKS					2,737,326.02
07.23.02	EARTH WORKS					
07.23.03	CONCRETE WORKS					10,565,211.05
07.23.04	MASONRY WORKS					7,165,736.00
07.23.05	REINFORCEMENT WORKS					1,185,199.00
07.23.06	SUNDRIES					178,840.20
TOTAL Retaining wall 23-in the central reserve from km 883+685.14 to km 884+570.00, L=886m (07.23.):						21,832,312.27

07.24. Retaining wall 24 leftwards, from km 883+940 to km 884+030 L=92.23 m

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.24.01. 07.24.01.01	2.4.1	PRELIMINARY WORKS PRELIMINARY WORKS Works shall be paid in a lump sum	lump sum		283,870.85	283,870.85
TOTAL PRELIMINARY WORKS:						283,870.85
07.24.02. 07.24.02.01	3.1.1	EARTH WORKS Topsoil stripping This item includes stripping of 20 cm thick topsoil layer and stockpiling of material on the site. Measurement unit is m ² Measurement is made in the LOT 2 Civil engineering design	m ²			
07.24.02.02	11.1.1	Excavation of earth for walls Price includes excavation of III and IV category earth, loading and transport of surplus material to stockpiling area specified by the Engineer. Measurement unit is m ³ Measurement is made in the LOT 2 Civil engineering design	m ³			
TOTAL EARTH WORKS:						
07.24.03. 07.24.03.01	11.1.2	CONCRETE WORKS Construction of concrete cap Price includes construction of reinforced concrete cap ring by ring, fully in accordance with designed details. Measurement unit is m ³	m ³	36.00	10,454.37	376,357.32
07.24.03.02	11.1.2	Construction of concrete wall foundation This item includes concreting of wall foundation with MB 30 plain concrete, d=50 cm. Measurement unit is m ³	m ³	79.50	9,124.42	725,391.39
TOTAL CONCRETE WORKS:						1,101,748.71
07.24.04. 07.24.04.01	07.24.04.01	MASONRY WORKS Construction of stone wall Price includes construction of stone wall of 20-40 cm fractions in cement mortar, fully in accordance with designed details. Measurement unit is m ³	m ³	700.00	1,885.72	1,320,004.00
TOTAL MASONRY WORKS:						1,320,004.00
07.24.05. 07.24.05.01	11.1.3	REINFORCEMENT WORKS RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works Measurement unit is kg	kg	1,750.00	70.97	124,197.50
TOTAL REINFORCEMENT WORKS:						124,197.50
07.24.06. 07.24.06.01	11.1	SUNDRIES Plastic pipes 1100 mm for weepholes Price includes procurement and laying of 1100 mm plastic pipes for weepholes including all related works Measurement unit is m	m	45.00	425.81	19,161.45
TOTAL SUNDRIES:						19,161.45

07.24. SUMMARY Retaining wall 24-in the central reserve from km 883+940 to km 884+030, L=92.23m						
07.24.01	PRELIMINARY WORKS					283,870.85
07.24.02	EARTH WORKS					
07.24.03	CONCRETE WORKS					1,101,748.71
07.24.04	MASONRY WORKS					1,320,004.00
07.24.05	REINFORCEMENT WORKS					124,197.50
07.24.06	SUNDRIES					19,161.45
TOTAL Retaining wall 24-in the central reserve from km 883+940 to km 884+030, L=92.23m (07.24.):						2,848,982.51

07.25. Supporting structure 25 made of piles 25 leftwards
piles from KM 884+265 to km 884+390 L=125,22 m

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.25.12.		PRELIMINARY WORKS				
07.25.12.01.	2.4.1	PRELIMINARY WORKS Works shall be paid in a lump sum	lump sum		385,253.29	385,253.29
TOTAL PRELIMINARY WORKS:						385,253.29
Supporting structure MADE OF PILES						
CONCRETE WORKS						
07.25.13.		CONCRETE WORKS				
07.25.13.01.	11.1.7	Casting Ø 100 cm piles of MB30 reinforced concrete, RA 400/500 - 2 Price includes all works and materials required for concreting of piles. Reinforcement shall be paid separately. a) long piles l=8m, (63pcs) Measurement unit is m ³	m ³	395.64	20,234.10	8,005,419.32
07.25.13.02.	11.1.8	Casting pile cap of MB30 reinforced concrete Price includes all works and materials required for concreting of pile cap. Reinforcement shall be paid separately. Measurement unit is m ³	m ³	130.23	10,454.37	1,361,472.61
07.25.13.03.	11.2	Making drainage filling of single-size aggregate concrete Measurement unit is m ³	m ³	220.00	1,013.82	223,040.40
07.25.13.04.	11.1.2	Casting reinforced concrete carcass of MB30 and MA 500/560 concrete Measurement unit is m ³	m ³	96.86	32,442.38	3,142,368.93
TOTAL CONCRETE WORKS:						12,732,301.26
REINFORCEMENT WORKS						
07.25.14.		REINFORCEMENT WORKS				
07.25.14.01.	11.1.7	Pile reinforcement a) RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works Measurement unit is kg	kg	48,500.00	70.97	3,442,045.00
07.25.14.02.	11.1.8	Pile cap reinforcement a) RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works Measurement unit is kg	kg	4,310.00	70.97	305,880.70
07.25.14.03.	11.1.3	RC carcass reinforcement a) MAG 500/560 mesh reinforcement Price includes procurement, cutting, bending and fixing of all necessary material including all related works Measurement unit is kg	kg	1,392.00	81.11	112,905.12
07.25.14.04.	11.1.3	a) RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works Measurement unit is kg	kg	1,245.00	70.97	88,357.65
TOTAL REINFORCEMENT WORKS:						3,949,188.47
SUNDRIES						
07.25.15.		SUNDRIES				
07.25.15.01.	11.1.5	Installation of active prestressed anchors, la=17.0 m. Anchors consist of Ø16 mm three-wire cables. Strength of one anchor: Srač=442 kN Price includes cable formation, drilling Ø16 mm holes, installation of anchors, grouting all phases, prestressing of anchors and formation of protection cap. Price also includes manufacture of experimental anchors which quantity shall be 3% of the total number of Measurement unit is piece	piece	32.00	438,580.46	14,034,574.72
TOTAL SUNDRIES:						14,034,574.72

07.25. SUMMARY Supporting structure made of piles 25 -leftwards, piles from km 884+265 to km 884+390, L=125,22m

07.25.12. PRELIMINARY WORKS	385,253.29
07.25.13. CONCRETE WORKS	12,732,301.26
07.25.14. REINFORCEMENT WORKS	3,949,188.47
07.25.15. SUNDRIES	14,034,574.72

TOTAL Supporting structure made of piles - 25 -leftwards, piles from km 884+265 to km 884+390, L=125,22m(07.25.):

31,101,317.74

07.26. Retaining wall 26 leftwards, from km 884+725 to km 884+846 L=120,05 m

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.26.01.		PRELIMINARY WORKS				
07.26.01.01.	2.4.1	PRELIMINARY WORKS Works shall be paid in a lump sum	lump sum		364,976.80	364,976.80
TOTAL PRELIMINARY WORKS:						364,976.80

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
EARTH WORKS						
07.26.02.	3.1.1	Topsoil stripping This item includes stripping of 20 cm thick topsoil layer and stockpiling of material on the site. Measurement unit is m ² . Measurement is made in the LOT 2 Civil engineering design.	m ²			
07.26.02.02.	11.1.1	Excavation of earth for walls Price includes excavation of III and IV category earth, loading and transport of surplus material to stockpiling area specified by the Engineer. Measurement unit is m ³ . Measurement is made in the LOT 2 Civil engineering design.	m ³			
07.26.02.03.	3.4.1.4	Filling and compaction Price includes the following machine operations: filling and spreading, fine and rough leveling, wetting and compaction of locally excavated material. Measurement unit is m ³ .	m ³	600.25	314.29	188,652.37
07.26.02.04.	3.4.1.1	Embankment slope topsoiling This item includes embankment topsoiling above the filter filling in 15 cm thick layer. Measurement unit is m ² .	m ²	720.00	70.97	51,098.40
TOTAL EARTH WORKS:						239,750.97
CONCRETE WORKS						
07.26.03.	11.1.2	Construction of retaining walls Price includes concreting of retaining walls ring by ring with MB30, V4, M150 reinforced concrete, fully in accordance with designed details. Measurement unit is m ³ .	m ³	1,075.00	9,884.79	10,626,149.25
TOTAL CONCRETE WORKS:						10,626,149.25
REINFORCEMENT WORKS						
07.26.04.	11.1.3	RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works. Measurement unit is kg.	kg	38,079.00	70.97	2,702,466.63
TOTAL REINFORCEMENT WORKS:						2,702,466.63
SUNDRIES						
07.26.05.01.	11.1.4	Placing of drainage filter This item includes placing of gravel filter behind the wall including procurement and transport, fully as designed. Measurement unit is m ³ .	m ³	370.00	1,013.82	375,113.40
07.26.05.02.	11.1	Plastic pipes ϕ 100 mm for weepholes Price includes procurement and laying of ϕ 100 mm plastic pipes for weepholes including all related works. Measurement unit is m.	m	48.00	425.81	20,438.88
TOTAL SUNDRIES:						395,552.28

07.26. SUMMARY Retaining wall 26-leftwards, from km 884+725 to km 884+846, L=120.05m						
07.26.01. PRELIMINARY WORKS						364,976.80
07.26.02. EARTH WORKS						239,750.97
07.26.03. CONCRETE WORKS						10,626,149.25
07.26.04. REINFORCEMENT WORKS						2,702,466.63
07.26.05. SUNDRIES						395,552.28
TOTAL Retaining wall 26-leftwards, from km 884+725 to km 884+846, L=120.05m(07.26.):						14,328,895.93

07.M1. Retaining wall M1 leftwards, from km 0+414 to km 0+554 (following the M1 detour centerline)
L=140.87 m

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
PRELIMINARY WORKS						
07.M1.01.	2.4.1	PRELIMINARY WORKS Works shall be paid in a lump sum.	lump sum		435,944.51	435,944.51
TOTAL PRELIMINARY WORKS:						435,944.51
EARTH WORKS						
07.M1.02.	3.1.1	Topsoil stripping This item includes stripping of 20 cm thick topsoil layer and stockpiling of material on the site. Measurement unit is m ² . Measurement is made in the LOT 2 Civil engineering design.	m ²			
07.M1.02.02.	11.1.1	Excavation of earth for walls Price includes excavation of III and IV category earth, loading and transport of surplus material to stockpiling area specified by the Engineer. Measurement unit is m ³ . Measurement is made in the LOT 2 Civil engineering design.	m ³			
07.M1.02.03.	3.4.1.4	Filling and compaction Price includes the following machine operations: filling and spreading, fine and rough leveling, wetting and compaction of locally excavated material. Measurement unit is m ³ .	m ³	565.00	314.29	177,573.85
07.M1.02.04.	3.4.1.1	Embankment slope topsoiling This item includes embankment topsoiling above the filter filling in 15 cm thick layer. Measurement unit is m ² .	m ²	1,735.00	70.97	123,132.95
TOTAL EARTH WORKS:						300,706.80

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.M1.03.	11.1.2	CONCRETE WORKS Construction of retaining walls Price includes concreting of retaining walls ring by ring with MB30, V4, M150 reinforced concrete, fully in accordance with designed details Measurement unit is m ³	m ³	1,183.00	9,884.79	11,693,706.57
TOTAL CONCRETE WORKS:						11,693,706.57
10.M1.04.	11.1.3	REINFORCEMENT WORKS RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works Measurement unit is kg	kg	39,755.00	70.97	2,821,412.35
TOTAL REINFORCEMENT WORKS:						2,821,412.35
07.M1.05.	11.1.4	SUNDRIES Placing of drainage filter This item includes placing of gravel filter behind the wall including procurement and transport, fully as designed. Measurement unit is m ³ .	m ³	435.00	1,013.82	441,011.70
07.M1.05.02	11.1	Plastic pipes ϕ 100 mm for weepholes Price includes procurement and laying of ϕ 100 mm plastic pipes for weepholes including all related works. Measurement unit is m.	m	56.50	425.81	24,058.27
TOTAL SUNDRIES:						465,069.97

07.M1 SUMMARY Retaining wall M1-leftwards, from km 0+414 to km 0+554(following the M1 detour centerline), L=140.87m						
07.M1.01.		PRELIMINARY WORKS				435,944.51
07.M1.02.		EARTH WORKS				300,706.80
07.M1.03.		CONCRETE WORKS				11,693,706.57
07.M1.04.		REINFORCEMENT WORKS				2,821,412.35
07.M1.05.		SUNDRIES				465,069.97
TOTAL Retaining wall M1-leftwards, from km 0+414 to km 0+554(following the M1 detour centerline),						15,716,840.20

07.M2. Supporting structure of reinforced earth M2 rightwards, from km 0+565.38 to km 0+604.10 (following the M1 detour centerline) L=38.40 m

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.M2.06.	2.4.1	PRELIMINARY WORKS PRELIMINARY WORKS Works shall be paid in a lump sum.	lump sum		121,658.93	121,658.93
TOTAL PRELIMINARY WORKS:						121,658.93
07.M2.07.	3.1.1	EARTH WORKS Topsoil stripping This item includes stripping of 20 cm thick topsoil layer and stockpiling of material on the site Measurement unit is m ² Measurement is made in the LOT 2 Civil engineering design	m ²			
07.M2.07.02	11.1.1	Excavation of earth Price includes excavation of II and III category earth, loading and transport of surplus material to stockpiling area specified by the Engineer. Measurement unit is m ³ Measurement is made in the LOT 2 Civil engineering design	m ³			
07.M2.07.03	07.M2.07.03.	Construction of embankment This item includes construction of earth embankment with min. 30% of 0-125 mm stone fractions. Measurement unit is m ³	m ³	1,520.00	320.73	487,509.60
TOTAL EARTH WORKS:						487,509.60
07.M2.08.	11.1.2	CONCRETE WORKS Construction of foundation with MB20 plain concrete This item includes procurement, transport of necessary material, work on concrete mixing and placing, quality proof and other related works Measurement unit is m ³	m ³	4.88	8,516.12	41,558.67
07.M2.08.02	11.1.2	Construction of top section of retaining wall This item includes concreting of top section of retaining wall with MB 30 concrete, fully in accordance with designed detail. Measurement unit is m ³	m ³	2.30	10,454.37	24,045.05
TOTAL CONCRETE WORKS:						65,603.72
07.M2.09.	11.1.3	REINFORCEMENT WORKS RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works. Measurement unit is kg	kg	130.00	70.97	9,226.10
TOTAL REINFORCEMENT WORKS:						9,226.10
07.M2.10.	07.M2.10.01	WORKS WITH GEOSYNTHETIC MATERIALS Placing of geogrids This item includes procurement, cutting and placing of geogrids as designed. Measurement unit is m ² a) geogrid M1 with T _{dop} = 8,21KN/m a) geogrid M2 with T _{dop} = 18,14KN/m	m ²	560.00	309.68	173,420.80
			m ²	1,590.00	400.92	637,462.80

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.M2.10.02	07.M2.10.02	Procurement and installation of connectors This item includes procurement and installation of polyethylene connectors to connect georids and concrete blocks. Measurement unit is m	m	540.00	70.97	38,323.80
TOTAL WORKS WITH GEOSYNTHETIC MATERIALS :						849,207.40
07.M2.11. 07.M2.11.01	8.3.6	MASONRY WORKS Building wall face of concrete blocks This item includes procurement, transport and building wall face of concrete blocks MB30, V4, M150. 40x 15x22 in size. Measurement unit is piece	pcs	4,180.00	274.65	1,148,037.00
TOTAL MASONRY WORKS:						1,148,037.00

07.M2. SUMMARY Supporting structure of reinforced earth M2 -rightwards, from km 0+565.38 to km 0+604.10(following the M1 detour centerline).						
07.M2.06.	PRELIMINARY WORKS					121,658.93
07.M2.07.	EARTH WORKS					487,509.60
07.M2.08.	CONCRETE WORKS					65,603.72
07.M2.09.	REINFORCEMENT WORKS					9,276.10
07.M2.10.	WORKS WITH GEOSYNTHETIC MATERIALS					849,207.40
07.M2.11.	MASONRY WORKS					1,148,037.00
TOTAL Supporting structure of reinforced earth M2 -rightwards, from km 0+565.38 to km 0+604.10(following the M1 detour centerline), L=38.40m(07.M2):						2,681,242.75

07.M3. Retaining wall M3 leftwards, from km 0+606 to km 0+635.72 (following the M1 detour centerline)
L=30 m

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.M3.01. 07.M3.01.01	2.4.1	PRELIMINARY WORKS PRELIMINARY WORKS Works shall be paid in a lump sum	lump sum		91,244.20	91,244.20
TOTAL PRELIMINARY WORKS:						91,244.20
07.M3.02. 07.M3.02.01	3.1.1	EARTH WORKS Topsoil stripping This item includes stripping of 20 cm thick topsoil layer and stockpiling of material on the site. Measurement unit is m ² Measurement is made in the LOT 2 Civil engineering design.	m ²			
07.M3.02.02	11.1.1	Excavation of earth for walls Price includes excavation of III and IV category earth, loading and transport of surplus material to stockpiling area specified by the Engineer. Measurement unit is m ³ Measurement is made in the LOT 2 Civil engineering design.	m ³			
07.M3.02.03	3.4.1.4	Filling and compaction Price includes the following machine operations filling and spreading, fine and rough leveling, wetting and compaction of locally excavated material. Measurement unit is m ³	m ³	125.00	314.20	39,286.25
07.M3.02.04	3.4.1.1	Embankment slope topsoiling. This item includes embankment topsoiling above the filter filling in 15 cm thick layer Measurement unit is m ²	m ²	310.00	70.97	22,000.70
TOTAL EARTH WORKS:						61,286.95
07.M3.03. 07.M3.03.01	11.1.2	CONCRETE WORKS Construction of retaining walls Price includes concreting of retaining walls ring by ring with MB30, V4, M150 reinforced concrete, fully in accordance with designed details. Measurement unit is m ³	m ³	158.70	9,884.79	1,568,716.17
TOTAL CONCRETE WORKS:						1,568,716.17
07.M3.04. 07.M3.04.01	11.1.3	REINFORCEMENT WORKS RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works. Measurement unit is kg	kg	5,118.00	70.97	363,224.46
TOTAL REINFORCEMENT WORKS:						363,224.46
07.M3.05. 07.M3.05.02	11.1	SUNDRIES Plastic pipes 1100 mm for weepholes Price includes procurement and laying of 1100 mm plastic pipes for weepholes including all related works. Measurement unit is m	m	12.00	425.81	5,109.72
TOTAL SUNDRIES:						5,109.72

07.M3 SUMMARY Retaining wall M3-leftwards, from km 0+606 to km 0+635.72(following the M1 detour centerline), L=30m						
07.M3.01	PRELIMINARY WORKS					91,244.20
07.M3.02	EARTH WORKS					61,286.95
07.M3.03	CONCRETE WORKS					1,568,716.17
07.M3.04	REINFORCEMENT WORKS					363,224.46
07.M3.05	SUNDRIES					5,109.72
TOTAL Retaining wall M3-leftwards, from km 0+606 to km 0+635.72(following the M1 detour centerline),						2,089,581.50



07.M4. Retaining wall M4 leftwards, from km 0+675 to km 0+748 (following the M1 detour centerline) L=73,67 m						
Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.M4.01.		PRELIMINARY WORKS				
07.M4.01.01.	2.4.1	PRELIMINARY WORKS Works shall be paid in a lump sum.	lump sum		233,179.62	233,179.62
TOTAL PRELIMINARY WORKS:						233,179.62
07.M4.02.		EARTH WORKS				
07.M4.02.01.	3.1.1	Topsoil stripping This item includes stripping of 20 cm thick topsoil layer and stockpiling of material on the site. Measurement unit is m ² Measurement is made in the LOT 2 Civil engineering design.	m ²			
07.M4.02.02.	11.1.1	Excavation of earth for walls Price includes excavation of III and IV category earth, loading and transport of surplus material to stockpiling area specified by the Engineer. Measurement unit is m ³ Measurement is made in the LOT 2 Civil engineering design.	m ³			
07.M4.02.03.	3.4.1.4	Filling and compaction Price includes the following machine operations: filling and spreading, fine and rough leveling, wetting and compaction of locally excavated material. Measurement unit is m ³ .	m ³	300.00	314.29	94,287.00
07.M4.02.04.	3.4.1.1	Embankment slope topsoiling This item includes embankment topsoiling above the filter filling in 15 cm thick layer. Measurement unit is m ² .	m ²	740.00	70.97	52,517.80
TOTAL EARTH WORKS:						146,804.80
07.M4.03.		CONCRETE WORKS				
07.M4.03.01.	11.1.2	Construction of retaining walls Price includes concreting of retaining walls ring by ring with MB30, V4, M150 reinforced concrete, fully in accordance with designed details. Measurement unit is m ³ .	m ³	585.00	9,884.79	5,782,602.15
TOTAL CONCRETE WORKS:						5,782,602.15
07.M4.04.		REINFORCEMENT WORKS				
07.M4.04.01.	11.1.3	RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works. Measurement unit is kg.	kg	15,948.00	70.97	1,131,829.56
TOTAL REINFORCEMENT WORKS:						1,131,829.56
07.M4.05.		SUNDRIES				
07.M4.05.02.	11.1	Plastic pipes f100 mm for weepholes Price includes procurement and laying of f100 mm plastic pipes for weepholes including all related works. Measurement unit is m.	m	29.60	425.81	12,603.98
TOTAL SUNDRIES:						12,603.98
07.M4 SUMMARY Retaining wall M4-leftwards, from km 0+675 to km 0+748(following the M1 detour centerline), L=73,67m						
07.M4.01. PRELIMINARY WORKS						233,179.62
07.M4.02. EARTH WORKS						146,804.80
07.M4.03. CONCRETE WORKS						5,782,602.15
07.M4.04. REINFORCEMENT WORKS						1,131,829.56
07.M4.05. SUNDRIES						12,603.98
TOTAL Retaining wall M4-leftwards, from km 0+675 to km 0+748(following the M1 detour centerline), L=73,67m(07.M4.):						7,307,020.11

07.M5. Retaining wall M5 leftwards, from km 0+875 to km 0+919,78 (following the M1 detour centerline) L=45,14 m						
Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.M5.01.		PRELIMINARY WORKS				
07.M5.01.01.	2.4.1	PRELIMINARY WORKS Works shall be paid in a lump sum.	lump sum		141,935.43	141,935.43
TOTAL PRELIMINARY WORKS:						141,935.43
07.M5.02.		EARTH WORKS				
07.M5.02.01.	3.1.1	Topsoil stripping This item includes stripping of 20 cm thick topsoil layer and stockpiling of material on the site. Measurement unit is m ² . Measurement is made in the LOT 2 Civil engineering design.	m ²			
07.M5.02.02.	11.1.1	Excavation of earth for walls Price includes excavation of III and IV category earth, loading and transport of surplus material to stockpiling area specified by the Engineer. Measurement unit is m ³ . Measurement is made in the LOT 2 Civil engineering design.	m ³			
07.M5.02.03.	3.4.1.4	Filling and compaction Price includes the following machine operations: filling and spreading, fine and rough leveling, wetting and compaction of locally excavated material. Measurement unit is m ³ .	m ³	300.00	314.29	94,287.00
07.M5.02.04.	3.4.1.1	Embankment slope topsoiling This item includes embankment topsoiling above the filter filling in 15 cm thick layer. Measurement unit is m ² .	m ²	205.00	70.97	14,548.85
TOTAL EARTH WORKS:						108,835.85

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Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.M5.03. 07.M5.03.01	11.1.2	CONCRETE WORKS Construction of retaining walls Price includes concreting of retaining walls ring by ring with MB30, V4, M150 reinforced concrete, fully in accordance with designed details. Measurement unit is m ³	m ³	467.00	9,884.79	4,616,196.93
TOTAL CONCRETE WORKS:						4,616,196.93
07.M5.04. 07.M5.04.01	11.1.3	REINFORCEMENT WORKS RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works. Measurement unit is kg	kg	14,330.00	70.97	1,017,000.10
TOTAL REINFORCEMENT WORKS:						1,017,000.10
07.M5.05. 07.M5.05.01	11.1.4	SUNDRIES Placing of drainage filter This item includes placing of gravel filter behind the wall including procurement and transport, fully as designed. Measurement unit is m ³	m ³	165.00	1,013.82	167,280.30
07.M5.05.02	11.1	Plastic pipes ϕ 100 mm for weepholes Price includes procurement and laying of ϕ 100 mm plastic pipes for weepholes including all related works. Measurement unit is m.	m	18.50	425.81	7,877.49
TOTAL SUNDRIES:						175,157.79

07.M5 SUMMARY Retaining wall M5-leftwards, from km 0+875 to km 0+919.78 (following the M1 detour centerline), L=45.14m						
07.M5.01	PRELIMINARY WORKS					141,935.43
07.M5.02	EARTH WORKS					108,835.85
07.M5.03	CONCRETE WORKS					4,616,196.93
07.M5.04	REINFORCEMENT WORKS					1,017,000.10
07.M5.05	SUNDRIES					175,157.79
TOTAL Retaining wall M5-leftwards, from km 0+875 to km 0+919.78 (following the M1 detour centerline), L=45.14m(07.M5.):						6,059,126.10

07.P1. Supporting structure of reinforced earth P1 rightwards,
from km 0+150 to km 0+283.81 (following the centerline of interchange 1) L=135.79 m

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.P1.06. 07.P1.06.01	2.4.1	PRELIMINARY WORKS PRELIMINARY WORKS Works shall be paid in a lump sum	lump sum		415,668.02	415,668.02
TOTAL PRELIMINARY WORKS:						415,668.02
07.P1.07. 07.P1.07.01	3.1.1	EARTH WORKS Topsoil stripping This item includes stripping of 20 cm thick topsoil layer and stockpiling of material on the site. Measurement unit is m ² . Measurement is made in the LOT 2 Civil engineering design	m ²			
07.P1.07.02	11.1.1	Excavation of earth Price includes excavation of II and III category earth, loading and transport of surplus material to stockpiling area specified by the Engineer. Measurement unit is m ³ . Measurement is made in the LOT 2 Civil engineering design	m ³			
07.P1.07.03	07.P1.07.03	Construction of embankment This item includes construction of earth embankment with min. 30% of 0-125 mm stone fractions. Measurement unit is m ³	m ³	33,265.00	320.73	10,669,083.45
TOTAL EARTH WORKS:						10,669,083.45
07.P1.08. 07.P1.08.01	11.1.2	CONCRETE WORKS Construction of foundation with MB20 plain concrete This item includes procurement, transport of necessary material, work on concrete mixing and placing, quality proof and other related works. Measurement unit is m ³	m ³	17.11	8,516.12	145,710.81
07.P1.08.02	11.1.2	Construction of top section of retaining wall This item includes concreting of top section of retaining wall with MB 30 concrete, fully in accordance with designed detail. Measurement unit is m ³	m ³	8.15	10,454.37	85,203.12
TOTAL CONCRETE WORKS:						230,913.93
07.P1.09. 07.P1.09.01	11.1.3	REINFORCEMENT WORKS RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works. Measurement unit is kg	kg	450.00	70.97	31,936.50
TOTAL REINFORCEMENT WORKS:						31,936.50
07.P1.10. 07.P1.10.01	07.P1.10.01	WORKS WITH GEOSYNTHETIC MATERIALS Placing of geogrids This item includes procurement, cutting and placing of geogrids as designed. Measurement unit is m ² a) geogrid M1 with T _{dop} = 8,21KN/m a) geogrid M2 with T _{dop} = 18,14KN/m	m ²	4,505.00	309.68	1,395,108.40
			m ²	5,952.00	400.92	2,386,275.84

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.P1.10.02	07.P1.10.02	Procurement and installation of connectors This item includes procurement and installation of polyethylene connectors to connect geogrids and concrete blocks. Measurement unit is m'	m	2,175.00	70.97	154,359.75
TOTAL WORKS WITH GEOSYNTHETIC MATERIALS :						3,935,743.99
07.P1.11.		MASONRY WORKS				
07.P1.11.01	8.3.6	Building wall face of concrete blocks This item includes procurement, transport and building wall face of concrete blocks MB30, V4, M150, 40x 15x22 in size Measurement unit is piece	pc	13,485.00	274.65	3,703,655.25
TOTAL MASONRY WORKS:						3,703,655.25
07.P1. SUMMARY Supporting structure of reinforced earth P1 -rightwards, from km 0+150 to km 0+283,81(following the centerline of interchange 1), L=135,79m.						
07.P1.06. PRELIMINARY WORKS						415,668.02
07.P1.07. EARTH WORKS						10,669,083.45
07.P1.08. CONCRETE WORKS						230,913.93
07.P1.09. REINFORCEMENT WORKS						31,936.50
07.P1.10. WORKS WITH GEOSYNTHETIC MATERIALS						3,935,743.99
07.P1.11. MASONRY WORKS						3,703,655.25
TOTAL Supporting structure of reinforced earth P1 -rightwards, from km 0+150 to km 0+283,81(following the centerline of interchange 1), L=135,79m(07.P1.):						18,987,001.14

07.P2. Supporting structure of reinforced earth P2 rightwards, from km 0+300.63 (following the centerline of interchange 1) to km 0+125 (following the centerline of the leg3) L=165,20 m

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.P2.06.		PRELIMINARY WORKS				
07.P2.06.01.	2.4.1	PRELIMINARY WORKS Works shall be paid in a lump sum	lump sum		506,911.50	506,911.50
TOTAL PRELIMINARY WORKS:						506,911.50
07.P2.07.		EARTH WORKS				
07PP2.07.01	5.1.1	Topsoil stripping This item includes stripping of 20 cm thick topsoil layer and stockpiling of material on the site. Measurement unit is m ² . Measurement is made in the LOT 2 Civil engineering design	m ²			
07.P2.07.02.	11.1.1	Excavation of earth Price includes excavation of II and III category earth, loading and transport of surplus material to stockpiling area specified by the Engineer. Measurement unit is m ³ . Measurement is made in the LOT 2 Civil engineering design.	m ³			
07.P2.07.03.	07.P2.07.03	Construction of embankment This item includes construction of earth embankment with min. 30% of 0-125 mm stone fractions. Measurement unit is m ³ .	m ³	10,615.00	320.73	3,404,548.95
TOTAL EARTH WORKS:						3,404,548.95
07.P2.08.		CONCRETE WORKS				
07.P2.08.01.	11.1.2	Construction of foundation with MB20 plain concrete This item includes procurement, transport of necessary material, work on concrete mixing and placing, quality proof and other related works. Measurement unit is m ³	m ³	20.82	8,516.12	177,305.62
07.P2.08.02.	11.1.2	Construction of top section of retaining wall This item includes concreting of top section of retaining wall with MB 30 concrete, fully in accordance with designed detail Measurement unit is m ³ .	m ³	9.91	10,454.37	103,602.81
TOTAL CONCRETE WORKS:						280,908.43
07.P2.09.		REINFORCEMENT WORKS				
07.P2.09.01.	11.1.3	RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works. Measurement unit is kg	kg	545.00	70.97	38,678.65
TOTAL REINFORCEMENT WORKS:						38,678.65
07.P2.10.		WORKS WITH GEOSYNTHETIC MATERIALS				
07.P2.10.01.	07.P2.10.01	Placing of geogrids This item includes procurement, cutting and placing of geogrids as designed. Measurement unit is m ² . a) geogrid M1 with Tdop= 8,21KN/m a) geogrid M2 with Tdop= 18,14KN/m	m ²	4,765.00	309.68	1,475,625.20
07.P2.10.02.	07.P2.10.02	Procurement and installation of connectors This item includes procurement and installation of polyethylene connectors to connect geogrids and concrete blocks. Measurement unit is m'	m'	2,586.00	70.97	183,528.42
TOTAL WORKS WITH GEOSYNTHETIC MATERIALS :						3,697,831.82
07.P2.11.		MASONRY WORKS				
07.P2.11.01.	8.3.6	Building wall face of concrete blocks This item includes procurement, transport and building wall face of concrete blocks MB30, V4, M150, 40x 15x22 in size. Measurement unit is piece	pc	15,960.00	274.65	4,383,414.00
TOTAL MASONRY WORKS:						4,383,414.00

07.P2. SUMMARY Supporting structure of reinforced earth P2 -rightwards, from km 0+300,63 (following the centerline of interchange 1) to km 0+125 (following the centerline of the leg 3), L=165,20m		
07.P2.06	PRELIMINARY WORKS	506,911.50
07.P2.07	EARTH WORKS	3,404,548.95
07.P2.08	CONCRETE WORKS	280,908.43
07.P2.09	REINFORCEMENT WORKS	38,678.65
07.P2.10	WORKS WITH GEOSYNTHETIC MATERIALS	3,697,831.82
07.P2.11	MASONRY WORKS	4,383,414.00
TOTAL Supporting structure of reinforced earth P2 -rightwards, from km 0+300,63 (following the centerline of interchange 1) to km 0+125 (following the centerline of the leg 3), L=165,20m(07.P2.):		12,312,293.35

07.K6. Slope K6 rightwards from KM 882+200 to km 882+720

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.K6.01		PRELIMINARY WORKS				
07.K6.01.01	2.4.1	PRELIMINARY WORKS Works shall be paid in a lump sum.	lump sum		1,581,566.14	1,581,566.14
TOTAL PRELIMINARY WORKS:						
07.K6.02		WORKS ON SLOPE PROTECTION				
07.K6.02.01	5.1	Drilling and installation of SN anchor R025 This item includes drilling of f42-44 mm holes, procurement, treatment, installation and grouting of 5 m long SN anchor Rf25, placing the concrete base, installation of steel base plate and tightening the nut Measurement unit is piece	pc	1,288.00	7,539.17	9,710,450.96
07.K6.02.02	5.2	Reinforcement mesh This item includes procurement, transport, cutting and fixing of Q138 reinforcement mesh Measurement unit is kg	kg	10,325.00	78.35	808,963.75
07.K6.02.03	5.3	Placing 5-10 cm thick layer of MMB30 jet concrete This item includes procurement, transport and placing of jet concrete in two layers. Measurement unit is m2	m ²	9,830.00	2,980.65	29,299,789.50
07.K6.02.04	8.3.6.	Installation of prefabricated berm perimeter channel made of MB30 reinforced concrete This item includes procurement, transport and installation of prefabricated perimeter channel Measurement unit is m	m	920.00	22,304.14	20,519,808.80
07.K6.02.05	4.4.6	Laying of drainage half-pipes This item includes procurement, preparation, laying and protection of half-pipes against clogging during jet concreting. Measurement unit is m	m	175.00	811.06	141,935.50
TOTAL WORKS ON SLOPE PROTECTION:						
						60,480,948.51

07.K6. SUMMARY Slope 6 rightwards from km 882+200 to km 882+720

07.K6.01	PRELIMINARY WORKS	1,581,566.14
07.K6.02	WORKS ON SLOPE PROTECTION	60,480,948.51
TOTAL Slope 6 rightwards from km 882+200 to km 882+720(07.K6.):		62,062,514.65

07. SUMMARY - Final design of engineering structures

7.16	Supporting structure of reinforced earth 16 -leftwards, from km 881+332,32 to km 881+450, L=114,81m	11,574,747.52
7.17	Retaining wall 17 -in the central reserve from km 882+203 to km 882+675, L=472m	12,602,789.49
7.18	Supporting structure of reinforced earth 18 -leftwards, from km 882+320 to km 882+480, L=160m	10,105,128.39
7.19	Retaining wall 19-leftwards, from km 883+250 to km 883+515, L=267m	26,508,919.82
7.20	Supporting structure of reinforced earth 20 -in the central reserve from km 883+582,42 to km 883+685,14, L=102,60m	3,757,927.80
7.21	Supporting structure of reinforced earth 21 -rightwards, from km 883+591,72 to km 883+810, L=220m	20,110,722.06
7.22	Supporting structure made of walls and piles - 22, stone walls from km 883+630 to km 883+725 and from km 883+868,74 to km 883+896,59, L=95,21+28,55=123,76m	3,256,151.49
7.22	Supporting structure made of walls and piles - 22 -leftwards, piles from km 883+725 to km 883+868,74, L=146,70m	39,915,716.09
7.23	Retaining wall 23-in the central reserve from km 883+685,14 to km 884+570,00, L=886m	21,832,312.27
7.24	Retaining wall 24-in the central reserve from km 883+940 to km 884+030, L=92,23m	2,848,982.51
7.25	Supporting structure made of piles 25 -leftwards, piles from km 884+265 to km 884+390, L=125,22m	31,101,317.74
7.26	Retaining wall 26-leftwards, from km 884+725 to km 884+846, L=120,05m	14,328,895.93
7.M1	Retaining wall M1-leftwards, from km 0+414 to km 0+554 (following the M1 detour centerline), L=140,87m	15,716,840.20
7.M2	Supporting structure of reinforced earth M2 -rightwards, from km 0+565,38 to km 0+604,10 (following the M1 detour centerline), L=38,40m	2,681,242.75
7.M3	Retaining wall M3-leftwards, from km 0+606 to km 0+635,72 (following the M1 detour centerline), L=30m	2,089,581.50
7.M4	Retaining wall M4-leftwards, from km 0+675 to km 0+748 (following the M1 detour centerline), L=73,67m	7,307,020.11
7.M5	Retaining wall M5-leftwards, from km 0+875 to km 0+919,78 (following the M1 detour centerline), L=45,14m	6,059,126.10
7.P1	Supporting structure of reinforced earth P1 -rightwards, from km 0+150 to km 0+283,81 (following the centerline of interchange 1), L=135,79m	18,987,001.14
7.P2	Supporting structure of reinforced earth P2 -rightwards from km 0+300,63 (following the centerline of interchange 1) to km 0+125 (following the centerline of leg 3), L=165,20m	12,312,293.35
7.K6	Slope 6 rightwards from km 882+200 to km 882+720	62,062,514.65
SUB-TOTAL		325,159,230.89
Unforeseen work (5% of sub-total)		16,257,961.54
TOTAL ENGINEERING STRUCTURES (Σ):		341,417,192.43



08.09. BRIDGE AT km 881+101.843

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.09.01	13.2	EARTH WORKS				
		Excavation for foundations				
08.09.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth				
		- at depth of 0-2 m	m ³	5,378.80	226.73	1,219,535.32
		- at depth of 2-4 m	m ³	2,192.20	297.69	652,596.02
		- at depth of 4-6 m	m ³	2,110.90	368.67	778,225.50
		- at depth over 6 m	m ³	1,920.70	439.63	844,397.34
08.09.01.02	13.2.1	Excavation of foundations in IV category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth				
		- at depth of 4-6 m	m ³	783.70	368.67	288,926.68
		- at depth over 6 m	m ³	6,132.20	439.63	2,695,899.09
08.09.01.03	13.2.2	Extra for excavation of foundations with pumping of 30 lit/min - 120 lit/min water	m ³	9,259.25	439.63	4,070,644.08
08.09.01.04	13.2.3	Excavation of Trenches and Channels Less than 1.5 m Wide and Less than 2.0 m Deep	m ³	91.20	248.85	22,695.12
08.09.01.05	13.2.4	Backfilling of pier foundations with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa Payment per m ³ of compacted earth	m ³	5,707.80	390.78	2,230,494.08
08.09.01.06	13.2.5	Construction of wedge made of well-graded gravel compacted in 30 cm thick layers to modulus of compressibility Ms=40 MPa. It shall be constructed behind the abutments. Payment per m ³ of compacted gravel	m ³	2,815.30	851.62	2,397,565.79
08.09.01.07	13.2.7 additional specifications	Placing the sub-base made of gravel and sand in 30 cm thick layers under foundation including compaction of layers to modulus of compressibility Ms=30 MPa Payment per m ³ of compacted gravel	m ³	164.50	1,078.34	177,386.93
08.09.01.08	13.2.8 additional specifications	Construction of end slope of material from the cutting or borrow pit including mechanical compaction in 30 cm thick layers, fully as designed. Payment per m ³ of compacted material	m ³	647.80	301.38	195,233.96
08.09.01.09	13.2.9 additional specifications	Placing 80 cm thick cover protecting a gravel wedge made of gravel sand where top 30 cm shall be stabilized with cement and bottom 50 cm compacted in two layers to modulus of compressibility Ms=40 MPa. Payment per m ³ of compacted gravel	m ³	353.40	3,193.55	1,128,600.57
08.09.01.10	13.4.2	Construction of Ø120 cm piles with concrete, class MB 30, M-150, V-3. Payment per m ³ of completed pile	m ³	1,126.00	29,993.54	33,772,726.04
TOTAL EARTH WORKS:						50,474,926.52
08.09.02.	13.4	CONCRETE				
		This shall apply to all items. * Concrete shall be mixed mechanically and compacted by vibrating. * Reinforcing bars shall be paid separately, except for bored piles. * Cables shall be paid separately. * The price of concrete includes formwork and scaffold. * Payment per m ³ of placed concrete for completely performed work				
	13.4.1	Plain concrete				
08.09.02.01	13.4.1.1	Foundation of end slope wall made of concrete, class I MB25	m ³	29.70	7,254.38	215,455.09
08.09.02.02	13.4.1.2	Lining of end slopes with concrete plates (60'40'12 cm) MB 40, M-150, V-3	m ²	649.00	1,603.68	1,040,788.32
08.09.02.03	13.4.1.3 additional specifications	Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs	m ³	161.90	6,387.09	1,034,069.87
08.09.02.04	13.4.1.4 additional specifications	Plain concrete for open caissons. Class I MB 20	m ³	116.60	6,861.74	800,078.88
	13.4.3	Reinforced concrete constructions				
08.09.02.05	13.4.3.1	Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 30, M-150, V-6	m ³	2,073.90	9,124.42	18,923,134.64
08.09.02.06	13.4.3.2	Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 45, M-150, V-6	m ³	245.00	8,714.29	2,135,001.05
	13.4.3.2	Piers supporting plain spanning constructions of different systems and bearing beams				
08.09.02.07	13.4.3.2	Abutment bodies constructed of concrete, class II, MB 30, M-150, V-6	m ³	225.50	8,211.98	1,851,801.49
08.09.02.08	13.4.3.2	Abutment wing walls made of concrete, class II, MB 30, M-150, V-6	m ³	127.90	10,265.44	1,312,949.78
08.09.02.09	13.4.3.2	Bearing beams of abutment made of concrete, class II, MB 30, M-150, V-6	m ³	182.70	8,211.98	1,500,328.75
08.09.02.10	13.4.3.2	Abutment parapets constructed of concrete, class II, MB 30, M-150, V-6	m ³	87.50	8,211.98	718,548.25
08.09.02.11	13.4.3.2	Pedestrian cantilever walkway at abutment wing walls constructed of concrete, class II, MB 30, M-150, V-6	m ³	11.00	10,036.86	110,405.46
08.09.02.12	13.4.3.2	Masking covers of abutments and middle piers made of concrete, class II, MB 30, M-150, V-6	m ³	46.00	23,326.25	1,073,007.50

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.09.02.13	13.4.3.2	Middle pier bodies constructed of concrete, class II, MB 30, M-150, V-6.	m ³	1,129.00	9,124.42	10,301,470.18
08.09.02.14	13.4.3.2	Middle pier bodies constructed of concrete, class II, MB 40, M-150, V-6.	m ³	22.10	9,854.37	217,781.58
08.09.02.15	13.4.3.2	Bearing beams of middle piers made of concrete, class II, MB 30, M-150, V-6.	m ³	1,290.10	11,476.49	14,805,819.75
08.09.02.16	13.4.3.2	Abutment and middle pier caps made of concrete, class II, MB 30, M-150, V-6.	m ³	26.50	8,211.98	217,617.47
08.09.02.17	13.4.3.2	Wing walls constructed of reinforced concrete, class II MB 30, M-150, V-6.	m ³	316.60	10,265.44	3,250,038.30
08.09.02.18	13.4.3.3	Spanning bridge construction of reinforced concrete				
08.09.02.19	13.4.3.3	Cross girders made of reinforced concrete, class II, MB 40, M-150, V-6.	m ³	430.64	10,424.88	4,489,370.32
08.09.02.20	13.4.3.3	Bridge deck over prefabricated girders made of reinforced concrete, class II, MB 40, M-150, V-6.	m ³	1,937.28	10,995.39	21,301,149.14
08.09.02.21	13.4.3.4	Cornices at footway level (including inspection manholes) cast in situ Concrete class II MB 40, M-150, V-6.	m ³	409.90	10,766.82	4,413,319.52
08.09.02.22	13.4.3.5	Crossing slabs made of concrete MB 30, M-150, V-6.	m ³	50.00	7,528.10	376,405.00
08.09.02.23	13.4.3.4	Masking covers of cornices at footway level made of concrete, class II, MB 45, M-150, V-8.	m ³	128.80	24,512.44	3,157,202.27
08.09.02.24	13.4.4	Prestressed bridge constructions				
08.09.02.25	13.4.4	Prefabricated main girders made of prestressed concrete, class II MB 50, M-150, V-3.	m ³	1,901.00	15,214.74	28,923,220.74
08.09.02.26	13.4.4	Prestressed box bridge construction cast in situ Concrete class II MB 45, M-150, V-3.	m ³	3,020.00	17,403.68	52,559,113.60
TOTAL CONCRETE WORKS:						174,728,076.94
08.09.03.	13.5	METALWORK				
Reinforcing bars in concrete members and constructions						
* The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed.						
08.09.03.01	13.5.1	Smooth rebars GA 240/360	kg	466.51	63.59	29,665.37
08.09.03.02	13.5.1	Ribbed rebars RA 400/500-2	kg	2,210,378.00	63.59	140,557,937.02
08.09.03.03	13.5.1	Welded mesh reinforcement MAG 500/560	kg	1,069.22	72.81	77,849.65
Metal works in prestressed concrete						
* The price includes procurement, fixing and tensioning.						
08.09.03.04	13.5.2	Patented high-strength prestressing strands with all anchors, base plates and protective tubes for cables.	kg	251,089.32	310.60	77,988,342.79
08.09.03.05	13.6	Expansion joints - procurement and installation as designed MT-100.	m'	26.00	40,880.17	1,062,884.42
08.09.03.06	13.6	Expansion joints - procurement and installation as designed MT-160.	m'	52.00	88,717.01	4,613,284.52
08.09.03.07	13.6	Expansion joints - procurement and installation as designed MT-230.	m'	26.00	163,816.52	4,259,229.52
08.09.03.08	13.7	gullies of cast iron, procurement and installation as designed S-6.	pc	16.00	18,248.84	291,981.44
08.09.03.09	13.7	gullies of cast iron, procurement and installation as designed S-7.	pc	17.00	18,248.84	310,230.28
08.09.03.10	13.7	gullies of cast iron, procurement and installation as designed S-9.	pc	16.00	18,248.84	291,981.44
Steel bridge fences:						
08.09.03.11	13.8.2	- tubular fences or fences made of steel sections	kg	17,946.00	259.91	4,664,344.86
08.09.03.12	13.9	Bridge bearings				
		NGe, Nge, N	pc	18.00	331,065.30	5,959,175.40
		NAL-a, NAL-b, NAL-f, NAL	pc	72.00	76,371.40	5,498,740.80
TOTAL METAL WORK						245,605,647.52
08.09.04.	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES				
This shall apply to all items of finishing works:						
* The price includes procurement, construction and installation as designed.						
08.09.04.01	13.10.1	Concrete or stone curbs along the highway, 13/20 MB 40	m'	1,788.50	1,505.99	2,693,463.12
08.09.04.02	13.10.2	Insulating coat on pavement top	m ²	9,277.30	793.55	7,362,001.42
08.09.04.03	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth.	m ²	3,623.00	383.41	1,389,094.43
08.09.04.04	13.10.4	Bituminous pavement base course, BNHS 16A, 5 cm thick	m ²	8,690.40	481.10	4,180,951.44
08.09.04.05	13.10.4	Pavement wearing course of skeleton mastic asphalt SMA 0/11S, 4cm thick	m ²	8,690.40	623.96	5,422,461.98
08.09.04.06	13.10.5	Trial loading of constructed bridge	lump sum		912,442.01	912,442.01
08.09.04.07	13.10.6	Photographing during bridge construction	lump sum		54,746.52	54,746.52
08.09.04.08	13.10.8	Fitting and sealing joints with elastic bituminous sealing compound (livobit) on asphalt next to curbs and cornices at footway level and next to expansion joints	m'	3,577.00	380.65	1,361,585.05
08.09.04.09	13.11.1	Laying PVC pipes into footways (cat walks), Ø110 mm	m'	2,646.20	483.87	1,280,416.79
08.09.04.10	13.11.2	Epoxy and polyurethane preservative on footways	m ²	2,298.60	584.33	1,343,140.94
08.09.04.11	13.11.8 additional specifications	Construction of cementitious grouting mortar beds	m ²	75.80	538.25	40,799.35
08.09.04.12	13.7.2	Cast iron pipes for gully water discharge including all fixing accessories	m'	210.00	7,697.69	1,616,514.90
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						27,657,617.95

SUMMARY - BRIDGE AT km 881+101.843		
08.09.01	EARTH WORKS	50,474,926.52
08.09.02	CONCRETE	174,728,076.94
08.09.03	METALWORK	245,605,647.52
08.09.04	FINISHING AND SUNDRY WORKS ON BRIDGES	27,657,617.95
TOTAL BRIDGE AT km 881+101.843:		498,466,268.93

08.10. BRIDGE at km 881+705.810

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.10.01.	13.2	EARTH WORKS				
		Excavation for foundations				
08.10.01.01	13.2.1	Excavation of foundations in IV and V category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth - at depth of 0-2 m	m ³	2,108.44	297.69	627,661.50
		- at depth of 2-4 m	m ³	1,557.12	368.67	574,063.43
		- at depth of 4-6 m	m ³	1,329.18	439.63	584,347.40
		- at depth over 6 m	m ³	1,311.87	510.60	669,840.82
08.10.01.02	13.2.2	Extra for excavation of foundations with pumping of 30 lit/min - 120 lit/min water	m ³	1,261.32	439.63	554,514.11
08.10.01.03	13.2.4	Backfilling of pier foundations with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa Payment per m ³ of compacted earth.	m ³	1,145.56	390.78	447,661.94
08.10.01.04	13.2.5	Construction of wedge made of well-graded gravel compacted in 30 cm thick layers to modulus of compressibility Ms=40 MPa. It shall be constructed behind the abutments Payment per m ³ of compacted gravel.	m ³	1,893.01	851.62	1,612,125.18
08.10.01.05	13.2.8 additional specifications	Construction of end slope of material from the cutting or borrow pit including mechanical compaction in 30 cm thick layers, fully as designed. Payment per m ³ of compacted material.	m ³	666.46	301.38	200,857.71
08.10.01.06	13.4.2	Construction of Ø120 cm piles with concrete, class MB 30, M-150, V-3. Payment per m ³ of completed pile.	m ³	168.00	29,993.54	5,038,914.72
TOTAL EARTH WORKS:						10,309,986.82
08.10.02.	13.4	CONCRETE				
		This shall apply to all items: * Concrete shall be mixed mechanically and compacted by vibrating. * Reinforcing bars shall be paid separately, except for bored piles. * Cables shall be paid separately. * The price of concrete includes formwork and scaffold. * Payment per m ³ of placed concrete for completely performed work.				
		13.4.1 Plain concrete				
08.10.02.01	13.4.1.3 additional specifications	Blinding layer, 10 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs	m ³	45.30	6,387.09	289,335.18
08.10.02.02	13.4.1.1	Foundation of end slope wall made of concrete, class I MB25	m ³	5.25	7,254.38	38,085.50
08.10.02.03	13.4.1.2	Lining of end slopes with concrete plates (60'40'12 cm) MB 40, M-150, V-3	m ²	31.00	1,603.68	49,714.08
08.10.02.04	13.4.1.6	Concrete MB20 to fill foundation hole. Filling is done under the water. Payment per m ³ completed job	m ³	1,570.00	6,861.74	10,772,931.80
		13.4.3 Reinforced concrete constructions				
08.10.02.05	13.4.3.1	Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 30, M-150, V-6.	m ³	984.20	9,124.42	8,980,254.16
		13.4.3.2 Piers supporting plain spanning constructions of different systems and bearing beams				
08.10.02.06	13.4.3.2	Abutment bodies constructed of concrete, class II, MB 30, M-150, V-6	m ³	436.10	8,211.98	3,581,244.48
08.10.02.07	13.4.3.2	Abutment wing walls made of concrete, class II, MB 30, M-150, V-6	m ³	52.80	10,265.44	542,015.23
08.10.02.08	13.4.3.2	Bearing beams of abutment made of concrete, class II, MB 30, M-150, V-6	m ³	118.10	8,211.98	969,834.84
08.10.02.09	13.4.3.2	Abutment parapets constructed of concrete, class II, MB 30, M-150, V-6	m ³	101.50	8,211.98	833,515.97
08.10.02.10	13.4.3.2	Pedestrian cantilever walkway at abutment wing walls constructed of concrete, class II, MB 30, M-150, V-6	m ³	8.95	10,036.86	89,829.90
08.10.02.11	13.4.3.2	Masking covers of abutments and middle piers made of concrete, class II, MB 30, M-150, V-6	m ³	7.50	23,326.25	174,946.88
08.10.02.12	13.4.3.2	Middle pier bodies constructed of concrete, class II, MB 30, M-150, V-6	m ³	191.10	9,124.42	1,743,676.66
08.10.02.13	13.4.3.2	Bearing beams and caps of middle piers made of concrete, class II, MB 30, M-150, V-6	m ³	152.20	11,476.49	1,746,721.78
08.10.02.14	13.4.3.2	Wing walls constructed of reinforced concrete, class II MB 30, M-150, V-6	m ³	228.50	10,265.44	2,345,653.04
		13.4.3.3 Spanning bridge construction of reinforced concrete				
08.10.02.15	13.4.3.4	Cornices at footway level (including inspection manholes) cast in situ Concrete class II MB 40, M-150, V-6	m ³	168.10	10,766.82	1,809,902.44
08.10.02.16	13.4.3.4	Crossing slabs made of concrete MB 30, M-150, V-6	m ³	52.70	7,528.10	396,730.87
08.10.02.17	13.4.3.5	Masking covers of cornices at footway level made of concrete, class II, MB 45, M-150, V-8	m ³	55.60	24,512.44	1,362,891.66

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.10.02.19	13.4.4 13.4.4	Prestressed bridge constructions Prestressed box bridge construction cast in situ Concrete class II MB 50, M-150, V-3	m ³	3,988.00	16,241.47	64,770,982.36
TOTAL CONCRETE WORKS:						100,498,266.82
08.10.03.	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed				
08.10.03.01	13.5.1 13.5.2	Ribbed rebars RA 400/500-2	kg	1,179,594.44	63.59	75,010,410.44
		Metal works in prestressed concrete * The price includes procurement, fixing and tensioning:				
08.10.03.02	13.5.2	Patented high-strength prestressing strands with all anchors, base plates and protective tubes for cables	kg	152,000.00	310.60	47,211,200.00
08.10.03.03	13.6	Expansion joints - procurement and installation as designed (drawing No. 33)	m ²	52.20	40,880.17	2,133,944.87
08.10.03.04	13.7	S-7 gullies of cast iron, procurement and installation as designed	pc	20.00	18,248.84	364,976.80
08.10.03.05	13.8.2	- tubular fences or fences made of steel sections	kg	7,863.70	259.91	2,043,854.27
08.10.03.06	13.9	Bridge bearings				
		Nge 450	pc	4.00	197,999.92	791,999.68
		Nga 450	pc	4.00	166,064.45	664,257.80
		Nge 1100	pc	4.00	504,580.43	2,018,321.72
		N 1100	pc	8.00	344,903.08	2,759,224.64
TOTAL METAL WORK						132,998,190.22
08.10.04	13.11	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works: * The price includes procurement, construction and installation as designed				
08.10.04.01	13.10.1	Concrete or stone curbs along the highway, 13/20 MB 40	m ³	382.00	1,505.99	575,288.18
08.10.04.02	13.10.2	Insulating coat on pavement top	m ²	3,714.02	793.55	2,947,260.57
08.10.04.03	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	1,418.00	383.41	543,675.38
08.10.04.04	13.10.4	Bituminous pavement base course, BNHS 16A, 5 cm thick	m ²	3,626.64	481.10	1,744,776.50
08.10.04.05	13.10.4	Pavement wearing course of skeleton mastic asphalt SMA 0/11S, 4cm thick	m ²	3,626.64	623.96	2,262,878.29
08.10.04.06	13.11.2	Epoxy and polyurethane preservative on footways	m ²	973.00	584.33	568,553.09
08.10.04.07	13.10.8	Fitting and sealing joints with elastic bituminous sealing compound ('livobit) on asphalt next to curbs and cornices at footway level and next to expansion joints	m ³	740.25	380.65	281,776.16
08.10.04.08	13.11.1	Laying PVC pipes into footways (cat walks), Ø110 mm	m ³	1,156.00	483.87	559,353.72
08.10.04.09	13.10.5	Trial loading of constructed bridge	lump sum		912,442.01	912,442.01
08.10.04.10	13.10.6	Photographing during bridge construction	lump sum		54,746.52	54,746.52
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						10,450,750.43

SUMMARY - BRIDGE AT km 881+705.810		
08.10.01 EARTH WORKS		10,309,986.82
08.10.02 CONCRETE		100,498,266.82
08.10.03 METALWORK		132,998,190.22
08.10.04 FINISHING AND SUNDRY WORKS ON BRIDGES		10,450,750.43
TOTAL BRIDGE AT km 881+705.810:		254,257,194.29

08.11. BRIDGE AT km 883+067.252						
Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.11.01	13.2	EARTH WORKS				
		Excavation for foundations				
08.11.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth				
		- at depth of 0-2 m	m ³	11,690.45	226.73	2,650,574.59
		- at depth of 2-4 m	m ³	8,125.82	297.69	2,418,973.87
		- at depth of 4-6 m	m ³	3,736.00	368.67	1,377,351.12
		- at depth over 6 m	m ³	2,251.00	439.63	989,607.13
08.11.01.02	13.2.1	Excavation of foundations in V category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth				
		- at depth of 4-6 m	m ³	245.00	439.63	107,709.35
		- at depth over 6 m	m ³	122.00	510.60	62,293.20
08.11.01.03	13.2.2	Extra for excavation of foundations with pumping of 30 lit/min - 120 lit/min water	m ³	13,085.13	439.63	5,752,615.70
08.11.01.04	13.2.4	Backfilling of pier foundations with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa				
		Payment per m ³ of compacted earth	m ³	19,269.00	390.78	7,529,939.82
08.11.01.05	13.2.5	Construction of wedge made of well-graded gravel compacted in 30 cm thick layers to modulus of compressibility Ms=40 MPa. It shall be constructed behind the abutments. Payment per m ³ of compacted gravel	m ³	2,991.00	851.62	2,547,195.42

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.11.01.06	13.2.8 additional specifications	Construction of end slope of material from the cutting or borrow pit including mechanical compaction in 30 cm thick layers, fully as designed				
		Payment per m ³ of compacted material	m ³	780.00	301.38	235,076.40
08.11.01.07	13.4.2	Construction of Ø150 cm piles with concrete, class MB 30, M-150, V-3. Payment per m ³ of completed pile	m ³	478.00	37,491.23	17,920,807.94
TOTAL EARTH WORKS:						41,592,144.54
08.11.02.	13.4	CONCRETE				
		This shall apply to all items: * Concrete shall be mixed mechanically and compacted by vibrating. * Reinforcing bars shall be paid separately, except for bored piles. * Cables shall be paid separately. * The price of concrete includes formwork and scaffold * Payment per m ³ of placed concrete for completely performed work				
	13.4.1	Plain concrete				
08.11.02.01	13.4.1.3 additional specifications	Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs	m ³	775.00	6,387.09	4,949,994.75
	13.4.3	Reinforced concrete constructions				
08.11.02.02	13.4.3.1	Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 30, M-150, V-6	m ³	2,395.00	7,528.10	18,029,799.50
	13.4.3.2	Piers supporting plain spanning constructions of different systems and bearing beams				
08.11.02.03	13.4.3.2	Abutment bodies constructed of concrete, class II, MB 35, M-150, V-6	m ³	152.00	8,485.71	1,289,827.92
08.11.02.04	13.4.3.2	Abutment wing walls made of concrete, class II, MB 35, M-150, V-6	m ³	124.00	10,539.16	1,306,855.84
08.11.02.05	13.4.3.2	Bearing beams of abutment made of concrete, class II, MB 35, M-150, V-6	m ³	116.00	9,968.66	1,156,364.56
08.11.02.06	13.4.3.2	Abutment parapets constructed of concrete, class II, MB 35, M-150, V-6	m ³	82.00	8,485.71	695,828.22
08.11.02.07	13.4.3.2	Pedestrian cantilever walkway at abutment wing walls constructed of concrete, class II, MB 35, M-150, V-6	m ³	34.40	10,310.60	354,684.64
08.11.02.08	13.4.3.2	Masking covers of abutments and middle piers made of concrete, class II, MB 30, M-150, V-6	m ³	28.00	23,326.25	653,135.00
08.11.02.09	13.4.3.2	Middle pier bodies constructed of concrete, class II, MB 35, M-150, V-6	m ³	1,257.00	9,398.15	11,813,474.55
08.11.02.10	13.4.3.2	Bearing beams of middle piers made of concrete, class II, MB 40, M-150, V-6	m ³	728.00	12,206.45	8,886,295.60
08.11.02.11	13.4.3.2	Abutment and middle pier caps made of concrete, class II, MB 40, M-150, V-6	m ³	46.00	9,283.87	427,058.02
08.11.02.12	13.4.3.2	Wing walls constructed of reinforced concrete, class II MB 30, M-150, V-6	m ³	629.10	10,265.44	6,457,988.30
	13.4.3.3	Spanning bridge construction of reinforced concrete				
08.11.02.13	13.4.3.3	Cross girders made of reinforced concrete, class II, MB 50, M-150, V-6	m ³	713.00	11,519.81	8,213,624.53
08.11.02.14	13.4.3.3	Bridge deck over prefabricated girders made of reinforced concrete, class II, MB 45, M-150, V-6	m ³	2,289.00	11,451.61	26,212,735.29
08.11.02.15	13.4.3.4	Cornices at footway level (including inspection manholes) cast in situ Concrete class II MB 30, M-150, V-6	m ³	558.00	10,036.86	5,600,567.88
08.11.02.16	13.4.3.5	Crossing slabs made of concrete MB 35, M-150, V-6	m ³	53.00	7,801.84	413,497.52
08.11.02.17	13.4.3.4	Masking covers of cornices at footway level made of concrete, class II, MB 45, M-150, V-8	m ³	376.00	24,512.44	9,216,677.44
	13.4.4	Prestressed bridge constructions				
08.11.02.18	13.4.4	Prefabricated main girders made of prestressed concrete, class II MB 50, M-150, V-3	m ³	2,350.00	15,214.74	35,754,639.00
08.11.02.19	13.4.4	Prestressed box bridge construction cast in situ. Concrete class II MB 45, M-150, V-3	m ³	2,516.00	20,572.34	51,760,007.44
TOTAL CONCRETE WORKS:						193,193,056.00
08.11.03.	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions				
		* The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed				
08.11.03.01		Reinforcement B500A	kg	1,605,246.00	63.59	102,077,593.14
08.11.03.02	13.5.1	Ribbed rebars RA 400/500-2	kg	140,916.00	63.59	8,960,848.44
		Metal works in prestressed concrete				
		* The price includes procurement, fixing and tensioning				
08.11.03.03	13.5.2	Patented high-strength prestressing strands with all anchors, base plates and protective tubes for cables	kg	193,332.00	310.60	60,048,919.20
08.11.03.04	13.6	Expansion joints - procurement and installation as designed (drawing No. 32)	m ²	105.00	40,880.17	4,292,417.85
08.11.03.05	13.7	S-6 gullies of cast iron, procurement and installation as designed.	pc.	18.00	18,248.84	328,479.12
08.11.03.06	13.7	S-7 gullies of cast iron, procurement and installation as designed.	pc.	16.00	18,248.84	291,981.44
08.11.03.07	13.7	S-9 gullies of cast iron, procurement and installation as designed	pc.	20.00	18,248.84	364,976.80
	13.8	Steel bridge fences:				
08.11.03.09	13.8.2	- tubular fences or fences made of steel sections	kg	18,800.00	259.91	4,886,308.00
08.11.03.10	13.8.3	- protective mesh	kg	891.40	187.10	166,780.94
08.11.03.11	13.9	Bridge bearings				
		(procurement and installation as designed (drawing No. 32)				
		fixed end bearings	pc.	19.00	76,371.40	1,451,056.60
		free end bearings movable in direction of bridge center line	pc.	17.00	76,371.40	1,298,313.80
		bearings movable vertically to bridge centerline	pc.	45.00	76,371.40	3,436,713.00
		bearings movable in both directions	pc.	27.00	76,371.40	2,062,027.80
TOTAL METAL WORK						189,666,416.13

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.11.04	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works. * The price includes procurement, construction and installation as designed				
08.11.04.01	13.10.1	Concrete or stone curbs along the highway, 13/20 MB 40	m ¹	1,976.00	1,505.99	2,975,836.24
08.11.04.02	13.10.2	Insulating coat on pavement top	m ²	9,796.00	793.55	7,773,615.80
08.11.04.03	13.10.3	Applying one layer of bitulte and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	3,887.00	383.41	1,490,314.67
08.11.04.04	13.10.4	Bituminous pavement base course, BNHS 16A, 5 cm thick	m ²	9,200.00	481.10	4,426,120.00
08.11.04.05	13.10.4	Pavement wearing course of skeleton mastic asphalt SMA 0/11S, 4cm thick	m ²	9,200.00	623.96	5,740,432.00
08.11.04.06	13.10.5	Trial loading of constructed bridge	lump sum		912,442.01	912,442.01
08.11.04.07	13.10.6	Photographing during bridge construction	lump sum		54,746.52	54,746.52
08.11.04.08	13.10.8	Fitting and sealing joints with elastic bituminous sealing compound (livobit) on asphalt next to curbs and cornices at footway level and next to expansion joints	m ¹	4,082.00	380.65	1,553,813.30
08.11.04.09	13.11.1	Laying PVC pipes into footways (cat walks), Ø110 mm	m ¹	2,747.00	483.87	1,329,190.89
08.11.04.10	13.11.2	Epoxy and polyurethane preservative on footways	m ²	2,381.00	584.33	1,391,289.73
08.11.04.11	13.11.8 additional specifications	Construction of cementitious grouting mortar beds	m ²	74.00	538.25	39,830.50
08.11.04.12	13.11.9 additional specifications	Steel plates embedded in girder at points where girders rest on bearings	kg	2,291.00	319.82	732,707.62
08.11.04.13	13.7.2	Cast iron pipes for gully water discharge including all fixing accessories	m ¹	170.00	7,697.69	1,308,607.30
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						29,728,946.58

SUMMARY - BRIDGE AT km 883+067.252		
08.11.01	EARTH WORKS	41,592,144.54
08.11.02	CONCRETE	193,193,056.00
08.11.03	METALWORK	189,666,416.13
08.11.04	FINISHING AND SUNDRY WORKS ON BRIDGES	29,728,946.58
TOTAL BRIDGE AT km 883+067.252:		454,180,563.26

08.12. BRIDGE AT km 883+576.495.

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.12.01	13.2	EARTH WORKS				
		Excavation for foundations				
08.12.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth - at depth of 0-2 m - at depth of 2-4 m - at depth of 4-6 m	m ³	1,779.00	226.73	403,352.67
08.12.01.02	13.2.2	Extra for excavation of foundations with pumping of 30 lit/min - 120 lit/min water	m ³	2,000.00	439.63	879,260.00
08.12.01.03	13.2.4	Backfilling of pier foundations with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa Payment per m ³ of compacted earth	m ³	1,486.00	390.78	580,699.08
08.12.01.04	13.2.5	Construction of wedge made of well-graded gravel compacted in 30 cm thick layers to modulus of compressibility Ms=40 MPa. It shall be constructed behind the abutments. Payment per m ³ of compacted gravel	m ³	1,701.00	851.62	1,448,605.62
08.12.01.05	13.2.8 additional specifications	Construction of end slope of material from the cutting or borrow pit including mechanical compaction in 30 cm thick layers, fully as designed. Payment per m3 of compacted material	m ³	21.20	301.38	6,389.26
08.12.01.06	13.2.9 additional specifications	Placing 80 cm thick cover protecting a gravel wedge made of gravel sand where top 30 cm shall be stabilized with cement and bottom 50 cm compacted in two layers to modulus of compressibility Ms=40 MPa. Payment per m3 of compacted material	m ³	6.40	3,193.55	20,438.72
TOTAL EARTH WORKS:						3,966,294.20

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.12.02	13.4	CONCRETE				
		This shall apply to all items: * Concrete shall be mixed mechanically and compacted by vibrating * Reinforcing bars shall be paid separately, except for bored piles. * Cables shall be paid separately * The price of concrete includes formwork and scaffold. * Payment per m ³ of placed concrete for completely performed work				
		13.4.1 Plain concrete				
08.12.02.01	13.4.1.3 additional specifications	Blinding layer, 10 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs	m ³	108.50	6,387.09	692,999.27
		13.4.3 Reinforced concrete constructions				
08.12.02.02	13.4.3.1	Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 30, M-150, V-6	m ³	500.00	7,528.10	3,764,050.00

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
	13.4.3.2	Piers supporting plain spanning constructions of different systems and bearing beams				
08.12.02.03	13.4.3.2	Abutment bodies constructed of concrete, class II, MB 30, M-150, V-6	m ³	345.50	8,211.98	2,837,239.09
08.12.02.04	13.4.3.2	Abutment wing walls made of concrete, class II, MB 30, M-150, V-6	m ³	15.20	10,265.44	156,034.69
08.12.02.05	13.4.3.2	Pedestrian cantilever walkway at abutment wing walls constructed of concrete, class II, MB 30, M-150, V-6	m ³	1.10	10,036.86	11,040.55
08.12.02.06	13.4.3.2	Wing walls constructed of reinforced concrete, class II MB 30, M-150, V-6	m ³	204.20	10,265.44	2,096,202.85
	13.4.3.3	Spanning bridge construction of reinforced concrete				
08.12.02.07	13.4.3.3	Main plate girder made of reinforced concrete class II, MB 30, M-150, V-6	m ²	316.10	12,174.19	3,848,261.46
08.12.02.08	13.4.3.4	Cornices at footway level (including inspection manholes) cast in situ, Concrete class II MB 30, M-150, V-6	m ³	25.20	10,036.86	252,928.87
08.12.02.09	13.4.3.5	Crossing slabs made of concrete MB 30, M-150, V-6	m ²	64.85	7,528.10	488,197.29
TOTAL CONCRETE WORKS:						14,146,954.05

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions				
		* The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed				
08.12.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	171,411.61	63.59	10,900,064.28
TOTAL METAL WORK						10,900,064.28

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works.				
		* The price includes procurement, construction and installation as designed				
08.12.04.01	13.10.1	Concrete or stone curbs along the highway, 13/20 MB 40	m ³	81.60	1,505.99	122,888.78
08.12.04.02	13.10.2	Insulating coat on pavement top	m ²	381.40	793.55	302,659.97
08.12.04.03	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	1,806.50	583.41	692,630.17
08.12.04.04	13.10.4	Bituminous pavement base course, BNHS 16A, 5 cm thick	m ²	303.70	481.10	146,110.07
08.12.04.05	13.10.4	Pavement wearing course of skeleton mastic asphalt SMA 0/11S, 4cm thick	m ²	303.70	623.96	189,496.65
08.12.04.06	13.10.5	Trial loading of constructed bridge	lump sum		912,442.01	912,442.01
08.12.04.07	13.10.6	Photographing during bridge construction	lump sum		54,746.52	54,746.52
08.12.04.08	13.10.8	Fitting and sealing joints with elastic bituminous sealing compound (Tivobit) on asphalt next to curbs and cornices at footway level and next to expansion joints	m ²	154.00	380.65	58,620.10
08.12.04.09	13.11.1	Laying PVC pipes into footways (cat walks), Ø110 mm	m ²	280.00	483.87	135,483.60
08.12.04.10	13.11.2	Epoxy and polyurethane preservative on footways	m ²	101.60	584.33	59,367.93
08.12.04.11	13.11.6 additional specifications	Crashed stone revetment	m ³	102.00	6,898.62	703,659.24
08.12.04.12	13.11.8 additional specifications	Construction of cementitious grouting mortar beds	m ²	18.00	538.25	9,688.50
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						3,387,793.54

SUMMARY - BRIDGE AT km 883+576.495		Total
08.12.01	EARTH WORKS	3,966,294.20
08.12.02	CONCRETE	14,146,954.05
08.12.03	METALWORK	10,900,064.28
08.12.04	FINISHING AND SUNDRY WORKS ON BRIDGES	3,387,793.54
TOTAL BRIDGE AT km 883+576.495:		32,401,106.07

08.13. BRIDGE AT km 884+958.430

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
	13.2	EARTH WORKS				
		Excavation for foundations				
08.13.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth - at depth of 2-4 m	m ³	3,508.00	297.69	1,044,296.52
08.13.01.02	13.2.4	Backfilling of pier foundations with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa. Payment per m ³ of compacted earth.	m ³	1,530.00	390.78	597,893.40
08.13.01.03	13.2.5	Construction of wedge made of well-graded gravel compacted in 30 cm thick layers to modulus of compressibility Ms=40 MPa. It shall be constructed behind the abutments. Payment per m ³ of compacted gravel.	m ³	716.90	851.62	610,526.38
08.13.01.04	13.2.8 additional specifications	Construction of end slope of material from the cutting or borrow pit including mechanical compaction in 30 cm thick layers, fully as designed. Payment per m ³ of compacted material.	m ³	538.50	301.38	162,293.13
08.13.01.05	13.4.2	Construction of Ø120 cm piles with concrete, class MB 30, M-150, V-3. Payment per m ³ of completed pile	m ³	720.00	29,993.54	21,595,348.80
TOTAL EARTH WORKS:						24,010,358.23

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.13.02.	13.4	CONCRETE This shall apply to all items: * Concrete shall be mixed mechanically and compacted by vibrating. * Reinforcing bars shall be paid separately, except for bored piles * Cables shall be paid separately. * The price of concrete includes formwork and scaffold * Payment per m ³ of placed concrete for completely performed work				
08.13.02.01	13.4.1	Plain concrete Blinding layer, 10 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs	m ³	107.55	6,387.09	686,931.53
08.13.02.02	13.4.3	Reinforced concrete constructions Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 30, M-150, V-6	m ³	1,334.60	7,528.10	10,047,002.26
08.13.02.03	13.4.3.2	Piers supporting plain spanning constructions of different systems and bearing beams Abutment bodies constructed of concrete, class II, MB 30, M-150, V-6	m ³	321.80	8,211.98	2,642,615.16
08.13.02.04	13.4.3.2	Abutment wing walls made of concrete, class II, MB 30, M-150, V-6	m ³	97.40	10,265.44	999,853.86
08.13.02.05	13.4.3.2	Abutment parapets constructed of concrete, class II, MB 30, M-150, V-6	m ³	78.20	8,211.98	642,176.84
08.13.02.06	13.4.3.2	Pedestrian cantilever walkway at abutment wing walls constructed of concrete, class II, MB 30, M-150, V-6	m ³	17.50	10,036.86	175,645.05
08.13.02.07	13.4.3.2	Masking covers of abutments and middle piers made of concrete, class II, MB 30, M-150, V-6	m ³	8.88	23,326.25	207,137.10
08.13.02.08	13.4.3.2	Middle pier bodies constructed of concrete, class II, MB 30, M-150, V-6	m ³	244.80	9,124.42	2,233,658.02
08.13.02.09	13.4.3.2	Bearing beams of middle piers made of concrete, class II, MB 30, M-150, V-6	m ³	241.30	11,476.49	2,769,277.04
08.13.02.10	13.4.3.2	Abutment and middle pier caps made of concrete, class II, MB 40, M-150, V-6	m ³	11.56	8,941.93	103,368.71
08.13.02.11	13.4.3.2	Wing walls constructed of reinforced concrete, class II MB 30, M-150, V-6	m ³	95.90	10,265.44	984,455.70
08.13.02.12	13.4.3.3	Spanning bridge construction of reinforced concrete Cross girders made of reinforced concrete, class II, MB 50, M-150, V-6	m ³	220.00	11,519.81	2,534,358.20
08.13.02.13	13.4.3.3	Bridge deck over prefabricated girders made of reinforced concrete, class II, MB 50, M-150, V-6	m ³	948.30	12,090.32	11,465,250.46
08.13.02.14	13.4.3.4	Cornices at footway level (including inspection manholes) cast in situ Concrete class II MB 40, M-150, V-6	m ³	152.80	10,766.82	1,645,170.10
08.13.02.15	13.4.3.5	Crossing slabs made of concrete MB 30, M-150, V-6	m ³	42.10	7,528.10	316,933.01
08.13.02.16	13.4.3.4	Masking covers of cornices at footway level made of concrete, class II, MB 45, M-150, V-8	m ³	45.40	24,512.44	1,112,864.78
08.13.02.17	13.4.4	Prestressed bridge constructions Prefabricated main girders made of prestressed concrete, class II MB 50, M-150, V-3	m ³	984.00	15,214.74	14,971,304.16
TOTAL CONCRETE WORKS:						53,538,001.95
08.13.03.	13.5	METALWORK Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed				
08.13.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	877,876.80	63.59	55,824,185.71
08.13.03.02	13.5.2	Metal works in prestressed concrete * The price includes procurement, fixing and tensioning Patented high-strength prestressing strands with all anchors, base plates and protective tubes for cables	kg	65,368.00	310.60	20,303,300.80
08.13.03.03	13.6	Expansion joints - procurement and installation as designed MT-100	m ²	52.00	40,880.17	2,125,768.84
08.13.03.04	13.7	gullies of cast iron, procurement and installation as designed S9	pc	16.00	18,248.84	291,981.44
08.13.03.05	13.8.2	Steel bridge fences: - tubular fences or fences made of steel sections	kg	315.00	259.91	81,871.65
08.13.03.06	13.9	Bridge bearings NAL-b-350x450x85 NAL-f-450x600x85	pc	16.00	46,808.27	748,932.32
			pc	24.00	76,371.40	1,832,913.60
TOTAL METAL WORK						81,208,954.36
08.13.04.	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES This shall apply to all items of finishing works: * The price includes procurement, construction and installation as designed.				
08.13.04.01	13.10.1	Concrete or stone curbs along the highway, 13/20 MB 40	m ²	630.00	1,505.99	948,773.70
08.13.04.02	13.10.2	Insulating coat on pavement top	m ²	3,024.00	793.55	2,399,695.20
08.13.04.03	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	667.00	383.41	255,734.47
08.13.04.04	13.10.4	Bituminous pavement base course, BNHS 16A, 5 cm thick	m ²	2,924.00	481.10	1,406,736.40
08.13.04.05	13.10.4	Pavement wearing course of skeleton mastic asphalt SMA 0/11S, 4cm thick	m ²	2,924.00	623.96	1,824,459.04
08.13.04.06	13.10.5	Trial loading of constructed bridge	lump sum		912,442.01	912,442.01
08.13.04.07	13.10.6	Photographing during bridge construction	lump sum		54,746.52	54,746.52
08.13.04.08	13.10.8	Fitting and sealing joints with elastic bituminous sealing compound ('livobit) on asphalt next to curbs and cornices at footway level and next to expansion joints	m ²	1,312.00	380.65	499,412.80

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.13.04.09	13.11.1	Laying PVC pipes into footways (cat walks), Ø110 mm	m'	472.00	483.87	228,386.64
08.13.04.10	13.11.2	Epoxy and polyurethane preservative on footways	m ²	725.00	584.33	423,639.25
08.13.04.11	13.11.8 additional specifications	Construction of cementitious grouting mortar beds	m ²	28.16	538.25	15,157.12
08.13.04.12	13.11.9 additional specifications	Steel plates embedded in girder at points where girders rest on bearings	kg	1,100.00	319.82	351,802.00
08.13.04.13	13.7.2	Cast iron pipes for gully water discharge including all fixing accessories	m'	108.00	7,697.69	831,350.52
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						10,152,335.67

SUMMARY - BRIDGE AT km 884+958.430		
08.13.01	EARTH WORKS	24,010,358.23
08.13.02	CONCRETE	53,538,001.95
08.13.03	METALWORK	81,208,954.36
08.13.04	FINISHING AND SUNDRY WORKS ON BRIDGES	10,152,335.67
TOTAL BRIDGE AT km 884+958.430:		168,909,650.21

08.14. BRIDGE AT km 885+445.066

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.14.01. EARTH WORKS						
Excavation for foundations						
08.14.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth - at depth of 0-2 m - at depth of 2-4 m - at depth of 4-6 m	m ³	867.00	226.73	196,574.91
08.14.01.02	13.2.2	Extra for excavation of foundations with pumping of 30 lit/min - 120 lit/min water	m ³	1,500.00	439.63	659,445.00
08.14.01.03	13.2.4	Backfilling of pier foundations with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa. Payment per m ³ of compacted earth.	m ³	433.30	390.78	169,324.97
08.14.01.04	13.2.5	Construction of wedge made of well-graded gravel compacted in 30 cm thick layers to modulus of compressibility Ms=40 MPa. It shall be constructed behind the abutments. Payment per m ³ of compacted gravel	m ³	461.00	851.62	392,596.82
08.14.01.05	13.2.9 additional specifications	Placing 80 cm thick cover protecting a gravel wedge made of gravel sand where top 30 cm shall be stabilized with cement and bottom 50 cm compacted in two layers to modulus of compressibility Ms=40 MPa. Payment per m ³ of compacted gravel	m ³	81.00	3,193.55	258,677.55
TOTAL EARTH WORKS:						2,182,991.38
08.14.02. CONCRETE						
This shall apply to all items * Concrete shall be mixed mechanically and compacted by vibrating * Reinforcing bars shall be paid separately, except for bored piles. * Cables shall be paid separately. * The price of concrete includes formwork and scaffold. * Payment per m ³ of placed concrete for completely performed work						
13.4.1 Plain concrete						
08.14.02.01	13.4.1.3 additional specifications	Blinding layer, 10 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs.	m ³	44.00	6,387.09	281,031.96
13.4.3 Reinforced concrete constructions						
08.14.02.02	13.4.3.1	Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 30, M-150, V-6.	m ³	79.70	7,528.10	599,989.57
13.4.3.2 Piers supporting plain spanning constructions of different systems and bearing beams						
08.14.02.03	13.4.3.2	Abutment bodies constructed of concrete, class II, MB 30, M-150, V-6.	m ³	99.70	8,211.98	818,734.41
08.14.02.04	13.4.3.2	Abutment wing walls made of concrete, class II, MB 30, M-150, V-6	m ³	20.30	10,265.44	208,388.43
08.14.02.05	13.4.3.2	Pedestrian cantilever walkway at abutment wing walls constructed of concrete, class II, MB 30, M-150, V-6	m ³	2.13	10,036.86	21,378.51
13.4.3.3 Spanning bridge construction of reinforced concrete						
08.14.02.06	13.4.3.3	Main plate girder made of reinforced concrete class II, MB 30, M-150 V-6	m ³	85.70	11,358.52	973,425.16
08.14.02.07	13.4.3.4	Cornices at footway level (including inspection manholes) cast in situ. Concrete class II MB 30, M-150, V-6	m ³	13.10	10,036.86	131,482.87
08.14.02.08	13.4.3.5	Crossing slabs made of concrete MB 35, M-150, V-6	m ³	50.40	7,801.84	393,212.74
TOTAL CONCRETE WORKS:						3,427,643.65
08.14.03. METALWORK						
Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed						
08.14.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	50,905.44	63.59	3,237,076.93
TOTAL METAL WORK						3,237,076.93

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.14.04.	13.10	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works * The price includes procurement, construction and installation as designed				
08.14.04.01	13.10.1	Concrete or stone curbs along the highway, 13/20 MB 40	m ³	44.00	1,505.99	66,263.56
08.14.04.02	13.10.2	Insulating coat on pavement top	m ²	190.10	793.55	150,853.86
08.14.04.03	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	550.00	383.41	210,875.50
08.14.04.04	13.10.4	Bituminous pavement base course, BNHS 16A, 5 cm thick	m ²	141.00	481.10	67,835.10
08.14.04.05	13.10.4	Pavement wearing course of skeleton mastic asphalt SMA 0/11S, 4cm thick	m ²	141.00	623.96	87,978.36
08.14.04.06	13.10.5	Trial loading of constructed bridge	lump sum		912,442.01	912,442.01
08.14.04.07	13.10.6	Photographing during bridge construction	lump sum		54,746.52	54,746.52
08.14.04.08	13.10.8	Fitting and sealing joints with elastic bituminous sealing compound (livobit) on asphalt next to curbs and cornices at footway level and next to expansion joints	m ¹	88.00	380.65	33,497.20
08.14.04.09	13.11.1	Laying PVC pipes into footways (cat walks), Ø110 mm	m ¹	180.00	483.87	87,096.60
08.14.04.10	13.11.2	Epoxy and polyurethane preservative on footways	m ²	47.10	584.33	27,521.94
08.14.04.11	13.11.6 additional specifications	Crashed stone revetment	m ³	40.00	6,897.69	275,907.60
08.14.04.12	13.11.8 additional specifications	Construction of cementitious grouting mortar beds	m ²	9.70	538.25	5,221.03
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						1,980,239.27

SUMMARY - BRIDGE AT km 885+445.066		
08.14.01	EARTH WORKS	2,182,991.38
08.14.02	CONCRETE	3,427,643.65
08.14.03	METALWORK	3,237,076.93
08.14.04	FINISHING AND SUNDRY WORKS ON BRIDGES	1,980,239.27
TOTAL BRIDGE AT km 885+445.066:		10,827,951.23

08.16. TOP SLAB CULVERT AT km 884+067.303 (UNDER THE HIGHWAY)

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.16.01.	13.2	EARTH WORKS				
		Excavation for foundations				
08.16.01.01	13.2.1	Excavation of foundations in IV category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth - at depth of 0-2 m	m ³	442.96	226.73	100,432.32
		- at depth of 2-4 m	m ³	188.50	297.69	56,114.57
		- at depth of 4-6 m	m ³	67.02	368.67	24,708.26
08.16.01.02	13.2.5	Construction of wedge made of well-graded gravel compacted in 30 cm thick layers to modulus of compressibility Ms=40 MPa. It shall be constructed behind the abutments Payment per m ³ of compacted gravel	m ³	373.32	851.62	317,926.78
08.16.01.03	13.2.7 additional specifications	Placing the sub-base made of gravel and sand in 30 cm thick layers under foundation including compaction of layers to modulus of compressibility Ms=30 MPa. Payment per m ³ of compacted gravel	m ³	62.69	1,078.34	67,601.13
TOTAL EARTH WORKS:						566,783.06

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.16.02.	13.4	CONCRETE				
		This shall apply to all items * Concrete shall be mixed mechanically and compacted by vibrating. * Reinforcing bars shall be paid separately, except for bored piles. * Cables shall be paid separately * The price of concrete includes formwork and scaffold. * Payment per m ³ of placed concrete for completely performed work				
		Plain concrete				
08.16.02.01	13.4.1.3 additional specifications	Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs.	m ³	26.06	6,387.09	166,447.57
08.16.02.02	13.1.4.1 additional specifications	Concrete layer for slope. Concrete class I MB 20.	m ³	49.30	6,660.83	328,378.92
08.16.02.03	13.1.4.2 additional specifications	Protective concrete over waterproofing layer (MB20, 5cm) with galvanized mesh	m ²	188.10	686.64	129,156.98
		Reinforced concrete constructions				
08.16.02.04	13.4.3 13.4.3.1	Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 30, M-150, V-6	m ³	51.14	7,528.10	384,987.03
		Piers supporting plain spanning constructions of different systems and bearing beams				
08.16.02.05	13.4.3.2	Abutment bodies constructed of concrete, class II, MB 30, M-150, V-6.	m ³	100.96	8,211.98	829,081.50
08.16.02.06	13.4.3.2	Abutment wing walls made of concrete, class II, MB 30, M-150, V-6.	m ³	6.35	10,265.44	65,185.54
		Spanning bridge construction of reinforced concrete				
08.16.02.07	13.4.3.3 13.4.3.3	Main plate girder made of reinforced concrete class II, MB 30, M-150, V-6.	m ³	44.47	16,980.64	755,129.06

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.16.02.08	13.4.3.4	Cornices at footway level (including inspection manholes) cast in situ. Concrete class II MB 30, M-150, V-6	m ³	6.31	10,036.86	63,332.59
TOTAL CONCRETE WORKS:						2,721,699.19
08.16.03.	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed				
08.16.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	21,817.24	63.59	1,387,358.29
	13.8	Steel bridge fences:				
08.16.03.02	13.8.3	- tubular fences or fences made of steel sections	kg	16.00	259.91	4,158.56
TOTAL METAL WORK						1,391,516.85
08.16.04	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works * The price includes procurement, construction and installation as designed				
08.16.04.01	13.10.2	Insulating coat on pavement top	m ²	200.00	793.55	158,710.00
08.16.04.02	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	523.73	383.41	200,803.32
08.16.04.03	13.10.5	Trial loading of constructed bridge	lump sum		912,442.01	912,442.01
08.16.04.04	13.10.6	Photographing during bridge construction	lump sum		54,746.52	54,746.52
08.16.04.05	13.10.8	Fitting and sealing joints with elastic bituminous sealing compound (Tivobit) on asphalt next to curbs and cornices at footway level and next to expansion joints	m ³	13.50	380.65	5,138.78
08.16.04.06	13.11.6	Crashed stone revetment	m ³	34.80	6,898.62	240,071.98
08.16.04.07	13.11.15	Fugeband tapes for sealing concrete connections	m ²	31.60	2,132.72	67,393.95
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						1,639,306.55
08.16.05.	2	PRELIMINARY WORKS				
08.16.05.01	2.5	Demolition of existing construction	lump sum		1,386,911.84	1,386,911.84
TOTAL PRELIMINARY WORKS:						1,386,911.84

SUMMARY TOP SLAB CULVERT AT km 884+067.303 (UNDER THE HIGHWAY)		
08.16.01	EARTH WORKS	566,783.06
08.16.02	CONCRETE	2,721,699.19
08.16.03	METALWORK	1,391,516.85
08.16.04	FINISHING AND SUNDRY WORKS ON BRIDGES	1,639,306.55
08.16.05	PRELIMINARY WORKS	1,386,911.84
TOTAL TOP SLAB CULVERT km 884+167.303 (UNDER THE HIGHWAY):		7,706,217.50

08.16. TOP SLAB CULVERT AT km 884+067.303 (part under main road with inlect structure)

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.16.01.	13.2	EARTH WORKS				
		Excavation of foundations				
08.16.01.01	13.2.1	Excavation of foundations in IV category soil and transport of earth to distance of 500 m. Payment per m ³ of excavated earth				
		- at depth of 0-2 m	m ³	382.96	226.73	86,828.52
		- at depth of 2-4 m	m ³	410.72	297.69	122,267.24
		- at depth of 4-6 m	m ³	410.72	368.67	151,420.14
		- at depth over 6 m	m ³	731.84	439.63	321,738.82
08.16.01.02	13.2.5	Construction of wedge made of well-graded gravel compacted in 30 cm thick layers to modulus of compressibility Ms=40 MPa. It shall be constructed behind the abutments. Payment per m ³ of compacted gravel.	m ³	220.50	851.62	187,782.21
08.16.01.03	13.2.7 additional specifications	Placing the sub-base made of gravel and sand in 30 cm thick layers under foundation including compaction of layers to modulus of compressibility Ms=30 MPa. Payment per m ³ of compacted gravel.	m ³	46.85	1,078.34	50,520.23
TOTAL EARTH WORKS:						920,557.16
08.16.02.	13.4	CONCRETE				
		This shall apply to all items. * Concrete shall be mixed mechanically and compacted by vibrating. * Reinforcing bars shall be paid separately, except for bored piles. * Cables shall be paid separately. * The price of concrete includes formwork and scaffold. * Payment per m ³ of placed concrete for completely performed work				
	13.4.1	Plain concrete				
08.16.02.01	13.4.1.3 additional specifications	Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs.	m ³	21.46	6,387.09	137,066.95
08.16.02.02	13.4.1.4 additional specifications	Concrete layer for slope. Concrete class I MB 20	m ³	35.70	6,660.83	237,791.63
08.16.02.03	13.4.1.2 additional specifications	Protective concrete over waterproofing layer (MB20, 5cm) with galvanized mesh.	m ²	138.60	686.64	95,168.30

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.16.02.04	13.4.3 13.4.3.1	Reinforced concrete constructions Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 30, M-150, V-6	m ³	44.09	7,528.10	331,913.93
08.16.02.05	13.4.3.2	Piers supporting plain spanning constructions of different systems and bearing beams Abutment bodies constructed of concrete, class II, MB 30, M-150, V-6	m ³	106.96	8,211.98	878,353.38
08.16.02.06	13.4.3.3	Spanning bridge construction of reinforced concrete Main plate girder made of reinforced concrete class II, MB 30, M-150, V-6	m ³	32.34	16,980.64	549,153.90
TOTAL CONCRETE WORKS:						2,229,448.09

METALWORK						
Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed						
08.16.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	17,325.65	63.59	1,101,738.08
08.16.03.02	13.5.1	Welded mesh reinforcement MAG 500/560	kg	4,078.89	72.81	296,983.98
TOTAL METAL WORK						1,398,722.06

FINISHING AND SUNDRY WORKS ON BRIDGES						
This shall apply to all items of finishing works: * The price includes procurement, construction and installation as designed						
08.16.04.01	13.10.2	Insulating coat on pavement top	m ²	138.60	793.55	109,986.03
08.16.04.02	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	367.41	383.41	140,868.67
08.16.04.03	13.10.5	Trial loading of constructed bridge	lump sum		912,442.01	912,442.01
08.16.04.04	13.10.6	Photographing during bridge construction	lump sum		54,746.52	54,746.52
08.16.04.05	13.11.6	Crashed stone revetment	m ³	25.20	6,898.62	173,845.22
08.16.04.06	13.11.15 additional specifications	"Fugeband" tapes for sealing concrete connections	m ²	13.50	2,132.72	28,791.72
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						1,420,680.17

SUMMARY TOP SLAB CULVERT AT km 884+167.303 (part under main road)						
08.16.01 EARTH WORKS						920,557.16
08.16.02 CONCRETE						2,229,448.09
08.16.03 METALWORK						1,398,722.06
08.16.04 FINISHING AND SUNDRY WORKS ON BRIDGES						1,420,680.17
TOTAL CULVERT AT km 884+167.303 (part under main road):						5,969,407.49

08.17. SLAB TOP CULVERT AT km 884+815.865						
Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
EARTH WORKS						
Excavation for foundations						
08.17.01.01	13.2.1	Excavation of foundations in IV and V category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth - at depth of 0-2 m	m ³	583.36	297.69	173,660.44
		- at depth of 2-4 m	m ³	474.62	368.67	174,978.16
		- at depth of 4-6 m	m ³	286.52	439.63	125,962.79
08.17.01.02	13.2.5	Construction of wedge made of well-graded gravel compacted in 30 cm thick layers to modulus of compressibility Ms=40 MPa. It shall be constructed behind the abutments Payment per m ³ of compacted gravel	m ³	458.05	851.62	390,084.54
08.17.01.03	13.2.7 additional specifications	Placing the sub-base made of gravel and sand in 30 cm thick layers under foundation including compaction of layers to modulus of compressibility Ms=30 MPa. Payment per m ³ of compacted gravel	m ³	83.54	1,078.34	90,084.52
08.17.01.04	13.2.9 additional specifications	Placing 80 cm thick cover protecting a gravel wedge made of gravel sand where top 30 cm shall be stabilized with cement and bottom 50 cm compacted in two layers to modulus of compressibility Ms=40 MPa. Payment per m ³ of compacted gravel	m ³	29.96	3,193.55	95,678.76
TOTAL EARTH WORKS:						1,050,449.20

CONCRETE						
This shall apply to all items: * Concrete shall be mixed mechanically and compacted by vibrating * Reinforcing bars shall be paid separately, except for bored piles. * Cables shall be paid separately. * The price of concrete includes formwork and scaffold. * Payment per m ³ of placed concrete for completely performed work						
Plain concrete						
08.17.02.01	13.4.1.3 additional specifications	Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs.	m ³	35.00	6,387.09	223,548.15



Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.17.02.02	13.1.4.1 additional specifications	Concrete layer for slopes: Concrete class I MB 20.	m ²	99.00	6,660.83	659,422.17
08.17.02.03	13.1.4.2 additional specifications	Protective concrete over waterproofing layer (MB20, 5cm) with galvanized mesh	m ²	330.00	686.64	226,591.20
Reinforced concrete constructions						
08.17.02.04	13.4.3 13.4.3.1	Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 30, M-150, V-6.	m ³	86.98	7,528.10	654,794.14
Piers supporting plain spanning constructions of different systems and bearing beams						
08.17.02.05	13.4.3.2	Abutment bodies constructed of concrete, class II, MB 30, M-150, V-6	m ³	89.54	8,211.98	735,300.69
08.17.02.06	13.4.3.2	Abutment wing walls made of concrete, class II, MB 30, M-150, V-6	m ³	4.50	10,265.44	46,194.48
Spanning bridge construction of reinforced concrete						
08.17.02.07	13.4.3.3	Main plate girder made of reinforced concrete class II, MB 30, M-150, V-6.	m ³	61.78	11,852.53	732,249.30
08.17.02.08	13.4.3.4	Cornices at footway level (including inspection manholes) cast in situ. Concrete class II MB 30, M-150, V-6	m ³	2.96	10,036.86	29,709.11
TOTAL CONCRETE WORKS:						3,307,809.24
METALWORK						
Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed.						
08.17.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	25,401.86	63.59	1,615,304.28
Steel bridge fences:						
08.17.03.02	13.8.2	- tubular fences or fences made of steel sections	kg	218.61	259.91	56,818.93
TOTAL METAL WORK						1,672,123.20
FINISHING AND SUNDRY WORKS ON BRIDGES						
This shall apply to all items of finishing works. * The price includes procurement, construction and installation as designed						
08.17.04.01	13.10.2	Insulating coat on pavement top	m ²	350.00	793.55	277,742.50
08.17.04.02	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth.	m ²	787.72	383.41	302,019.73
08.17.04.03	13.10.5	Trial loading of constructed bridge	lump sum		912,442.01	912,442.01
08.17.04.04	13.10.6	Photographing during bridge construction	lump sum		54,746.52	54,746.52
08.17.04.05	13.10.8	Fitting and sealing joints with elastic bituminous sealing compound ('livobit) on asphalt next to curbs and cornices at footway level and next to expansion joints	m ¹	10.95	380.65	4,168.12
08.17.04.06	13.11.6 additional specifications	Crashed stone revetment	m ³	60.00	6,898.62	413,917.20
08.17.04.07	13.11.15 additional specifications	'Fugeband" tapes for sealing concrete connections	m ¹	67.50	2,132.72	143,958.60
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						2,108,994.67
PRELIMINARY WORKS						
08.17.05.01	2.5	Demolition of existing construction	lump sum		1,386,911.84	1,386,911.84
TOTAL PRELIMINARY WORKS:						1,386,911.84

SUMMARY SLAB TOP CULVERT AT km 884+815.865		Total
08.17.01 EARTH WORKS		1,050,449.20
08.17.02 CONCRETE		3,307,809.24
08.17.03 METALWORK		1,672,123.20
08.17.04 FINISHING AND SUNDRY WORKS ON BRIDGES		2,108,994.67
08.17.05 PRELIMINARY WORKS		1,386,911.84
TOTAL SLAB TOP CULVERT km 884+815.865:		9,526,288.16

08.17. INLECT STRUCTURES AT km 884+815.865						
Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
EARTH WORKS						
Excavation for foundations						
08.17.01.01	13.2.1	Excavation of foundations in IV and V category soil and transport of earth to distance of 500 m. Payment per m ³ of excavated earth				
		- at depth of 0-2 m	m ³	294.56	297.69	87,687.57
		- at depth of 2-4 m	m ³	247.03	368.67	91,072.55
		- at depth of 4-6 m	m ³	220.80	439.63	97,070.30
		- at depth over 6 m	m ³	294.52	510.60	150,381.91
08.17.01.02	13.2.4	Backfilling of pier foundations with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa. Payment per m ³ of compacted earth.	m ³	126.00	390.78	49,238.28
08.17.01.03	13.2.5	Construction of wedge made of well-graded gravel compacted in 30 cm thick layers to modulus of compressibility Ms=40 MPa. It shall be constructed behind the abutments. Payment per m ³ of compacted gravel.	m ³	46.20	851.62	39,344.84



Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.17.01.04	13.2.7 additional specifications	Placing the sub-base made of gravel and sand in 30 cm thick layers under foundation including compaction of layers to modulus of compressibility $M_s=30$ MPa Payment per m ³ of compacted gravel.	m ³	10.56	1,078.34	11,387.27
TOTAL EARTH WORKS:						526,182.73
08.17.02.	13.4	CONCRETE This shall apply to all items: * Concrete shall be mixed mechanically and compacted by vibrating * Reinforcing bars shall be paid separately, except for bored piles. * Cables shall be paid separately. * The price of concrete includes formwork and scaffold * Payment per m ³ of placed concrete for completely performed work				
	13.4.1	Plain concrete				
08.17.02.01	13.4.1.3 additional specifications	Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs	m ³	11.73	6,387.09	74,920.57
08.17.02.02	13.4.1.4 additional specifications	Concrete layer for slope. Concrete class I MB 20.	m ³	22.07	6,660.83	147,004.52
08.17.02.03	13.4.2 additional specifications	Protective concrete over waterproofing layer (MB20, 5cm) with galvanized mesh	m ²	29.04	686.64	19,940.03
	13.4.3	Reinforced concrete constructions				
08.17.02.04	13.4.3.1	Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 30, M-150, V-6.	m ³	31.94	7,528.10	240,447.51
	13.4.3.2	Piers supporting plain spanning constructions of different systems and bearing beams				0.00
08.17.02.05	13.4.3.2	Abutment bodies constructed of concrete, class II, MB 30, M-150, V-6	m ³	106.67	8,211.98	875,971.91
	13.4.3.3	Spanning bridge construction of reinforced concrete				
08.17.02.06	13.4.3.3	Main plate girder made of reinforced concrete class II, MB 30, M-150, V-6	m ³	17.14	7,528.10	129,031.63
TOTAL CONCRETE WORKS:						1,487,316.16
08.17.03.	13.5	METALWORK Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed				
08.17.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	10,688.66	63.59	679,691.89
08.17.03.02	13.5.1	Welded mesh reinforcement MAG 500/560	kg	3,807.30	72.81	277,209.51
TOTAL METAL WORK						956,901.40
08.17.04.	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES This shall apply to all items of finishing works: * The price includes procurement, construction and installation as designed				
08.17.04.01	13.10.2	Insulating coat on pavement top	m ²	29.04	793.55	23,044.69
08.17.04.02	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	436.36	383.41	167,304.79
08.17.04.03	13.10.5	Trial loading of constructed bridge	lump sum		912,442.01	912,442.01
08.17.04.04	13.10.6	Photographing during bridge construction	lump sum		54,746.52	54,746.52
08.17.04.05	13.10.8	Fitting and sealing joints with elastic bituminous sealing compound (Ivobit) on asphalt next to curbs and cornices at footway level and next to expansion joints	m ¹	4.40	380.65	1,674.86
08.17.04.06	13.11.6 additional specifications	Crashed stone revetment	m ³	13.38	6,898.62	92,303.54
08.17.04.07	13.11.15 additional specifications	"Fugeband" tapes for sealing concrete connections	m ¹	40.50	2,132.72	86,375.16
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						1,337,891.57
08.17.05.	2	PRELIMINARY WORKS				
08.17.05.01	2.5	Demolition of existing construction	lump sum		1,386,911.84	1,386,911.84
TOTAL PRELIMINARY WORKS:						1,386,911.84
SUMMARY INJECT STRUCTURES						
08.17.01 EARTH WORKS						526,182.73
08.17.02 CONCRETE						1,487,316.16
08.17.03 METALWORK						956,901.40
08.17.04 FINISHING AND SUNDRY WORKS ON BRIDGES						1,337,891.57
08.17.05 PRELIMINARY WORKS						1,386,911.84
TOTAL INJECT STRUCTURES:						5,695,203.70

08.18. UNDERPASS AT km 885+335.85

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.18.01	13.2	EARTH WORKS				
		Excavation for foundations				
08.18.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth				
		- at depth of 0-2 m	m ³	1,002.30	226.73	227,251.48
		- at depth of 2-4 m	m ³	265.30	297.69	78,977.16

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.18.01.02	13.2.2	Extra for excavation of foundations with pumping of 30 lit/min - 120 lit/min water	m ³	500.00	439.63	219,815.00
08.18.01.03	13.2.4	Backfilling of pier foundations with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa	m ³	1,106.00	390.78	432,202.68
08.18.01.04	13.2.5	Construction of wedge made of well-graded gravel compacted in 30 cm thick layers to modulus of compressibility Ms=40 MPa. It shall be constructed behind the abutments	m ³	986.00	851.62	839,697.32
08.18.01.05	13.2.7 additional specifications	Placing the sub-base made of gravel and sand in 30 cm thick layers under foundation including compaction of layers to modulus of compressibility Ms=30 MPa	m ³	70.00	1,078.34	75,483.80
08.18.01.06	13.2.9 additional specifications	Placing 80 cm thick cover protecting a gravel wedge made of gravel sand where top 30 cm shall be stabilized with cement and bottom 50 cm compacted in two layers to modulus of compressibility Ms=40 MPa	m ³	208.00	3,193.55	664,258.40
TOTAL EARTH WORKS:						2,537,685.84
08.18.01.	13.4	CONCRETE				
This shall apply to all items: * Concrete shall be mixed mechanically and compacted by vibrating * Reinforcing bars shall be paid separately, except for bored piles. * Cables shall be paid separately * The price of concrete includes formwork and scaffold. * Payment per m ³ of placed concrete for completely performed work						
	13.4.1	Plain concrete				
08.18.02.01	13.4.1.3 additional specifications	Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs.	m ³	40.50	6,387.09	258,677.15
08.18.02.02	13.4.1 additional specifications	Concrete layer for slope Concrete class I MB 20	m ³	14.20	6,660.83	94,583.79
08.18.02.03	13.4.2 additional specifications	Protective concrete over waterproofing layer (MB20, 5cm) with galvanized mesh	m ³	1,000.00	686.64	686,640.00
	13.4.3	Reinforced concrete constructions				
08.18.02.04	13.4.3.1	Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 30, M-150, V-6.	m ³	246.90	7,528.10	1,858,687.89
	13.4.3.2	Piers supporting plain spanning constructions of different systems and bearing beams				
08.18.02.05	13.4.3.2	Abutment bodies constructed of concrete, class II, MB 30, M-150, V-6	m ³	221.00	8,211.98	1,814,847.58
08.18.02.06	13.4.3.2	Abutment wing walls made of concrete, class II, MB 30, M-150, V-6.	m ³	91.40	10,265.44	938,261.22
	13.4.3.3	Spanning bridge construction of reinforced concrete				
08.18.02.07	13.4.3.3	Main plate girder made of reinforced concrete class II, MB 30, M-150, V-6.	m ³	112.00	13,654.37	1,529,289.44
08.18.02.08	13.4.3.4	Cornices at footway level (including inspection manholes) cast in situ. Concrete class II MB 30, M-150, V-6.	m ³	7.60	10,036.86	76,280.14
TOTAL CONCRETE WORKS:						7,257,267.19
08.18.03.	13.5	METALWORK				
Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed.						
08.18.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	54,164.52	63.59	3,444,321.83
08.18.03.02	13.8	Steel bridge fences:				
	13.8.2	- tubular fences or fences made of steel sections	kg	288.90	259.91	75,088.00
TOTAL METAL WORK						3,519,409.83
08.18.04.	13.10	FINISHING AND SUNDRY WORKS ON BRIDGES				
This shall apply to all items of finishing works. * The price includes procurement, construction and installation as designed						
08.18.04.01	13.10.2	Insulating coat on pavement top	m ²	183.50	793.55	145,616.43
08.18.04.02	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	1,253.00	383.41	480,412.73
08.18.04.03	13.10.5	Trial loading of constructed bridge	lump sum		912,442.01	912,442.01
08.18.04.04	13.10.6	Photographing during bridge construction	lump sum		54,746.52	54,746.52
08.18.04.05	13.11.15 additional specifications	"Fugeband" tapes for sealing concrete connections	m ¹	25.00	2,132.72	53,318.00
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						1,646,535.69
SUMMARY - UNDERPASS AT km 885+335.85						
08.18.01 EARTH WORKS						2,537,685.84
08.18.02 CONCRETE						7,257,267.19
08.18.03 METALWORK						3,519,409.83
08.18.04 FINISHING AND SUNDRY WORKS ON BRIDGES						1,646,535.69
TOTAL UNDERPASS AT km 885+335.85:						14,960,898.54

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.19.03.	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions				
		* The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed.				
08.19.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	421,994.10	63.59	26,834,604.82
08.19.03.02	13.6	Expansion joints - procurement and installation as designed MT-100.	m'	16.00	40,880.17	654,082.72
08.19.03.03	13.7	S-7 gullies of cast iron, procurement and installation as designed	pc	7.00	18,248.84	127,741.88
08.19.03.04	13.8	Steel bridge fences:				
08.19.03.05	13.8.3	- protective mesh	kg	584.50	187.10	109,359.95
	13.9	Bridge bearings				
		NAL-b 350x450x85	pc	4.00	46,808.27	187,233.08
TOTAL METAL WORK						27,913,022.45
08.19.04.	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works.				
		* The price includes procurement, construction and installation as designed				
08.19.04.01	13.10.1	Concrete or stone curbs along the highway, 13/20 MB 40	m'	484.00	1,505.99	728,899.16
08.19.04.02	13.10.2	Insulating coat on pavement top	m ²	1,300.00	793.55	1,031,615.00
08.19.04.03	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth.	m ²	856.64	383.41	328,444.34
08.19.04.04	13.10.4	Bituminous pavement base course, BNHS 16A, 5 cm thick	m ²	1,331.00	481.10	640,344.10
08.19.04.05	13.10.4	Pavement wearing course of skeleton mastic asphalt SMA 0/11S, 4cm thick	m ²	1,331.00	623.96	830,490.76
08.19.04.06	13.10.5	Trial loading of constructed bridge.	lump sum		912,442.01	912,442.01
08.19.04.07	13.10.6	Photographing during bridge construction	lump sum		54,746.52	54,746.52
08.19.04.08	13.10.8	Fitting and sealing joints with elastic bituminous sealing compound (livobit) on asphalt next to curbs and cornices at footway level and next to expansion joints	m'	512.00	380.65	194,892.80
08.19.04.09	13.11.1	Laying PVC pipes into footways (cat walks), Ø110 mm	m'	120.00	483.87	58,064.40
08.19.04.10	13.11.2	Epoxy and polyurethane preservative on footways	m ²	244.00	584.33	142,576.52
08.19.04.11	13.11.8 additional specifications	Construction of cementitious grouting mortar beds	m ²	2.56	538.25	1,377.92
08.19.04.12	13.7.2	Cast iron pipes for gully water discharge including all fixing accessories	m'	9.00	7,697.69	69,279.21
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						4,993,172.74
SUMMARY - OVERPASS AT km 0+719.11						
08.19.01 EARTH WORKS						8,594,175.80
08.19.02 CONCRETE						27,480,077.27
08.19.03 METALWORK						27,913,022.45
08.19.04 FINISHING AND SUNDRY WORKS ON BRIDGES						4,993,172.74
TOTAL OVERPASS AT km 0+719.11						68,980,448.26

08.20. OVERPASS AT km 0+038.46 OF SPLIT LEVEL CROSSROAD PREDEJANE

LEG 2

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.20.01.	13.2	EARTH WORKS				
		Excavation for foundations				
08.20.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m				
		Payment per m ³ of excavated earth				
		- at depth of 0-2 m	m ³	1,128.40	226.73	255,842.13
		- at depth of 2-4 m	m ³	200.50	297.69	59,686.85
		- at depth of 4-6 m	m ³	276.00	368.67	101,752.92
08.20.01.02	13.2.1	Excavation of foundations in V category soil and transport of earth to distance of 500 m.				
		Payment per m ³ of excavated earth				
		- at depth of 4-6 m	m ³	45.14	439.63	19,844.90
		- at depth over 6 m	m ³	149.12	510.60	76,140.67
08.20.01.03	13.2.2	Extra for excavation of foundations with pumping of 30 lit/min - 120 lit/min water.	m ³	267.60	439.63	117,644.99
08.20.01.04	13.2.4	Backfilling of pier foundations with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa.				
		Payment per m ³ of compacted earth.	m ³	1,040.20	390.78	406,489.36
08.20.01.05	13.2.5	Construction of wedge made of well-graded gravel compacted in 30 cm thick layers to modulus of compressibility Ms=40 MPa. It shall be constructed behind the abutments.				
		Payment per m ³ of compacted gravel.	m ³	370.00	851.62	315,099.40
08.20.01.06	13.2.6 additional specifications	Extra for excavation to place all needed supports in the foundation pit including wooden shoring, combination of wooden shoring and steel supports and steel shoring. Payment per m ² of used material.	m ²	280.00	241.48	67,614.40
08.20.01.07	13.2.8 additional specifications	Construction of end slope of material from the cutting or borrow pit including mechanical compaction in 30 cm thick layers, fully as designed.				
		Payment per m ³ of compacted material.	m ³	421.00	301.38	126,880.98

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.20.01.08	13.2.9 additional specifications	Placing 80 cm thick cover protecting a gravel wedge made of gravel sand where top 30 cm shall be stabilized with cement and bottom 50 cm compacted in two layers to modulus of compressibility Ms=40 MPa				
		Payment per m ³ of compacted material	m ³	93.84	3,193.55	299,682.73
08.20.01.09	13.4.2	Construction of Ø120 cm piles with concrete, class MB 30, M-150, V-3	m ²	226.00	29,993.54	6,778,540.04
		Payment per m ² of completed pile				
TOTAL EARTH WORKS:						8,625,219.36
08.20.01.	13.4	CONCRETE				
		This shall apply to all items				
		* Concrete shall be mixed mechanically and compacted by vibrating				
		* Reinforcing bars shall be paid separately, except for bored piles				
		* Cables shall be paid separately				
		* The price of concrete includes formwork and scaffold				
		* Payment per m ³ of placed concrete for completely performed work				
	13.4.1	Plain concrete				
08.20.02.01	13.4.1.3 additional specifications	Blinding layer, 10 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs	m ³	25.90	6,387.09	165,425.63
08.20.02.02		Plain concrete under the pier S2, MB 30	m ³	90.00	7,409.21	666,828.90
	13.4.3	Reinforced concrete constructions				
08.20.02.03	13.4.3.1	Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 30, M-150, V-6	m ³	476.80	7,528.10	3,589,398.08
	13.4.3.2	Piers supporting plain spanning constructions of different systems and bearing beams				
08.20.02.04	13.4.3.2	Abutment bodies constructed of concrete, class II, MB 30, M-150, V-6	m ³	253.10	8,211.98	2,078,452.14
08.20.02.05	13.4.3.2	Abutment wing walls made of concrete, class II, MB 30, M-150, V-6	m ³	43.47	10,265.44	446,238.68
08.20.02.06	13.4.3.2	Abutment parapets constructed of concrete, class II, MB 30, M-150, V-6	m ³	16.53	8,211.98	135,744.03
08.20.02.07	13.4.3.2	Pedestrian cantilever walkway at abutment wing walls constructed of concrete, class II, MB 30, M-150, V-6	m ³	2.63	10,036.86	26,396.94
08.20.02.08	13.4.3.2	Masking covers of abutments and middle piers made of concrete, class II, MB 30, M-150, V-6	m ²	1.15	23,326.25	26,825.19
08.20.02.09	13.4.3.2	Middle pier bodies constructed of concrete, class II, MB 40, M-150, V-6	m ³	282.94	9,854.37	2,788,195.45
08.20.02.10	13.4.3.2	Abutment caps made of concrete, class II, MB 40, M-150, V-6	m ³	0.81	8,941.93	7,242.96
	13.4.3.3	Spanning bridge construction of reinforced concrete				
08.20.02.11	13.4.3.3	Main plate girder made of reinforced concrete class II, MB 40, M-150, V-6	m ³	815.88	20,799.99	16,970,295.84
08.20.02.12	13.4.3.4	Cornices at footway level (including inspection manholes) cast in situ Concrete class II MB 40, M-150, V-6	m ³	40.00	10,036.86	401,474.40
08.20.02.13	13.4.3.5	Crossing slabs made of concrete MB 30, M-150, V-6	m ³	17.25	7,528.10	129,859.73
08.20.02.14	13.4.3.4	Masking covers of cornices at footway level made of concrete, class II, MB 45, M-150, V-8	m ³	16.63	24,512.44	407,641.88
TOTAL CONCRETE WORKS:						27,840,019.84
08.20.03.	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions				
		* The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed				
08.20.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	417,435.70	63.59	26,544,736.16
08.20.03.02	13.6	Expansion joints - procurement and installation as designed MT-100.	m ²	17.00	40,880.17	694,962.89
08.20.03.03	13.7	S-7 gullies of cast iron, procurement and installation as designed	pc	7.00	18,248.84	127,741.88
	13.8	Steel bridge fences:				
08.20.03.04	13.8.3	- protective mesh	kg	584.50	187.10	109,359.95
08.20.03.05	13.9	Bridge bearings				
		NaL-b 350x450x85	pc	4.00	46,808.27	187,233.08
TOTAL METAL WORK						27,664,033.96
08.20.04.	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works:				
		* The price includes procurement, construction and installation as designed				
08.20.04.01	13.10.1	Concrete or stone curbs along the highway, 13/20 MB 40	m ²	484.00	1,505.99	728,899.16
08.20.04.02	13.10.2	Insulating coat on pavement top	m ²	1,396.00	793.55	1,107,795.80
08.20.04.03	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth.	m ²	874.30	383.41	335,215.36
08.20.04.04	13.10.4	Bituminous pavement base course, BNHS 16A, 5 cm thick	m ³	1,347.00	481.10	648,041.70
08.20.04.05	13.10.4	Pavement wearing course of skeleton mastic asphalt SMA 0/11S, 4cm thick	m ²	1,347.00	623.96	840,474.12
08.20.04.06	13.10.5	Trial loading of constructed bridge	lump sum		912,442.01	912,442.01
08.20.04.07	13.10.6	Photographing during bridge construction	lump sum		54,746.52	54,746.52
08.20.04.08	13.10.8	Fitting and sealing joints with elastic bituminous sealing compound (Ivobit) on asphalt next to curbs and cornices at footway level and next to expansion joints	m ¹	516.00	380.65	196,415.40
08.20.04.09	13.11.1	Laying PVC pipes into footways (cat walks), Ø110 mm	m ¹	120.00	483.87	58,064.40
08.20.04.10	13.11.2	Epoxy and polyurethane preservative on footways	m ²	244.00	584.33	142,576.52
08.20.04.11	13.11.8 additional specifications	Construction of cementitious grouting mortar beds	m ²	2.56	538.25	1,377.92



Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.20.04.12	13.7.2	Cast iron pipes for gully water discharge including all fixing accessories	m	9.00	7,697.69	69,279.21
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						5,095,328.12

SUMMARY OVERPASS AT km 0+038.46						
08.20.01	EARTH WORKS					8,625,219.36
08.20.02	CONCRETE					27,840,019.84
08.20.03	METALWORK					27,664,033.96
08.20.04	FINISHING AND SUNDRY WORKS ON BRIDGES					5,095,328.12
TOTAL OVERPASS AT km 0+038.46						69,224,601.29

08.21. UNDERPASS AT km 0+30.0 OF SPLIT LEVEL CROSSROAD PREDEJANE

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.21.01.	13.2	EARTH WORKS				
Excavation for foundations						
08.21.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m				
		Payment per m ³ of excavated earth				
		- at depth of 0-2 m	m ³	630.00	226.73	142,839.90
		- at depth of 2-4 m	m ³	122.50	297.69	36,467.03
08.21.01.02	13.2.2	Extra for excavation of foundations with pumping of 30 lit/min - 120 lit/min water	m ³	400.00	439.63	175,852.00
08.21.01.03	13.2.4	Backfilling of pier foundations with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa				
		Payment per m ³ of compacted earth	m ³	378.00	390.78	147,714.84
08.21.01.04	13.2.5	Construction of wedge made of well-graded gravel compacted in 30 cm thick layers to modulus of compressibility Ms=40 MPa. It shall be constructed behind the abutments				
		Payment per m ³ of compacted gravel	m ³	400.00	851.62	340,648.00
08.21.01.05	13.2.7 additional specifications	Placing the sub-base made of gravel and sand in 30 cm thick layers under foundation including compaction of layers to modulus of compressibility Ms=30 MPa				
		Payment per m ³ of compacted gravel	m ³	39.60	1,078.34	42,702.26
08.21.01.06	13.2.9 additional specifications	Placing 80 cm thick cover protecting a gravel wedge made of gravel sand where top 30 cm shall be stabilized with cement and bottom 50 cm compacted in two layers to modulus of compressibility Ms=40 MPa				
		Payment per m ³ of compacted gravel	m ³	39.20	3,193.55	125,187.16
TOTAL EARTH WORKS:						1,011,411.19
08.21.02.	13.4	CONCRETE				
This shall apply to all items: * Concrete shall be mixed mechanically and compacted by vibrating. * Reinforcing bars shall be paid separately, except for bored piles. * Cables shall be paid separately. * The price of concrete includes formwork and scaffold. * Payment per m ³ of placed concrete for completely performed work						
13.4.1 Plain concrete						
08.21.02.01	13.4.1.3 additional specifications	Blinding layer, 10 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs.	m ³	28.70	6,387.09	183,309.48
08.21.02.02	13.4.1.2 additional specifications	Protective concrete over waterproofing layer (MB20, 5cm) with galvanized mesh.	m ²	209.50	686.64	143,851.08
13.4.3 Reinforced concrete constructions						
08.21.02.03	13.4.3.1	Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 30, M-150, V-6	m ³	122.80	7,528.10	924,450.68
13.4.3.2 Piers supporting plain spanning constructions of different systems and bearing beams						
08.21.02.04	13.4.3.2	Abutment bodies constructed of concrete, class II, MB 30, M-150, V-6	m ³	92.60	8,211.98	760,429.35
08.21.02.05	13.4.3.2	Abutment wing walls made of concrete, class II, MB 30, M-150, V-6	m ³	32.40	10,265.44	332,600.26
13.4.3.3 Spanning bridge construction of reinforced concrete						
08.21.02.06	13.4.3.3	Main plate girders made of reinforced concrete class II, MB 30, M-150, V-6	m ³	54.00	12,070.96	651,831.84
08.21.02.07	13.4.3.4	Cornices at footway level (including inspection manholes) cast in situ. Concrete class II MB 30, M-150, V-6	m ³	8.50	10,036.86	85,313.31
08.21.02.08	13.4.3.5	Crossing slabs made of concrete MB 30, M-150, V-6	m ³	36.00	7,528.10	271,011.60
TOTAL CONCRETE WORKS:						3,352,797.60
08.21.03.	13.5	METALWORK				
Reinforcing bars in concrete members and constructions						
* The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed.						
08.21.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	87,310.33	63.59	5,552,063.88
Steel bridge fences:						
08.21.03.02	13.8.2	- tubular fences or fences made of steel sections	kg	400.00	259.91	103,964.00
TOTAL METAL WORK						5,656,027.88

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.21.04.	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works:				
		* The price includes procurement, construction and installation as designed				
08.21.04.01	13.10.1	Concrete or stone curbs along the highway, 13/20 MB 40	m ^l	12.00	1,505.99	18,071.88
08.21.04.02	13.10.2	Insulating coat on pavement top	m ²	104.80	793.55	83,164.04
08.21.04.03	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	608.20	383.41	233,189.96
08.21.04.04	13.10.4	Bituminous pavement base course, BNHS 16A, 5 cm thick	m ²	74.40	481.10	35,793.84
08.21.04.05	13.10.4	Pavement wearing course of skeleton mastic asphalt SMA 0/11S, 4cm thick	m ²	74.40	623.96	46,422.62
08.21.04.06	13.10.5	Trial loading of constructed bridge	lump sum		912,442.01	912,442.01
08.21.04.07	13.10.6	Photographing during bridge construction	lump sum		54,746.52	54,746.52
08.21.04.08	13.10.8	Fitting and sealing joints with elastic bituminous sealing compound (livobit) on asphalt next to curbs and cornices at footway level and next to expansion joints	m ^l	24.00	380.65	9,135.60
08.21.04.09	13.11.2	Epoxy and polyurethane preservative on footways	m ²	36.00	584.33	21,035.88
08.21.04.10	13.11.8 additional specifications	Construction of cementitious grouting mortar beds	m ²	2.64	538.25	1,420.98
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						1,415,423.34

SUMMARY UNDERPASS AT km 0+030.0		
08.21.01	EARTH WORKS	1,011,411.19
08.21.02	CONCRETE	3,352,797.60
08.21.03	METALWORK	5,656,027.88
08.21.04	FINISHING AND SUNDRY WORKS ON BRIDGES	1,415,423.34
TOTAL UNDERPASS AT km 0+030.0		11,435,660.01

08.22. TOP SLAB CULVERT AT km 0+112.53 OF SPLIT LEVEL CROSSROAD PREDEJANE

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.22.01.	13.2	EARTH WORKS				
		Excavation for foundations				
08.22.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m. Payment per m ³ of excavated earth - at depth of 0-2 m	m ³	617.90	226.73	140,096.47
		- at depth of 2-4 m	m ³	309.95	297.69	92,269.02
08.22.01.02	13.2.5	Construction of wedge made of well-graded gravel compacted in 30 cm thick layers to modulus of compressibility Ms=40 MPa. It shall be constructed behind the abutments. Payment per m ³ of compacted gravel	m ³	1,226.18	851.62	1,044,239.41
08.22.01.03	13.2.7 additional specifications	Placing the sub-base made of gravel and sand in 30 cm thick layers under foundation including compaction of layers to modulus of compressibility Ms=30 MPa. Payment per m ³ of compacted gravel	m ³	149.60	1,078.34	161,319.66
TOTAL EARTH WORKS:						1,437,924.56
08.22.02.	13.4	CONCRETE				
		This shall apply to all items: * Concrete shall be mixed mechanically and compacted by vibrating. * Reinforcing bars shall be paid separately, except for bored piles. * Cables shall be paid separately * The price of concrete includes formwork and scaffold. * Payment per m ³ of placed concrete for completely performed work				
		Plain concrete				
08.22.02.01	13.4.1.3 additional specifications	Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs	m ³	60.27	6,387.09	384,949.91
08.22.02.02	13.4.1.1 additional specifications	Concrete layer for slope. Concrete class I MB 20.	m ³	128.52	6,660.83	856,049.87
08.22.02.03	13.4.2 additional specifications	Protective concrete over waterproofing layer (MB20, 5cm) with galvanized mesh	m ²	359.04	686.64	246,531.23
		Reinforced concrete constructions				
08.22.02.04	13.4.3.1	Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 30, M-150, V-6	m ³	167.09	7,528.10	1,257,870.23
		Piers supporting plain spanning constructions of different systems and bearing beams				
08.22.02.05	13.4.3.2	Abutment bodies constructed of concrete, class II, MB 30, M-150, V-6	m ³	251.47	8,211.98	2,065,066.61
08.22.02.06	13.4.3.2	Abutment wing walls made of concrete, class II, MB 30, M-150, V-6.	m ³	59.30	10,265.44	608,740.59
		Spanning bridge construction of reinforced concrete				
08.22.02.07	13.4.3.3	Main plate girder made of reinforced concrete class II, MB 30, M-150, V-6	m ³	83.81	12,070.96	1,011,667.16
08.22.02.08	13.4.3.4	Cornices at footway level (including inspection manholes) cast in situ Concrete class II MB 30, M-150, V-6	m ³	1.70	10,036.86	17,062.66
TOTAL CONCRETE WORKS:						6,447,938.26

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.22.03.	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions				
		* The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed				
08.22.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	56,058.36	63.59	3,564,751.11
08.22.03.02	13.8.2	Steel bridge fences: - tubular fences or fences made of steel sections	kg	171.20	259.91	44,496.59
TOTAL METAL WORK						3,609,247.70
08.22.04.	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works				
		* The price includes procurement, construction and installation as designed				
08.22.04.01	13.10.2	Insulating coat on pavement top	m ²	359.04	793.55	284,916.19
08.22.04.02	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	951.15	383.41	364,680.42
08.22.04.03	13.10.5	Trial loading of constructed bridge	lump sum		912,442.01	912,442.01
08.22.04.04	13.10.6	Photographing during bridge construction	lump sum		54,746.52	54,746.52
08.22.04.05	13.10.8	Fitting and sealing joints with elastic bituminous sealing compound (livobit) on asphalt next to curbs and cornices at footway level and next to expansion joints	m ¹	7.40	380.65	2,816.81
08.22.04.06	13.11.6 additional specifications	Crashed stone revetment	m ³	95.64	6,898.62	659,784.02
08.22.04.07	13.11.15 additional specifications	'Fugeband' tapes for sealing concrete connections	m ¹	154.00	2,132.72	328,438.88
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						2,607,824.85

SUMMARY SLAB TOP CULVERT AT km 0+112.53		
08.22.01	EARTH WORKS	1,437,924.56
08.22.02	CONCRETE	6,447,938.26
08.22.03	METALWORK	3,609,247.70
08.22.04	FINISHING AND SUNDRY WORKS ON BRIDGES	2,607,824.85
TOTAL SLAB TOP CULVERT AT km 0+112.53		14,102,935.38

08.23. BRIDGE AT km 0+264.889

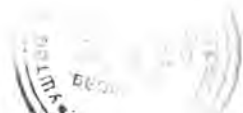
Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.23.01.	13.2	EARTH WORKS				
		Excavation for foundations				
		Excavation of foundations in II and III category soil and transport of earth to distance of 500 m				
		Payment per m ³ of excavated earth:				
		- at depth of 0-2 m	m ³	2,060.20	226.73	467,109.15
		- at depth of 2-4 m	m ³	1,445.70	297.69	430,370.43
08.23.01.02	13.2.1	Excavation of foundations in V category soil and transport of earth to distance of 500 m.				
		Payment per m ³ of excavated earth:				
		- at depth of 4-6 m	m ³	1,032.10	439.63	453,742.12
08.23.01.03	13.2.2	Extra for excavation of foundations with pumping of 30 lit/min - 120 lit/min water	m ³	2,000.00	439.63	879,260.00
08.23.01.04	13.2.4	Backfilling of pier foundations with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa				
		Payment per m ³ of compacted earth	m ³	1,589.00	390.78	620,949.42
08.23.01.05	13.2.5	Construction of wedge made of well-graded gravel compacted in 30 cm thick layers to modulus of compressibility Ms=40 MPa. It shall be constructed behind the abutments				
		Payment per m ³ of compacted gravel	m ³	752.80	851.62	641,099.54
08.23.01.06	13.2.8 additional specifications	Construction of end slope of material from the cutting or borrow pit including mechanical compaction in 30 cm thick layers, fully as designed.				
		Payment per m ³ of compacted material	m ³	663.00	301.38	199,814.94
08.23.01.07	13.2.9 additional specifications	Placing 80 cm thick cover protecting a gravel wedge made of gravel sand where top 30 cm shall be stabilized with cement and bottom 50 cm compacted in two layers to modulus of compressibility Ms=40 MPa.				
		Payment per m ³ of compacted material	m ³	152.00	3,193.55	485,419.60
TOTAL EARTH WORKS:						4,177,765.20
08.23.02.	13.4	CONCRETE				
		This shall apply to all items:				
		* Concrete shall be mixed mechanically and compacted by vibrating.				
		* Reinforcing bars shall be paid separately, except for bored piles				
		* Cables shall be paid separately				
		* The price of concrete includes formwork and scaffold				
		* Payment per m ³ of placed concrete for completely performed work				
		Plain concrete				
08.23.02.01	13.4.1 additional specifications	Blinding layer, 10 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs.	m ³	14.30	6,387.09	91,335.39
		Reinforced concrete constructions				

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.23.02.02	13.4.3.1	Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 30, M-150, V-6	m ³	85.80	7,528.10	645,910.98
	13.4.3.2	Piers supporting plain spanning constructions of different systems and bearing beams				
08.23.02.03	13.4.3.2	Abutment bodies constructed of concrete, class II, MB 30, M-150, V-6	m ³	150.00	8,211.98	1,231,797.00
08.23.02.04	13.4.3.2	Abutment wing walls made of concrete, class II, MB 30, M-150, V-6.	m ³	69.30	10,265.44	711,394.09
08.23.02.05	13.4.3.2	Pedestrian cantilever walkway at abutment wing walls constructed of concrete, class II, MB 30, M-150, V-6	m ³	30.00	10,036.86	301,105.80
	13.4.3.3	Spanning bridge construction of reinforced concrete				
08.23.02.06	13.4.3.3	Main plate girder made of reinforced concrete class II, MB 30, M-150, V-6.	m ³	94.20	12,070.96	1,137,084.43
08.23.02.07	13.4.3.4	Cornices at footway level (including inspection manholes) cast in situ Concrete class II MB 30, M-150, V-6	m ³	16.70	10,036.86	167,615.56
08.23.02.08	13.4.3.5	Crossing slabs made of concrete MB 30, M-150, V-6	m ³	20.10	7,528.10	151,314.81
TOTAL CONCRETE WORKS:						4,437,558.96
08.23.02.	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions				
		* The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed.				
08.23.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	69,264.81	63.59	4,404,549.27
TOTAL METAL WORK						4,404,549.27
08.23.04.	13.10	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works.				
		* The price includes procurement, construction and installation as designed.				
08.23.04.01	13.10.1	Concrete or stone curbs along the highway, 13/20 MB 40	m	53.50	1,505.99	80,570.47
08.23.04.02	13.10.2	Insulating coat on pavement top	m ²	174.70	793.55	138,633.19
08.23.04.03	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	1,078.70	383.41	413,584.37
08.23.04.04	13.10.4	Bituminous pavement base course, BNHS 16A, 5 cm thick	m ²	117.70	481.10	56,625.47
08.23.04.05	13.10.4	Pavement wearing course of skeleton mastic asphalt SMA 0/11S, 4cm thick	m ²	117.70	623.96	73,440.09
08.23.04.06	13.10.5	Trial loading of constructed bridge	lump sum		912,442.01	912,442.01
08.23.04.07	13.10.6	Photography during bridge construction	lump sum		54,746.52	54,746.52
08.23.04.08	13.10.8	Fitting and sealing joints with elastic bituminous sealing compound ('livobit) on asphalt next to curbs and cornices at footway level and next to expansion joints	m	53.50	380.65	20,364.78
08.23.04.09	13.11.1	Laying PVC pipes into footways (cat walks), Ø110 mm	m	214.00	483.87	103,548.18
08.23.04.10	13.11.2	Epoxy and polyurethane preservative on footways	m ²	56.18	584.33	32,824.74
08.23.04.11	13.11.6 additional specifications	Crashed stone revetment	m ³	69.10	6,898.62	476,694.64
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						2,363,474.44

SUMMARY BRIDGE AT km 0+264.889		
08.23.01	EARTH WORKS	4,177,765.20
08.23.02	CONCRETE	4,437,558.96
08.23.03	METALWORK	4,404,549.27
08.23.04	FINISHING AND SUNDRY WORKS ON BRIDGES	2,363,474.44
TOTAL BRIDGE AT km 0+264.889		15,383,347.87

08.24. BRIDGE AT LOCAL ROAD L5, AT km 0+115.365

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.24.01.	13.2	EARTH WORKS				
		Excavation for foundations				
08.24.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m. Payment per m ³ of excavated earth - at depth of 0-2 m	m ³	321.00	226.73	72,780.33
		- at depth of 2-4 m	m ³	279.00	297.69	83,055.51
		- at depth of 4-6 m	m ³	176.60	368.67	65,107.12
08.24.01.02	13.2.2	Extra for excavation of foundations with pumping of 30 lit/min - 120 lit/min water	m ³	500.00	439.63	219,815.00
08.24.01.03	13.2.4	Backfilling of pier foundations with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa Payment per m ³ of compacted earth	m ³	133.40	390.78	52,130.05
08.24.01.04	13.2.5	Construction of wedge made of well-graded gravel compacted in 30 cm thick layers to modulus of compressibility Ms=40 MPa. It shall be constructed behind the abutments. Payment per m ³ of compacted gravel.	m ³	160.00	851.62	136,259.20
08.24.01.05	13.2.9 additional specifications	Placing 80 cm thick cover protecting a gravel wedge made of gravel sand where top 30 cm shall be stabilized with cement and bottom 50 cm compacted in two layers to modulus of compressibility Ms=40 MPa. Payment per m ³ of compacted gravel.	m ³	31.70	3,193.55	101,235.54
TOTAL EARTH WORKS:						730,382.75



Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.24.02	13.4	CONCRETE				
		This shall apply to all items: * Concrete shall be mixed mechanically and compacted by vibrating. * Reinforcing bars shall be paid separately, except for bored piles * Cables shall be paid separately * The price of concrete includes formwork and scaffold * Payment per m ³ of placed concrete for completely performed work				
	13.4.1	Plain concrete				
08.24.02.01	13.4.1.3 additional specifications	Blinding layer, 10 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs.	m ³	7.60	6,387.09	48,541.88
08.24.02.02	13.4.1.1 additional specifications	Concrete layer for slope Concrete class I MB 20	m ³	3.70	6,660.83	24,645.07
08.24.02.03	13.4.2 additional specifications	Protective concrete over waterproofing layer (MB20, 5cm) with galvanized mesh	m ²	54.00	686.64	37,078.56
	13.4.3	Reinforced concrete constructions				
08.24.02.04	13.4.3.1	Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 30, M-150, V-6.	m ³	20.60	7,528.10	155,078.86
	13.4.3.2	Piers supporting plain spanning constructions of different systems and bearing beams				
08.24.02.05	13.4.3.2	Abutment bodies constructed of concrete, class II, MB 30, M-150, V-6.	m ³	27.00	8,211.98	221,723.46
08.24.02.06	13.4.3.2	Abutment wing walls made of concrete, class II, MB 30, M-150, V-6	m ³	24.00	10,265.44	246,370.56
	13.4.3.3	Spanning bridge construction of reinforced concrete				
08.24.02.07	13.4.3.3	Main plate girder made of reinforced concrete class II, MB 30, M-150, V-6.	m ³	23.20	12,070.96	280,046.27
08.24.02.08	13.4.3.4	Cornices at footway level (including inspection manholes) cast in situ Concrete class II MB 30, M-150, V-6	m ³	13.80	10,036.86	138,508.67
08.24.02.09	13.4.3.5	Crossing slabs made of concrete MB 30, M-150, V-6	m ³	13.40	7,528.10	100,876.54
TOTAL CONCRETE WORKS:						1,252,869.88

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.24.03	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed				
08.24.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	15,827.70	63.59	1,006,483.44
	13.8	Steel bridge fences:				
08.24.03.02	13.8.2	- tubular fences or fences made of steel sections	kg	659.70	259.91	171,462.63
TOTAL METAL WORK						1,177,946.07

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.24.04	13.10	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works: * The price includes procurement, construction and installation as designed				
08.24.04.01	13.10.2	Insulating coat on pavement top	m ²	55.00	793.55	43,645.25
08.24.04.02	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	210.00	383.41	80,516.10
08.24.04.03	13.10.5	Trial loading of constructed bridge	lump sum		912,442.01	912,442.01
08.24.04.04	13.10.6	Photographing during bridge construction	lump sum		54,746.52	54,746.52
08.24.04.05	13.10.8	Fitting and sealing joints with elastic bituminous sealing compound (Ivobit) on asphalt next to curbs and cornices at footway level and next to expansion joints	m ¹	18.00	380.65	6,851.70
08.24.04.06	13.11.2	Epoxy and polyurethane preservative on footways	m ²	27.00	584.33	15,776.91
08.24.04.07	13.11.6 additional specifications	Crashed stone revetment	m ³	9.80	6,898.62	67,606.48
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						1,181,584.97

SUMMARY BRIDGE AT LOCAL ROAD I.S, AT km 0+115.365		Total
08.24.01	EARTH WORKS	730,382.75
08.24.02	CONCRETE WORKS	1,252,869.88
08.24.03	METAL WORK	1,177,946.07
08.24.04	FINISHING AND SUNDRY WORKS ON BRIDGES	1,181,584.97
TOTAL BRIDGE AT km 0+115.365:		4,342,783.66

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.25.01	13.2	EARTH WORKS				
		Excavation for foundations				
08.25.01.01	13.2.1	Excavation of foundations in IV category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth				
		- at depth of 0-2 m	m ³	54.52	226.73	12,361.32
		- at depth of 2-4 m	m ³	51.66	297.69	15,378.67
		- at depth of 4-6 m	m ³	46.70	368.67	17,216.89
		- at depth over 6 m	m ³	71.99	439.63	31,648.96
08.25.01.02	13.2.4	Backfilling with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa Payment per m ³ of compacted earth.	m ³	67.60	301.38	20,373.29
TOTAL EARTH WORKS:						96,979.13

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.25.02.	13.4	CONCRETE				
		This shall apply to all items: * Concrete shall be mixed mechanically and compacted by vibrating. * Reinforcing bars shall be paid separately, except for bored piles. * Cables shall be paid separately. * The price of concrete includes formwork and scaffold * Payment per m ³ of placed concrete for completely performed work				
08.25.02.01	13.4.1	Plain concrete				
	13.4.1.3 additional specifications	Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs.	m ³	2.40	6,387.09	15,329.02
08.25.02.02	13.4.3	Reinforced concrete constructions				
	13.4.3.1	Reinforced concrete for inlet structure class II MB 30, M-150, V-6	Concrete m ³	54.02	9,694.93	523,720.12
TOTAL CONCRETE WORKS:						539,049.13
08.25.03.	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed				
08.25.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	4,437.16	63.59	282,159.00
08.25.03.02	13.5.1	Welded mesh reinforcement MAG 500/560	kg	2,233.65	72.81	162,632.06
TOTAL METAL WORK						444,791.06
08.25.04.	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works: * The price includes procurement, construction and installation as designed				
08.25.04.01	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth.	m ²	130.40	383.41	49,996.66
08.25.04.02	13.10.10	Procurement, transport and installation of metal rungs. Payment per pieces	pc	46.00	437.79	20,138.34
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						70,135.00
SUMMARY INLET STRUCTURE AT km 882+480.90						
08.25.01 EARTH WORKS						96,979.13
08.25.02 CONCRETE						539,049.13
08.25.03 METALWORK						444,791.06
08.25.04 FINISHING AND SUNDRY WORKS ON BRIDGES						70,135.00
TOTAL INLET STRUCTURE AT km 882+480.90						1,150,954.33

08.25. INLET STRUCTURE UG1 AND UG2 AT km 883+762.574

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.25.01.	13.2	EARTH WORKS				
		Excavation for foundations				
08.25.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth - at depth of 0-2 m	m ³	88.62	226.73	20,092.81
		- at depth of 2-4 m	m ³	87.19	297.69	25,955.59
		- at depth of 4-6 m	m ³	84.92	368.67	31,307.46
08.25.01.02	13.2.1	Excavation of foundations in IV category soil and transport of earth to distance of 500 m. Payment per m ³ of excavated earth - at depth over 6 m	m ³	143.44	439.63	63,060.53
08.25.01.03	13.2.4	Backfilling with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa. Payment per m ³ of compacted earth.	m ³	125.20	301.38	37,732.78
TOTAL EARTH WORKS:						178,149.16
08.25.02.	13.4	CONCRETE				
		This shall apply to all items: * Concrete shall be mixed mechanically and compacted by vibrating. * Reinforcing bars shall be paid separately, except for bored piles. * Cables shall be paid separately. * The price of concrete includes formwork and scaffold * Payment per m ³ of placed concrete for completely performed work				
08.25.02.01	13.4.1	Plain concrete				
	13.4.1.3 additional specifications	Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs.	m ³	4.80	6,387.09	30,658.03
08.25.02.02	13.4.3	Reinforced concrete constructions				
	13.4.3.1	Reinforced concrete for inlet structure class II MB 30, M-150, V-6	Concrete m ³	103.90	9,694.93	1,007,303.23
TOTAL CONCRETE WORKS:						1,037,961.26
08.25.03.	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed				
08.25.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	8,644.78	63.59	549,721.56
08.25.03.02	13.5.1	Welded mesh reinforcement MAG 500/560	kg	4,285.19	72.81	312,004.68
TOTAL METAL WORK						861,726.24



Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.25.04.	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works * The price includes procurement, construction and installation as designed				
08.25.04.01	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth.	m ²	249.60	383.41	95,699.14
08.25.04.02	13.10.10	Procurement, transport and instalation of metal rungs. Payment per pieces	pc	88.00	437.79	38,525.52
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						134,224.66

SUMMARY INLECT STRUCTURE UG1 AND UG2 AT km 883+762.574		
08.25.01	EARTH WORKS	178,149.16
08.25.02	CONCRETE	1,037,961.26
08.25.03	METALWORK	861,726.24
08.25.04	FINISHING AND SUNDRY WORKS ON BRIDGES	134,224.66
TOTAL INLECT STRUCTURE UG1 AND UG2 AT km 883+762.574		2,212,061.32

08.25. INLECT STRUCTURE AT km 883+882.283

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.25.01.	13.2	EARTH WORKS				
		Excavation for foundations				
08.25.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth - at depth of 0-2 m	m ³	48.51	226.73	10,998.67
		- at depth of 2-4 m	m ³	45.78	297.69	13,628.25
08.25.01.02	13.2.1	Excavation of foundations in IV category soil and transport of earth to distance of 500 m. Payment per m ³ of excavated earth - at depth of 4-6 m	m ³	45.44	368.67	16,752.36
		- at depth over 6 m	m ³	55.52	439.63	24,408.26
08.25.01.03	13.2.4	Backfilling with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa. Payment per m ³ of compacted earth.	m ³	57.60	301.38	17,359.49
TOTAL EARTH WORKS:						83,147.03

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.25.02.	13.4	CONCRETE				
		This shall apply to all items: * Concrete shall be mixed mechanically and compacted by vibrating. * Reinforcing bars shall be paid separately, except for bored piles * Cables shall be paid separately. * The price of concrete includes formwork and scaffold. * Payment per m ³ of placed concrete for completely performed work				
		Plain concrete				
08.25.02.01	13.4.1.3 additional specifications	Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs.	m ³	1.95	6,387.09	12,454.83
		Reinforced concrete constructions				
08.25.02.02	13.4.3 13.4.3.1	Reinforced concrete for inlet structure class II MB 30, M-150, V-6.	Concrete m ³	40.46	9,694.93	392,256.87
TOTAL CONCRETE WORKS:						404,711.69

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.25.03.	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed.				
08.25.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	2,819.68	63.59	179,303.45
08.25.03.02	13.5.1	Welded mesh reinforcement MAG 500/560	kg	1,801.02	72.81	131,152.27
TOTAL METAL WORK						310,435.72

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.25.04.	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works: * The price includes procurement, construction and installation as designed				
08.25.04.01	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth.	m ²	100.20	383.41	38,417.68
08.25.04.02	13.10.10	Procurement, transport and instalation of metal rungs. Payment per pieces	pc	34.00	437.79	14,884.86
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						53,302.54

SUMMARY INLECT STRUCTURE AT km 883+882.283		
08.25.01	EARTH WORKS	83,147.03
08.25.02	CONCRETE	404,711.69
08.25.03	METALWORK	310,435.72
08.25.04	FINISHING AND SUNDRY WORKS ON BRIDGES	53,302.54
TOTAL INLECT STRUCTURE AT km 883+882.283		851,596.98

08.25. INLECT STRUCTURE UG1 AND UG2 AT km 883+952.142

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.25.01.	13.2	EARTH WORKS				
		Excavation for foundations				
08.25.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m. Payment per m ³ of excavated earth - at depth of 0-2 m	m ³	90.80	226.73	20,587.08
		- at depth of 2-4 m	m ³	46.41	297.69	13,815.79
08.25.01.02	13.2.1	Excavation of foundations in IV category soil and transport of earth to distance of 500 m. Payment per m ³ of excavated earth - at depth of 2-4 m	m ³	39.48	297.69	11,752.80
		- at depth of 4-6 m	m ³	88.26	368.67	32,538.81
		- at depth over 6 m	m ³	72.64	439.63	31,934.72
08.25.01.03	13.2.4	Backfilling with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa. Payment per m ³ of compacted earth.	m ³	119.60	301.38	36,045.05
TOTAL EARTH WORKS:						146,674.26
08.25.02.	13.4	CONCRETE				
		This shall apply to all items * Concrete shall be mixed mechanically and compacted by vibrating. * Reinforcing bars shall be paid separately, except for bored piles. * Cables shall be paid separately. * The price of concrete includes formwork and scaffold. * Payment per m ³ of placed concrete for completely performed work				
	13.4.1	Plain concrete				
08.25.02.01	13.4.1.3 additional specifications	Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs.	m ³	4.35	6,387.09	27,783.84
	13.4.3	Reinforced concrete constructions				
08.25.02.02	13.4.3.1	Reinforced concrete for inlet structure class II MB 30, M-150, V-6.	Concrete	94.44	9,694.93	915,589.19
TOTAL CONCRETE WORKS:						943,373.03
08.25.03.	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed				
08.25.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	7,256.84	63.59	461,462.46
08.25.03.02	13.5.1	Welded mesh reinforcement MAG 500/560	kg	4,034.67	72.81	293,764.32
TOTAL METAL WORK						755,226.78
08.25.04.	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works * The price includes procurement, construction and installation as designed				
08.25.04.01	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth.	m ²	230.52	383.41	88,383.67
08.25.04.02	13.10.10	Procurement, transport and installation of metal rungs. Payment per pieces	pc	80.00	437.79	35,023.20
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						123,406.87

SUMMARY INLECT STRUCTURE UG1 AND UG2 AT km 883+952.142	
08.25.01. EARTH WORKS	146,674.26
08.25.02. CONCRETE	943,373.03
08.25.03. METALWORK	755,226.78
08.25.04. FINISHING AND SUNDRY WORKS ON BRIDGES	123,406.87
TOTAL INLECT STRUCTURE UG1 AND UG2 AT km 883+952.142	1,968,680.95

08.25. INLECT STRUCTURE AT km 884+241.537

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.25.01.	13.2	EARTH WORKS				
		Excavation for foundations				
08.25.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m. Payment per m ³ of excavated earth - at depth of 0-2 m	m ³	39.27	226.73	8,903.69
08.25.01.02	13.2.1	Excavation of foundations in IV category soil and transport of earth to distance of 500 m. Payment per m ³ of excavated earth - at depth of 2-4 m	m ³	36.12	297.69	10,752.56
		- at depth of 4-6 m	m ³	34.02	368.67	12,542.15
		- at depth over 6 m	m ³	22.68	439.63	9,970.81
08.25.01.03	13.2.4	Backfilling with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa. Payment per m ³ of compacted earth.	m ³	52.00	301.38	15,671.76
TOTAL EARTH WORKS:						57,840.97



Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.25.02.	13.4	CONCRETE				
		This shall apply to all items: * Concrete shall be mixed mechanically and compacted by vibrating * Reinforcing bars shall be paid separately, except for bored piles * Cables shall be paid separately. * The price of concrete includes formwork and scaffold. * Payment per m ³ of placed concrete for completely performed work				
08.25.02.01	13.4.1	Plain concrete				
	13.4.1.3 additional specifications	Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs.	m ³	1.95	6,387.09	12,454.83
08.25.02.02	13.4.3	Reinforced concrete constructions				
	13.4.3.1	Reinforced concrete for inlet structure class II MB 30, M-150, V-6	Concrete m ³	40.46	9,694.93	392,256.87
TOTAL CONCRETE WORKS:						404,711.69
08.25.03.	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed				
08.25.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	2,819.68	63.59	179,303.45
08.25.03.02	13.5.1	Welded mesh reinforcement MAG 500/560	kg	1,801.02	72.81	131,132.27
TOTAL METAL WORK						310,435.72
08.25.04.	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works * The price includes procurement, construction and installation as designed				
08.25.04.01	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	100.20	383.41	38,417.68
08.25.04.02	13.10.10	Procurement, transport and installation of metal rungs. Payment per pieces	pc	34.00	437.79	14,884.86
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						53,302.54
SUMMARY INLECT STRUCTURE AT km 884+241.537						
08.25.01 EARTH WORKS						57,840.97
08.25.02 CONCRETE						404,711.69
08.25.03 METALWORK						310,435.72
08.25.04 FINISHING AND SUNDRY WORKS ON BRIDGES						53,302.54
TOTAL INLECT STRUCTURE AT km 884+241.537						826,290.92

08.25. INLECT STRUCTURE UG1 AND UG2 AT km 884+306.224

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.25.01.	13.2	EARTH WORKS				
		Excavation for foundations				
08.25.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth - at depth of 0-2 m	m ³	84.17	226.73	19,083.86
		- at depth of 2-4 m	m ³	78.71	297.69	23,431.18
		- at depth of 4-6 m	m ³	34.82	368.67	12,837.09
08.25.01.02	13.2.1	Excavation of foundations in IV category soil and transport of earth to distance of 500 m. Payment per m ³ of excavated earth - at depth of 4-6 m	m ³	41.54	368.67	15,314.55
		- at depth over 6 m	m ³	37.12	439.63	16,319.07
08.25.01.02	13.2.4	Backfilling with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa. Payment per m ³ of compacted earth.	m ³	100.80	301.38	30,379.10
TOTAL EARTH WORKS:						117,364.85
08.25.02.	13.4	CONCRETE				
		This shall apply to all items: * Concrete shall be mixed mechanically and compacted by vibrating * Reinforcing bars shall be paid separately, except for bored piles * Cables shall be paid separately. * The price of concrete includes formwork and scaffold. * Payment per m ³ of placed concrete for completely performed work				
		Plain concrete				
08.25.02.01	13.4.1	Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs.	m ³	4.35	6,387.09	27,783.84
08.25.02.02	13.4.3	Reinforced concrete constructions				
	13.4.3.1	Reinforced concrete for inlet structure class II MB 30, M-150, V-6	Concrete m ³	85.06	9,694.93	824,650.75
TOTAL CONCRETE WORKS:						852,434.89
08.25.03.	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed				
08.25.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	7,373.29	63.59	468,867.51
08.25.03.02	13.5.1	Welded mesh reinforcement MAG 500/560	kg	4,103.08	72.81	298,745.25
TOTAL METAL WORK						767,612.77

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.25.04.	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works: * The price includes procurement, construction and installation as designed				
08.25.04.01	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	201.12	383.41	77,111.42
08.25.04.02	13.10.11	Covers made of iron, procurement, transport and installation covers 625mm for control points for closed structures. Cover is installed on reinforced slab. Payment per pieces	pc	1.00	9,329.95	9,329.95
08.25.04.03	13.10.10	Procurement, transport and installation of metal rungs. Payment per pieces	pc	74.00	437.79	32,396.46
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						118,837.83

SUMMARY INLECT STRUCTURE UG1 AND UG2 AT km 884+306.224		Total
08.25.01	EARTH WORKS	117,364.85
08.25.02	CONCRETE	852,434.59
08.25.03	METALWORK	767,612.77
08.25.04	FINISHING AND SUNDRY WORKS ON BRIDGES	118,837.83
TOTAL INLECT STRUCTURE UG1 AND UG2 AT km 884+306.224		1,856,250.04

08.25. INLECT STRUCTURE AT km 884+358.565

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.25.01.	13.2	EARTH WORKS				
		Excavation for foundations				
08.25.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth - at depth of 0-2 m	m ³	40.91	226.73	9,275.52
		- at depth of 2-4 m	m ³	39.90	297.69	11,877.83
08.25.01.02	13.2.1	Excavation of foundations in IV category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth - at depth of 4-6 m	m ³	43.30	368.67	15,963.41
		- at depth over 6 m	m ³	62.92	439.63	27,661.52
08.25.01.03	13.2.4	Backfilling with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa Payment per m ³ of compacted earth	m ³	52.00	301.38	15,671.76
TOTAL EARTH WORKS:						80,450.05
08.25.02.	13.4	CONCRETE				
		This shall apply to all items: * Concrete shall be mixed mechanically and compacted by vibrating * Reinforcing bars shall be paid separately, except for bored piles * Cables shall be paid separately * The price of concrete includes formwork and scaffold * Payment per m ³ of placed concrete for completely performed work				
	13.4.1	Plain concrete				
08.25.02.01	13.4.1.3 additional specifications	Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs	m ³	1.95	6,387.09	12,454.83
	13.4.3	Reinforced concrete constructions				
08.25.02.02	13.4.3.1	Reinforced concrete for inlet structure class II MB 30, M-150, V-6	Concrete m ³	41.75	9,694.93	404,763.33
TOTAL CONCRETE WORKS:						417,218.15
08.25.03.	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed				
08.25.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	3,235.10	63.59	205,720.01
08.25.03.02	13.5.1	Welded mesh reinforcement MAG 500/560	kg	2,051.54	72.81	149,372.63
TOTAL METAL WORK						355,092.64
08.25.04.	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works: * The price includes procurement, construction and installation as designed				
08.25.04.01	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	90.32	383.41	34,629.59
08.25.04.02	13.10.11	Covers made of iron, procurement, transport and installation covers 625mm for control points for closed structures. Cover is installed on reinforced slab. Payment per pieces	pc	1.00	9,329.95	9,329.95
08.25.04.03	13.10.10	Procurement, transport and installation of metal rungs. Payment per pieces	pc	32.00	437.79	14,009.28
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						57,968.82

SUMMARY INLECT STRUCTURE AT km 884+358.565		Total
08.25.01	EARTH WORKS	80,450.05
08.25.02	CONCRETE	417,218.15
08.25.03	METALWORK	355,092.64
08.25.04	FINISHING AND SUNDRY WORKS ON BRIDGES	57,968.82
TOTAL INLECT STRUCTURE AT km 884+358.565		910,729.66

08.25. TOTAL INJECT STRUCTURE UG1 AND UG2 AT km 884+306.224

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.25.01.	13.2	EARTH WORKS				
		Excavation for foundations				
08.25.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth - at depth of 0-2 m	m ³	81.48	226.73	18,473.96
		- at depth of 2-4 m	m ³	42.42	297.69	12,628.01
08.25.01.02	13.2.1	Excavation of foundations in IV category soil and transport of earth to distance of 500 m Payment per m ³ of excavated earth - at depth of 2-4 m	m ³	36.54	297.69	10,877.59
		- at depth of 4-6 m	m ³	75.94	368.67	27,996.80
		- at depth over 6 m	m ³	160.00	439.63	70,340.80
08.25.01.03	13.2.4	Backfilling with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa. Payment per m ³ of compacted earth.	m ³	125.20	301.38	37,732.78
TOTAL EARTH WORKS:						178,049.94
08.25.02.	13.4	CONCRETE				
		This shall apply to all items. * Concrete shall be mixed mechanically and compacted by vibrating. * Reinforcing bars shall be paid separately, except for bored piles. * Cables shall be paid separately. * The price of concrete includes formwork and scaffold. * Payment per m ³ of placed concrete for completely performed work				
	13.4.1	Plain concrete				
08.25.02.01	13.4.1.3 additional specifications	Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs.	m ³	4.80	6,387.09	30,658.03
	13.4.3	Reinforced concrete constructions				
08.25.02.02	13.4.3.1	Reinforced concrete for inlet structure class II MB 30, M-150, V-6.	Concrete m ³	105.36	9,694.93	1,021,457.82
TOTAL CONCRETE WORKS:						1,052,115.86
08.25.03.	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed.				
08.25.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	9,195.64	63.59	584,750.75
08.25.03.02	13.5.1	Welded mesh reinforcement MAG 500/560	kg	4,330.46	72.81	315,300.79
TOTAL METAL WORK						900,051.54
08.25.04.	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works: * The price includes procurement, construction and installation as designed.				
08.25.04.01	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	241.20	383.41	92,478.49
08.25.04.02	13.10.11	Covers made of iron, procurement, transport and installation covers 625mm for control points for closed structures. Cover is installed on reinforced slab. Payment per pieces	pc	1.00	9,329.95	9,329.95
08.25.04.03	13.10.10	Procurement, transport and installation of metal rungs. Payment per pieces	pc	85.00	437.79	37,212.15
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						139,020.59

SUMMARY INJECT STRUCTURE UG1 AND UG2 AT km 884+496.123

08.25.01 EARTH WORKS	178,049.94
08.25.02 CONCRETE	1,052,115.86
08.25.03 METALWORK	900,051.54
08.25.04 FINISHING AND SUNDRY WORKS ON BRIDGES	139,020.59
TOTAL INJECT STRUCTURE UG1 AND UG2 AT km 884+496.123	2,269,237.93

08.25. INJECT STRUCTURE UG1 AND UG2 AT km 884+575.88

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.25.01.	13.2	EARTH WORKS				
		Excavation for foundations				
08.25.01.01	13.2.1	Excavation of foundations in IV category soil and transport of earth to distance of 500 m. Payment per m ³ of excavated earth - at depth of 0-2 m	m ³	129.40	226.73	29,338.86
		- at depth of 2-4 m	m ³	141.37	297.69	42,084.44
		- at depth of 4-6 m	m ³	112.98	368.67	41,652.34
		- at depth over 6 m	m ³	137.56	439.63	60,475.50
08.25.01.02	13.2.4	Backfilling with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa. Payment per m ³ of compacted earth.	m ³	125.20	301.38	37,732.78
TOTAL EARTH WORKS:						211,283.91

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.25.02.	13.4	CONCRETE This shall apply to all items. * Concrete shall be mixed mechanically and compacted by vibrating. * Reinforcing bars shall be paid separately, except for bored piles * Cables shall be paid separately. * The price of concrete includes formwork and scaffold. * Payment per m ³ of placed concrete for completely performed work				
08.25.02.01	13.4.1 additional specifications	Plain concrete Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs	m ³	4.80	6,387.09	30,658.03
08.25.02.02	13.4.3	Reinforced concrete constructions Reinforced concrete for inlet structure class II MB 30, M-150, V-6	Concrete m ³	105.86	9,694.93	1,026,305.29
TOTAL CONCRETE WORKS:						1,056,963.32
08.25.03.	13.5	METALWORK Reinforcing bars in concrete members and constructions * The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed.				
08.25.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	9,046.99	63.59	575,298.09
08.25.03.02	13.5.1	Welded mesh reinforcement MAG 500/560	kg	4,444.14	72.81	323,577.83
TOTAL METAL WORK						898,875.93
08.25.04.	13.1	FINISHING AND SUNDRY WORKS ON BRIDGES This shall apply to all items of finishing works: * The price includes procurement, construction and installation as designed.				
08.25.04.01	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth.	m ²	238.40	383.41	91,404.94
08.25.04.02	13.10.11	Covers made of iron, procurement, transport and installation covers 625mm for control points for closed structures. Cover is installed on reinforced slab. Payment per pieces	pc	1.00	9,329.95	9,329.95
08.25.04.03	13.10.10	Procurement, transport and installation of metal rungs. Payment per pieces	pc	87.00	437.79	38,087.73
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						138,822.62
SUMMARY INLECT STRUCTURE UG1 AND UG2 AT km 884+575.88						
08.25.01 EARTH WORKS						211,283.91
08.25.02 CONCRETE						1,056,963.32
08.25.03 METALWORK						898,875.93
08.25.04 FINISHING AND SUNDRY WORKS ON BRIDGES						138,822.62
TOTAL INLECT STRUCTURE UG1 AND UG2 AT km 884+575.88						2,305,945.79
08.26. BRIDGE AT km 0+185.52 (local station)						
Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.26.01.	13.2	EARTH WORKS Excavation for foundations				
08.26.01.01	13.2.1	Excavation of foundations in II and III category soil and transport of earth to distance of 500 m. Payment per m ³ of excavated earth - at depth of 0-2 m	m ³	597.35	226.73	135,437.17
		- at depth of 2-4 m	m ³	318.00	297.69	94,665.42
		- at depth of 4-6 m	m ³	14.82	368.67	5,463.69
08.26.01.02	13.2.2	Extra for excavation of foundations with pumping of 30 lit/min - 120 lit/min water	m ³	465.09	439.63	204,465.32
08.26.01.03	13.2.3	Excavation of Trenches and Channels Less than 1.5 m Wide and Less than 2.0 m Deep	m ³	10.73	226.73	2,432.81
08.26.01.04	13.2.4	Backfilling of pier foundations with earth in 30 cm thick layers including compaction of layers to modulus of compressibility Ms=30 MPa Payment per m ³ of compacted earth.	m ³	400.17	390.78	156,378.43
08.26.01.05	13.2.5	Construction of wedge made of well-graded gravel compacted in 30 cm thick layers to modulus of compressibility Ms=40 MPa. It shall be constructed behind the abutments. Payment per m ³ of compacted gravel	m ³	530.00	851.62	451,358.60
08.26.01.06	13.2.8 additional specifications	Construction of end slope of material from the cutting or borrow pit including mechanical compaction in 30 cm thick layers, fully as designed. Payment per m ³ of compacted material.	m ³	77.11	301.38	23,239.41
TOTAL EARTH WORKS:						1,073,440.85
08.26.02.	13.4	CONCRETE This shall apply to all items. * Concrete shall be mixed mechanically and compacted by vibrating. * Reinforcing bars shall be paid separately, except for bored piles * Cables shall be paid separately. * The price of concrete includes formwork and scaffold. * Payment per m ³ of placed concrete for completely performed work				
08.26.02.01	13.4.1.1	Plain concrete Foundation of end slope wall made of concrete, class I MB25	m ³	10.73	7,254.38	77,839.50
08.26.02.02	13.4.1.2	Lining of end slopes with concrete plates (60'40'12 cm) MB 40, M-150, V-3	m ²	38.63	1,603.68	61,950.16

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.26.02.03	13.4.1.3 additional specifications	Blinding layer, 15 cm thick, made of concrete, class I MB 15 under foundation, pile caps and crossing slabs	m ³	19.26	6,387.09	123,015.35
	13.4.3	Reinforced concrete constructions				
08.25.02.04	13.4.3.1	Strip foundations, foundations for wings, counter-beams, slab foundations, cushions and pile caps made of reinforced concrete, class III MB 30, M-150, V-6	m ³	121.92	7,528.10	917,825.95
	13.4.3.2	Piers supporting plain spanning constructions of different systems and bearing beams				
08.26.02.05	13.4.3.2	Abutment bodies constructed of concrete, class II, MB 30, M-150, V-6	m ³	93.50	8,211.98	767,820.13
08.26.02.06	13.4.3.2	Abutment wing walls made of concrete, class II, MB 30, M-150, V-6	m ³	29.80	10,265.44	305,910.11
	13.4.3.3	Spanning bridge construction of reinforced concrete				
08.26.02.07	13.4.3.3	Main plate girder made of reinforced concrete class II, MB 30, M-150, V-6	m ³	116.00	12,070.96	1,400,231.36
08.26.02.08	13.4.3.4	Cornices at footway level (including inspection manholes) cast in situ Concrete class II MB 30, M-150, V-6	m ³	12.84	10,036.86	128,873.28
08.26.02.09	13.4.3.5	Crossing slabs made of concrete MB 30, M-150, V-6	m ³	26.70	7,528.10	201,000.27
TOTAL CONCRETE WORKS:						3,984,466.12
08.26.03.	13.5	METALWORK				
		Reinforcing bars in concrete members and constructions				
		* The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed				
08.26.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	45,681.86	63.59	2,904,909.48
TOTAL METAL WORK						2,904,909.48
08.26.04.	13.10	FINISHING AND SUNDRY WORKS ON BRIDGES				
		This shall apply to all items of finishing works				
		* The price includes procurement, construction and installation as designed				
08.26.04.01	13.10.1	Concrete or stone curbs along the highway, 13/20 MB 40	m	42.80	1,505.99	64,456.37
08.26.04.02	13.10.2	Insulating coat on pavement top	m ²	145.00	793.55	115,064.75
08.26.04.03	13.10.3	Applying one layer of bitulite and one layer of hot bitumen onto concrete surfaces in contact with earth	m ²	330.88	383.41	126,862.70
08.26.04.04	13.10.4	Bituminous pavement base course, BNHS 16A, 5 cm thick	m ²	229.00	481.10	110,171.90
08.26.04.05	13.10.4	Pavement wearing course of skeleton mastic asphalt SMA 0/11S, 4cm thick	m ²	229.00	623.96	142,886.84
08.26.04.06	13.10.5	Trial loading of constructed bridge	lump sum		912,442.01	912,442.01
08.26.04.07	13.10.6	Photographing during bridge construction	lump sum		54,746.52	54,746.52
08.26.04.08	13.10.8	Fitting and sealing joints with elastic bituminous sealing compound (Tivobit) on asphalt next to curbs and cornices at footway level and next to expansion joints	m	85.60	380.65	32,583.64
08.26.04.09	13.11.1	Laying PVC pipes into footways (cat walks), Ø110 mm	m	128.40	483.87	62,128.91
08.26.04.10	13.11.2	Epoxy and polyurethane preservative on footways	m ²	53.50	584.33	31,261.66
TOTAL FINISHING AND SUNDRY WORKS ON BRIDGES:						1,652,605.30
08.26.05.	2	PRELIMINARY WORKS				
08.26.05.01	2.5	Demolition of existing construction	lump sum		1,386,911.84	1,386,911.84
TOTAL PRELIMINARY WORKS:						1,386,911.84
SUMMARY BRIDGE AT km 0+185.52 (local station)						
08.26.01 EARTH WORKS						1,073,440.85
08.26.02 CONCRETE						3,984,466.12
08.26.03 METALWORK						2,904,909.48
08.26.04 FINISHING AND SUNDRY WORKS ON BRIDGES						1,652,605.30
08.26.05 PRELIMINARY WORKS						1,386,911.84
TOTAL BRIDGE AT km 0+185.52:						11,002,333.58



08. SUMMARY – Bridges			
08.09	BRIDGE AT km 881+101.843		498,466,268.93
08.10	BRIDGE AT km 881+705.810		254,257,194.29
08.11	BRIDGE AT km 883+067.252		454,180,563.26
08.12	BRIDGE AT km 883+576.495		32,401,106.07
08.13	BRIDGE AT km 884+958.430		168,909,650.21
08.14	BRIDGE AT km 885+445.066		10,827,951.23
08.16	TOP SLAB CULVERT km 884+167.303 (UNDER THE HIGHWAY)		7,706,217.50
08.16	CULVERT AT km 884+167.303 (part under main road)		5,969,407.49
08.17	SLAB TOP CULVERT km 884+815.865		9,526,288.16
08.17	INLECT STRUCTURES		5,695,203.70
08.18	UNDERPASS AT km 885+335.85		14,960,898.54
08.19	OVERPASS AT km 0+719.11		68,980,448.26
08.20	OVERPASS AT km 0+038.46		69,224,601.29
08.21	UNDERPASS AT km 0+030.0		11,435,660.01
08.22	SLAB TOP CULVERT AT km 0+112.53		14,102,935.38
08.23	BRIDGE AT km 0+264.889		15,383,347.87
08.24	BRIDGE AT km 0+115.365		4,342,783.66
08.25	INLET STRUCTURE AT km 882+480.90		1,150,954.33
08.25	INLECT STRUCTURE UG1 AND UG2 AT km 883+762.574		2,212,061.32
08.25	INLECT STRUCTURE AT km 883+882.283		851,596.98
08.25	INLECT STRUCTURE UG1 AND UG2 AT km 883+952.142		1,968,680.95
08.25	INLECT STRUCTURE AT km 884+241.537		826,290.92
08.25	INLECT STRUCTURE UG1 AND UG2 AT km 884+306.224		1,856,250.04
08.25	INLECT STRUCTURE AT km 884+358.565		910,729.66
08.25	INLECT STRUCTURE UG1 AND UG2 AT km 884+496.123		2,269,237.93
08.25	INLECT STRUCTURE UG1 AND UG2 AT km 884+575.88		2,305,945.79
08.26	BRIDGE AT km 0+185.52		11,002,333.58
SUB-TOTAL			1,671,724,607.33
Unforeseen work (5% of sub-total)			83,586,230.37
		TOTAL Bridges (8.):	1,755,310,837.69

10.03. PROTECTION WALL 3- LEFTWARDS, from km 881+077.24 to km 881+328.14, L=244.0m

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
CONCRETE WORKS						
10.03.05. 10.03.05.01	8.3.6	Casting reinforced concrete sheet piles to make the bridge construction horizontal This item includes casting of reinforced concrete pile in situ to make the bridge construction horizontal. Price includes procurement and transport of materials, placing of concrete, reinforcement and formwork per piece Measurement unit is piece	piece	112.00	50,691.22	5,677,416.64
TOTAL CONCRETE WORKS:						5,677,416.64
REINFORCEMENT WORKS						
10.03.06. 10.03.06.01	10.03.06.01	Procurement and erection of HEA140 steel posts Price includes procurement, transport, assembly and erection of steel posts made of HEA140 sections including all related works. Measurement unit is kg.	kg	6,977.75	335.48	2,340,895.57
10.03.06.02	10.03.06.02	Procurement and fastening of anchor plates Price includes procurement, transport, assembly and fastening of anchor plates, 400x300x10 in size including all related works. Measurement unit is kg.	kg	113.00	285.71	32,285.23
TOTAL REINFORCEMENT WORKS:						2,373,180.80
SUNDRIES						
10.03.07. 10.03.07.01	10.03.07.01	Procurement and driving of transparent sheet piles This item includes procurement, transport and driving of transparent sheet piles on the bridge, 196x200x11 in size. Measurement unit is piece.	piece	112.00	59,612.88	6,676,642.56
TOTAL SUNDRIES:						6,676,642.56

10.03. SUMMARY PROTECTION WALL 3- LEFTWARDS, from km 881+077.24 to km 881+328.14, L=244.0m.

10.03.05.	CONCRETE WORKS	5,677,416.64
10.03.06.	REINFORCEMENT WORKS	2,373,180.80
10.03.07.	SUNDRIES	6,676,642.56
TOTAL PROTECTION WALL 3-leftwards, from km 881+077.24 to km 881+328.14, L=244.0m (10.03.):		14,727,240.00

10.04. PROTECTION WALL 4 – LEFTWARDS, from km 881+451.00 to km 881+613.74, L=164.0m

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
EARTH WORKS						
10.04.01. 10.04.01.01	3.2	Excavation of earth for foundations This item includes excavation of II category earth for O630 mm foundations with loading and transport of surplus material to stockpile area specified by the Engineer Measurement unit is m3.	m ³	33.00	3,495.85	115,363.05
10.04.01.02	3.4.1.3	Filling and leveling of stone aggregate This item includes filling and leveling of stone aggregate between reinforced concrete sheet piles and pavement edge Measurement unit is m3.	m ³	26.24	1,658.99	43,531.90
TOTAL EARTH WORKS:						158,894.95

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
CONCRETE WORKS						
10.04.02.10.04.02.01	8.3.6	Construction of prefabricated foundations with mB30 reinforced concrete This item includes procurement, transport of prefabricated foundations, designed size: Ø600 mm, 2.50 m high including all related works Measurement unit is piece.	piece	42.00	20,628.57	866,399.94
10.04.02.10.04.02.02	8.3.6	Construction and placing of 396x50x11 reinforced concrete sheet piles This item includes procurement, transport and placing of prefabricated sheet piles made of MB30 reinforced concrete, 396x50x11 in size. Measurement unit is piece.	piece	41.00	7,948.39	325,883.99
TOTAL CONCRETE WORKS:						1,192,283.93
REINFORCEMENT WORKS						
10.04.03.10.04.03.01	10.04.03.01	Procurement and erection of HEA140 steel posts. Price includes procurement, transport, assembly and erection of steel posts made of HEA140 sections including all related works Measurement unit is kg.	kg	5,187.00	335.48	1,740,134.76
TOTAL REINFORCEMENT WORKS:						1,740,134.76
SUNDRIES						
10.04.04.10.04.04.01	10.04.04.01	Procurement and placing of absorptive sheet piles This item includes procurement, transport and placing of absorptive sheet piles, 396x50x11 in size. Measurement unit is piece.	piece	328.00	30,110.59	9,876,273.52
TOTAL SUNDRIES:						9,876,273.52

10.04. SUMMARY PROTECTION WALL 4 – LEFTWARDS, from km 881+451.00 to km 881+613.74, L=164.0m						
10.04.01	EARTH WORKS					158,894.95
10.04.02	CONCRETE WORKS					1,192,283.93
10.04.03	REINFORCEMENT WORKS					1,740,134.76
10.04.04	SUNDRIES					9,876,273.52
TOTAL PROTECTION WALL 4 – LEFTWARDS, from km 881+451.00 to km 881+613.74, L=164.0m (10.04.):						12,967,587.16

10.05. PROTECTION WALL 5 – LEFTWARDS, from km 885+132.85 to km 885+399.70, L=264.0m						
Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
EARTH WORKS						
10.05.01.10.05.01.01	3.2	Excavation of earth for foundations This item includes excavation of II category earth for(Ø630 mm) foundations with loading and transport of surplus material to stockpile area specified by the Engineer. Measurement unit is m3.	m ³	50.70	3,495.85	177,239.60
10.05.01.10.05.01.02	3.4.1.3	Filling and leveling of stone aggregate This item includes filling and leveling of stone aggregate between reinforced concrete sheet piles and pavement edge Measurement unit is m3.	m ³	40.40	1,658.99	67,023.20
TOTAL EARTH WORKS:						244,262.79
CONCRETE WORKS						
10.05.02.10.05.02.01	8.3.6	Construction of prefabricated foundations with mB30 reinforced concrete This item includes procurement, transport and placing of prefabricated foundations, designed size: Ø600 mm, 2.50 m high including all related works Measurement unit is piece.	piece	67.00	20,628.57	1,382,114.19
10.05.02.10.05.02.02	8.3.6	Construction and placing of 396x50x11 reinforced concrete sheet piles This item includes procurement, transport and placing of prefabricated sheet piles made of MB30 reinforced concrete, 396x50x11 in size. Measurement unit is piece.	piece	66.00	7,948.39	524,593.74
TOTAL CONCRETE WORKS:						1,906,707.93
REINFORCEMENT WORKS						
10.05.03.10.05.03.01	10.05.03.01	Procurement and erection of HEA140 steel posts. Price includes procurement, transport, assembly and erection of steel posts made of HEA140 sections including all related works Measurement unit is kg.	kg	7,410.00	335.48	2,485,906.80
10.05.03.10.05.06.02	10.05.06.02	Procurement and fastening of anchor plates Price includes procurement, transport, assembly and fastening of anchor plates, 400x300x10 in size including all related works Measurement unit is piece.	piece	2.00	2,689.40	5,378.80
TOTAL REINFORCEMENT WORKS:						2,491,285.60
SUNDRIES						
10.05.04.10.05.04.01	10.05.04.01	Procurement and placing of absorptive sheet piles This item includes procurement, transport and placing of prefabricated sheet piles made of MB30 reinforced concrete, 396x50x11 in size. Measurement unit is piece.	piece	459.00	30,110.59	13,820,760.81
TOTAL SUNDRIES:						13,820,760.81



10.05. SUMMARY PROTECTION WALL. 5 – LEFTWARDS, from km 885+132,85 to km 885+399,70, L=264,0m		
10.05.01	EARTH WORKS	244,262.79
10.05.02	CONCRETE WORKS	1,906,707.93
10.05.03	REINFORCEMENT WORKS	2,491,285.60
10.05.04	SUNDRIES	13,820,760.81
TOTAL PROTECTION WALL. 5 – LEFTWARDS, from km 885+132,85 to km 885+399,70, L=264,0m (10.05.):		18,463,017.13

10. SUMMARY – ENVIRONMENTAL PROTECTION - PROTECTION WALLS		
10.03	WALL 3 LEFTWARDS from km 881+077,24 to km 881+328,14, L=244m	14,727,240.00
10.04	WALL 4 LEFTWARDS from km 881+451,00 to km 881+613,74, L=164m	12,967,587.16
10.05	WALL 5 LEFTWARDS from km 885+132,85 to km 885+399,70, L=264m	18,463,017.13
SUB-TOTAL:		46,157,844.29
Unforeseen work (5% of sub-total)		2,307,892.21
TOTAL ENVIRONMENTAL PROTECTION - PROTECTION WALLS (10.):		48,465,736.50

**11. Traffic-technical and service equipment for roads
ELEMENTS OF TRAFFIC SIGNS AND SIGNALS**

No.	T.S	Work description	Unit	Quantity	Unit price	Total
11.01. ELEMENTS OF TRAFFIC SIGNS AND SIGNALS						
11.01.01		Reflective traffic sign with mounting accessories, class 3				
OPEN SECTION						
11.01.01.01	12.1,12.2,3	I-20 1200x1200x1200mm	pcs	2	7,603.69	15,207.38
11.01.01.02	12.1,12.2,3	I-24 + 2 fleshers 1650x1400mm	pcs	1	31,428.56	31,428.56
11.01.01.03	12.1,12.2,3	I-24 1500x1400mm	pcs	1	25,345.61	25,345.61
11.01.01.04	12.1,12.2,3	II-29 ø900mm	pcs	2	7,603.69	15,207.38
11.01.01.05	12.1,12.2,3	II-30 (80) ø900mm	pcs	2	7,603.69	15,207.38
11.01.01.06	12.1,12.2,3	II-30 (100) ø900mm	pcs	2	7,603.69	15,207.38
11.01.01.07	12.1,12.2,3	III-26 ø900mm	pcs	2	7,603.69	15,207.38
11.01.01.08	12.1,12.2,3	III-17.1 400x200mm	pcs	10	1,013.82	10,138.20
11.01.01.10	12.1,12.2,3	III-56 (2) 1400x1200mm	pcs	1	19,262.66	19,262.66
11.01.01.11	12.1,12.2,3	III-58 2100x1200mm	pcs	3	33,456.20	100,368.60
11.01.01.12	12.1,12.2,3	3T3-1 2900x3200mm	pcs	1	131,797.18	131,797.18
OPEN SECTION						
394,377.71						
INTERCHANGE						
11.01.01.14	12.1,12.2,3	II-1 1200x1200x1200mm	pcs	3	7,603.69	22,811.07
11.01.01.15	12.1,12.2,3	II-4 ø900mm	pcs	1	7,603.69	7,603.69
11.01.01.16	12.1,12.2,3	II-26.1 ø900mm	pcs	1	7,603.69	7,603.69
11.01.01.17	12.1,12.2,3	II-30 (100) ø900mm	pcs	4	7,603.69	30,414.76
11.01.01.18	12.1,12.2,3	II-30 (20) ø900mm	pcs	2	7,603.69	15,207.38
11.01.01.19	12.1,12.2,3	II-30 (40) ø900mm	pcs	1	7,603.69	7,603.69
11.01.01.20	12.1,12.2,3	II-30 (60) ø900mm	pcs	3	7,603.69	22,811.07
11.01.01.21	12.1,12.2,3	II-32.2 ø900mm	pcs	2	7,603.69	15,207.38
11.01.01.22	12.1,12.2,3	II-43 ø900mm	pcs	5	7,603.69	38,018.45
11.01.01.23	12.1,12.2,3	II-45 ø900mm	pcs	2	7,603.69	15,207.38
11.01.01.24	12.1,12.2,3	III-12 (1) 2400x1000mm	pcs	2	31,428.56	62,857.12
11.01.01.25	12.1,12.2,3	III-13 (4) 2400x1500mm	pcs	1	50,691.22	50,691.22
11.01.01.26	12.1,12.2,3	III-19 900x1350mm	pcs	2	15,207.36	30,414.72
11.01.01.27	12.1,12.2,3	III-20 900x1350mm	pcs	2	15,207.36	30,414.72
11.01.01.28	12.1,12.2,3	III-61 (1) 4200x4800mm	pcs	1	273,732.60	273,732.60
11.01.01.29	12.1,12.2,3	III-61 (2) 3400x440mm	pcs	1	19,262.66	19,262.66
11.01.01.30	12.1,12.2,3	III-63 950x950mm	pcs	18	11,152.07	200,737.26
11.01.01.31	12.1,12.2,3	III-63.2 950x950mm	pcs	8	11,152.07	89,216.56

No.	T.S	Work description	Unit	Quantity	Unit price	Total
11.01.01.32	12.1,12.2,3	III-63.1 2250x750mm	pcs	1	21,290.31	21,290.31
11.01.01.33	12.1,12.2,3	III-65.1 (1) 5300x2500mm	pcs	2	172,350.15	344,700.30
11.01.01.34	12.1,12.2,3	III-66 1000x1200mm	pcs	2	15,207.36	30,414.72
11.01.01.35	12.1,12.2,3	III-72 (1) 5500x4800mm	pcs	1	334,562.07	334,562.07
11.01.01.36	12.1,12.2,3	III-72 (2) 5500x5200mm	pcs	1	354,838.55	354,838.55
11.01.01.37	12.1,12.2,3	III-76 3100x3400mm	pcs	2	141,935.43	283,870.86
11.01.01.38	12.1,12.2,3	P.P. ø1000mm	pcs	2	9,124.42	18,248.84
11.01.01.39	12.1,12.2,3	Directional board 300x1000mm	pcs	2	4,055.30	8,110.60
INTERCHANGE						2,335,851.67
LEVEL JUNCTION, class 2						
11.01.01.40	12.1,12.2,3	II-1 1200x1200x1200mm	pcs	1	5,069.12	5,069.12
11.01.01.41	12.1,12.2,3	II-2 ø900mm	pcs	1	5,069.12	5,069.12
11.01.01.42	12.1,12.2,3	II-28 ø900mm	pcs	4	5,069.12	20,276.48
11.01.01.43	12.1,12.2,3	II-30 (40) ø900mm	pcs	1	5,069.12	5,069.12
11.01.01.44	12.1,12.2,3	II-30 (60) ø900mm	pcs	2	5,069.12	10,138.24
11.01.01.45	12.1,12.2,3	II-30 (80) ø900mm	pcs	2	5,069.12	10,138.24
11.01.01.46	12.1,12.2,3	II-43 ø900mm	pcs	1	5,069.12	5,069.12
11.01.01.47	12.1,12.2,3	II-45.1 ø900mm	pcs	2	5,069.12	10,138.24
11.01.01.48	12.1,12.2,3	III-13 (1) 2400x2700mm	pcs	1	212,903.14	212,903.14
11.01.01.49	12.1,12.2,3	III-13 (2) 2100x2100mm	pcs	1	36,497.68	36,497.68
11.01.01.50	12.1,12.2,3	III-13 (3) 2400x1500mm	pcs	1	29,400.91	29,400.91
11.01.01.51	12.1,12.2,3	III-25 ø900mm	pcs	1	5,069.12	5,069.12
11.01.01.52	12.1,12.2,3	III-8 (1) 2400x2900mm	pcs	1	56,774.17	56,774.17
11.01.01.53	12.1,12.2,3	III-8 (2) 2800x2900mm	pcs	1	65,898.59	65,898.59
11.01.01.54	12.1,12.2,3	III-11 600x900mm	pcs	1	4,055.30	4,055.30
11.01.01.55	12.1,12.2,3	Directional board 300x1000mm	pcs	2	2,838.71	5,677.42
LEVEL JUNCTION, class 2						487,244.01
RELOCATION OF M-1, class 2						
11.01.01.56	12.1,12.2,3	II-28 ø900mm	pcs	3	5,069.12	15,207.36
11.01.01.57	12.1,12.2,3	III-25 ø900mm	pcs	3	5,069.12	15,207.36
RELOCATION OF M-1, class 2						30,414.72
RELOCATION OF R-214, class 2						
11.01.01.58	12.1,12.2,3	II-28 ø600mm	pcs	3	2,230.42	6,691.26
11.01.01.59	12.1,12.2,3	II-2 ø600mm	pcs	1	2,230.42	2,230.42
11.01.01.60	12.1,12.2,3	II-30(60) ø600mm	pcs	2	2,230.42	4,460.84
RELOCATION OF R-214, class 2						13,382.52
LOCAL ROADS, class 2						
11.01.01.61	12.1,12.2	II-21.4m ø600mm	pcs	6	2,433.18	14,599.08
LOCAL ROADS, class 2						14,599.08
11.01.02	12.4	Supporting post for reflective traffic sign (delivered to the site)				
OPEN SECTION						
11.01.02.01	12.4	φ 60 x 2300 mm	pcs	24	1,622.12	38,930.88
11.01.02.02		post sign	pcs	4	42,986.16	171,944.64
OPEN SECTION						210,875.52
INTERCHANGE						
11.01.02.03	12.4	φ 60 x 2300 mm	pcs	2	1,622.12	3,244.24
11.01.02.04		φ 60 x 3000 mm	pcs	13	2,027.65	26,359.45
11.01.02.05		φ 60 x 3500 mm	pcs	4	2,534.56	10,138.24
11.01.02.06		φ 60 x 4000 mm	pcs	3	2,737.32	8,211.96
11.01.02.07		segment - "T" portal + anchoring to wall + installation	pcs	1	871,889.02	871,889.02
11.01.02.08		"T" portal + foundation + installation	pcs	1	993,547.96	993,547.96
INTERCHANGE						1,913,390.87



No.	T.S	Work description	Unit	Quantity	Unit price	Total
LEVEL JUNCTION, class 2						
11.01.02.09	12.4	φ 60 x 2300 mm	pcs	4	1,622.12	6,488.48
11.01.02.10		φ 60 x 3000 mm	pcs	2	2,027.65	4,055.30
11.01.02.11		φ 60 x 4000 mm	pcs	8	2,737.32	21,898.56
LEVEL JUNCTION, class 2						
RELOCATION OF M-1, class 2						
11.01.02.12	12.4	φ 60 x 3000 mm	pcs	2	2,027.65	4,055.30
RELOCATION OF M-1, class 2						
RELOCATION OF R-214, class 2						
11.01.02.13	12.4	φ 60 x 3000 mm	pcs	2	2,027.65	4,055.30
11.01.02.14		φ 60 x 4000 mm	pcs	2	2,281.10	4,562.20
RELOCATION OF R-214, class 2						
LOCAL ROADS, class 2						
11.01.02.15	12.4	Sign support mounted to bridge wall	pcs	6	10,138.25	60,829.50
LOCAL ROADS, class 2						
11.01.03	12.4	Mounting of all delivered elements except non-standard boards and portals Working hours of two 5-men crews	day	1	101,382.44	101,382.44
Mounting of all delivered elements						
101,382.44						

SUMMARY ELEMENTS OF TRAFFIC SIGNS AND SIGNALS		Total
OPEN SECTION - TOTAL ELEMENTS OF TRAFFIC SIGNS AND SIGNALS		605,253.23
INTERCHANGE - TOTAL ELEMENTS OF TRAFFIC SIGNS AND SIGNALS		4,249,242.54
LEVEL JUNCTION - TOTAL ELEMENTS OF TRAFFIC SIGNS AND SIGNALS		519,686.35
RELOCATION OF M-1 - TOTAL ELEMENTS OF TRAFFIC SIGNS AND SIGNALS		34,470.02
R-214 - TOTAL ELEMENTS OF TRAFFIC SIGNS AND SIGNALS		22,000.02
LOCAL ROADS - TOTAL ELEMENTS OF TRAFFIC SIGNS AND SIGNALS		75,428.58
Mounting of all delivered elements		101,382.44
TOTAL ELEMENTS OF TRAFFIC SIGNS AND SIGNALS		5,607,463.18

ELEMENTS OF ROAD MARKINGS

No.	T.S	Work description	Unit	Quantity	Unit price	Total
ELEMENTS OF ROAD MARKINGS						
OPEN SECTION						
11.02.01.	12.5	continuous line (0.20m)	m ²	1,680.00	1,013.82	1,703,217.60
11.02.02.		vibro continuous line (0.20m)	m ²	1,680.00	1,622.12	2,725,161.60
11.02.03.		broken line, type C (0.2m)	m ²	560.00	1,013.82	567,739.20
		6-12m				
OPEN SECTION						
4,996,118.40						
INTERCHANGE						
11.02.04.	12.5	continuous line (0.20m)	m ²	1,040.40	1,013.82	1,054,778.33
11.02.05.		wide broken line, type B (0.3m)	m ²	43.20	1,216.59	52,556.69
11.02.06.		3-3m				
11.02.07.		short broken line, type A (0.15m)	m ²	4.00	1,216.59	4,866.36
11.02.08.		1-1m				
11.02.09.		slanted limit lines and limit lines	m ²	2,211.03	1,013.82	2,241,589.37
11.02.11.		sound strip	m	54.00	1,216.59	65,695.86
INTERCHANGE						
3,419,486.61						
LEVEL JUNCTION, class 2						
11.02.09.	12.5	continuous edge line	m ²	209.1	1,216.59	254,388.97
11.02.10.		cross road markings	m ²	6.6	1,216.59	8,029.49
11.02.11.		arrows	m ²	57.0	1,216.59	69,345.63
11.02.12.		traffic direction fields	m ²	271.0	1,216.59	329,695.89
11.02.13.		line 1-1m	m ²	4.8	1,216.59	5,839.63
11.02.14.		line 3-3m	m ²	3.6	1,216.59	4,379.72
LEVEL JUNCTION, class 2						
671,679.34						
RELOCATION OF M-1, class 2						
11.02.15.	12.5	continuous edge line	m ²	426.6	1,216.59	518,997.29
11.02.16.		warning line	m ²	27.0	1,216.59	32,847.93
11.02.17.		10-5m				
11.02.17.	broken line, type C (0.15m)	m ²	36.0	1,216.59	43,797.24	
RELOCATION OF M-1, class 2						
595,642.46						
RELOCATION OF R-214, class 2						
11.02.111	12.5	continuous edge line	m ²	126.2	1,216.59	153,582.32
11.02.19.		continuous lane line	m ²	63.1	1,216.59	76,791.16
11.02.20.	12.5	Mounting of all delivered elements except non-standard boards and portals Working hours for two 5-man teams	day	4	101,382.44	405,529.76
RELOCATION OF R-214, class 2						
635,903.24						

ELEMENTS OF ROAD MARKINGS		Total
OPEN SECTION - TOTAL ELEMENTS OF ROAD MARKINGS		4,996,118.40
INTERCHANGE - TOTAL ELEMENTS OF ROAD MARKINGS		3,419,486.61
LEVEL JUNCTION - TOTAL ELEMENTS OF ROAD MARKINGS		671,679.34
RELOCATION OF M-1 - TOTAL ELEMENTS OF ROAD MARKINGS		595,642.46
R-214 - TOTAL ELEMENTS OF ROAD MARKINGS		635,903.24
TOTAL ELEMENTS OF ROAD MARKINGS		10,318,830.06

TRAFFIC EQUIPMENT - delivery + full installation

No.	T.S	Work description	Unit	Quantity	Unit price	Total
11.03.		TRAFFIC EQUIPMENT - delivery + full installation				
OPEN SECTION						
11.3.01.	12.6	Double sided distance barrier H2W7 assembly-type	m	48	5,880.19	282,249.12
11.3.02.		Single sided distance barrier H1W4* on the road	m	424	4,055.30	1,719,447.20
11.3.03.		Single sided distance barrier H1W5	m	7172	3,244.24	23,267,689.28
11.3.04.		Single sided distance barrier H2W4	m	2250	5,373.27	12,089,857.50
11.3.05.		Single sided distance barrier H2W4* on the structure	m	4096	8,211.98	33,636,270.08
11.3.06.		Single sided barrier	m	16	3,345.62	53,529.92
11.3.07.		Single sided distance barrier H1W5-H2W4 crossing	pcs	28	11,152.07	312,257.96
11.3.08.		Direction sign	pcs	34	3,345.62	113,751.08
11.3.09.		Retroreflecting stud on safety barrier	pcs	500	405.53	202,765.00
11.3.10.		Oblique ending of single-sided distance barrier, 12m	pcs	18	4,055.30	72,995.40
OPEN SECTION						71,750,812.54
INTERCHANGE						
11.3.13.	12.6	Single sided barrier N2W4	m	3076	2,433.18	7,484,461.68
11.3.14.		Single sided distance barrier H1W4* on the road	m	444	4,055.30	1,800,553.20
11.3.15.		Single sided distance barrier H1W5	m	92	3,244.24	298,470.08
11.3.16.		Single sided distance barrier H1W4-N2W4 crossing	m	4	11,152.07	44,608.28
11.3.17.		Single sided distance barrier H1W5-N2W4 crossing	m	2	13,179.72	26,359.44
11.3.111.		Oblique ending of single-sided distance barrier, 12m	m	4	4,055.30	16,221.20
11.3.19.		Oblique ending of single-sided barrier, 12m	m	5	4,055.30	20,276.50
11.3.20.		Direction sign	pcs	16	3,345.62	53,529.92
11.3.21.		Retroreflecting stud on safety barrier	pcs	307	405.53	124,497.71
11.3.22.		Absorber	pcs	2	4,055.30	8,110.60
INTERCHANGE						9,877,088.61
LEVEL JUNCTION						
11.3.23.	12.6	Single sided barrier N2W4	m	596	2,433.18	1,450,175.28
11.3.24.		Oblique ending of single-sided barrier, 12m	pieces	4	3,345.62	13,382.48
11.3.25.		Direction sign	pcs	16	3,345.62	53,529.92
11.3.26.		Retroreflecting stud on safety barrier	pcs	44	405.53	17,843.32
LEVEL JUNCTION						1,534,931.00
RELOCATION OF M-1						
11.3.27.	12.6	Single sided barrier H1W5	m	1420	3,244.24	4,606,820.80
11.3.211.		Direction sign	pcs	29	3,345.62	97,022.98
11.3.29.		Retroreflecting stud on safety barrier	pcs	60	405.53	24,331.80
RELOCATION OF M-1						4,728,175.58
RELOCATION OF R-214						
11.3.30.	12.6	Single sided distance barrier H1W5	m	704	3,244.24	2,283,944.96
11.3.31.		Single sided distance barrier H2W4	m	88	5,373.27	472,847.76
11.3.32.		Single sided distance barrier H2W4* on the road	m	224	8,211.98	1,839,483.52
11.3.33.		Single sided distance barrier H1W5-H2W4 crossing	m	4	13,179.72	52,718.88
11.3.34.		Oblique ending of single-sided barrier, 12m	pieces	1	3,345.62	3,345.62
11.3.35.		Direction sign	pcs	2	3,345.62	6,691.24
11.3.36.		Retroreflecting stud on safety barrier	pcs	85	405.53	34,334.87
RELOCATION OF R-214						4,693,366.85
LOCAL ROADS						
11.3.37.	12.6	Single sided distance barrier N2W4	m	332	2,433.18	807,815.76
11.3.311.		Retroreflecting stud on safety barrier	pcs	28	405.53	11,219.66
LOCAL ROADS						819,035.42

SUMMARY TRAFFIC EQUIPMENT - delivery + full installation		
OPEN SECTION - TOTAL ELEMENTS OF TRAFFIC EQUIPMENT		71,750,812.54
INTERCHANGE - TOTAL ELEMENTS OF TRAFFIC EQUIPMENT		9,877,088.61
LEVEL JUNCTION - TOTAL ELEMENTS OF TRAFFIC EQUIPMENT		1,534,931.00
RELOCATION OF M-1 - TOTAL ELEMENTS OF TRAFFIC EQUIPMENT		4,728,175.58
R-214 - TOTAL ELEMENTS OF TRAFFIC EQUIPMENT		4,693,366.85
LOCAL ROADS - TOTAL ELEMENTS OF TRAFFIC EQUIPMENT		819,035.42
TOTAL TRAFFIC EQUIPMENT - delivery + full installation		93,403,410.01

11. Summary - Traffic-technical and service equipment for roads		
11.01.01. TRAFFIC SIGNS AND SIGNALS		5,607,463.18
11.01.02. ROAD MARKINGS		10,318,830.06
11.01.03. ELEMENTS OF TRAFFIC EQUIPMENT		93,403,410.01
SUB-TOTAL		109,329,703.24
Unforeseen work (5% of sub-total)		5,466,485.16
Total Traffic-technical and service equipment for roads (11.):		114,796,188.40

12. TECHNICAL INFRASTRUCTURE

DESIGN OF LIGHTING SYSTEM AT "PREDEJANE" GRADE-SEPARATED JUNCTION AND POWER SUPPLY TO TOLL STATIONS

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
1.1.01.00		PUBLIC LIGHTING SYSTEM AT "PREDEJANE" INTERCHANGE				
		CIVIL WORKS				
1.1.01.01	16.5.5.6	Construction of foundation for public lighting pole. The foundation is of prismatic shape with base of 1.2 mx1.2 m in size embedded to a depth of 1.2 m, as shown on the drawing. The item includes: earth excavation, placing formwork, laying Ø70 mm pipe for cable routing, fixing anchors for pole planting and sealing with concrete, class MB20. All materials and work included.	complete	32	53,387.99	1,708,415.68
1.1.01.02	16.5.5.6	Construction of foundation for public lighting pole. The foundation is of prismatic shape with base of 0.9 mx0.9 m in size embedded to a depth of 1 m, as shown on the drawing. The item includes: earth excavation, placing formwork, laying Ø70 mm pipe for cable routing, fixing anchors for pole planting and sealing with concrete, class MB20. All materials and work included.	complete	77	43,735.46	3,367,630.42
1.1.01.03	16.5.5.2	Excavation of 0.4 m wide and 0.8 m deep cable trench for laying one low-voltage cable line. Trench shall be filled with fine grained earth (sand) and backfilled, earth compacted and leveled.	m'	3316	739.17	2,451,087.72
1.1.01.04	16.5.5.2	Excavation of 0.5 m wide and 0.8 m deep cable trench for laying one low-voltage cable line. Trench shall be filled with fine grained earth (sand) and backfilled, earth compacted and leveled.	m'	363	828.57	300,770.91
1.1.01.05	16.5.5.2	Excavation of 0.6 m wide and 0.8 m deep cable trench for laying three low-voltage cable line. Trench shall be filled with fine grained earth (sand) and backfilled, earth compacted and leveled.	m'	175	876.50	153,387.50
1.1.01.06	16.5.5.2	Excavation of 0.75 m wide and 0.8 m deep cable trench for laying four low-voltage cable line. Trench shall be filled with fine grained earth (sand) and backfilled, earth compacted and leveled.	m'	30	917.97	27,539.10
1.1.01.07	1.1.01.07	For developed land: delivery and placing of markers for cable route, cable conduits and crossing points with underground installations.	pcs	5	5,165.89	25,829.45
1.1.01.08	1.1.01.08	For undeveloped land: delivery and placing of markers for cable route, cable conduits and crossing points with underground installations.	pcs	98	4,624.88	453,238.24
1.1.01.09	1.1.01.09	Delivery and laying of PVC pipe, F 2x110 mm	m'	105	815.67	85,645.35
1.1.01.10	1.1.01.10	Delivery and laying of PVC pipe, F 4x110 mm	m'	48	1,632.26	78,348.48
1.1.01.11	1.1.01.11	Delivery and laying of PVC pipe, F 6x110 mm	m'	7	2,447.93	17,135.51
		TOTAL CIVIL WORKS:				8,669,028.36
		ELECTRICAL AND INSTALLATION WORKS				
1.1.03.12	16.5.5.6	Delivery and erection of 13 m high public lighting pole. Outer and inner surfaces of the pole are galvanized and the pole is provided with anti-vandal lock. The item includes delivery and installation of connecting gears with 6 A fuses, one for each luminaire, including other electrical and installation material required for connecting the connecting gear equipment. Delivery and drawing of PP 00-Y 3x2.5 mm ² + 2.5 mm ² feeder cables through the pole to each luminaire as well as connecting of cable ends. The item also includes delivery and placing of rubber pad for pole leveling. The rubber pad shall be placed between the anchor plate and pole foundation and it will serve as a buffer between metal and concrete surfaces. The pad surface is grooved to enable water runoff. Poles on the bridge over the Južna Morava River shall be anchored on already prepared anchors on the brackets. All materials and work included.	pcs	56	193,354.76	10,827,866.56
1.1.03.13	16.5.5.6	Delivery and erection of 9 m high public lighting pole. Outer and inner surfaces of the pole are galvanized and the pole is provided with anti-vandal lock. The item includes delivery and installation of connecting gears with 6 A fuses, one for each luminaire, including other electrical and necessary installation material to connect equipment in the connecting gear. Delivery and drawing of PP 00-Y 3x2.5 mm ² + 2.5 mm ² feeder cables through the pole to each luminaire as well as connecting of cable ends. The item also includes delivery and placing of rubber pad for pole leveling. The rubber pad shall be placed between the anchor plate and pole foundation and it will serve as a buffer between metal and concrete surfaces. The pad surface is grooved to enable water runoff. Poles on overpasses above the Južna Morava River shall be anchored on already prepared anchors on the overpass structure. All materials and work included.	pcs	84	157,305.92	13,213,697.28
1.1.03.14	1.1.03.14	Delivery of 1.5 m long arm and its mounting on a public lighting pole. All materials and work included.	pcs	29	37,836.85	1,097,268.65
1.1.03.15	1.1.03.15	Delivery of 1.5 m long double arm and its mounting on a public lighting pole. All materials and work included.	pcs	19	52,852.51	1,004,197.69
1.1.03.16	1.1.03.16	Delivery of support for two luminaires and its mounting onto public lighting pole. All materials and work included.	pcs	8	18,590.78	148,726.24
1.1.03.17	1.1.03.17	Delivery of support for two luminaires and its mounting onto public lighting pole. All materials and work included.	pcs	8	18,590.78	148,726.24

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
1.1.03.18	1.1.03.18	Delivery of luminaires with adequate Na 250 W bulb and control gear (impedance bonds have double power rating) and their mounting onto galvanized steel pole	pcs	38	66,974.17	2,545,018.46
1.1.03.19	1.1.03.19	Delivery of luminaires with adequate Na 250 W bulb and control gear (impedance bonds have double power rating) and their mounting onto galvanized steel pole	pcs	29	66,974.17	1,942,250.93
1.1.03.20	1.1.03.20	Delivery of luminaires with adequate Na 150 W bulb and control gear (impedance bonds have double power rating) and their mounting onto galvanized steel pole	pcs	76	57,321.63	4,356,443.88
1.1.03.21	1.1.03.21	Delivery of luminaires with adequate Na 150 W bulb and control gear (impedance bonds have double power rating) and their mounting onto galvanized steel pole	pcs	16	57,321.63	917,146.08
1.1.03.22	1.1.03.22	Delivery of luminaires with adequate Na 250 W bulb and control gear (impedance bonds have double power rating) and their mounting onto galvanized steel pole	pcs	16	66,974.17	1,071,586.72
1.1.03.23	16.5.3	Delivery of outdoor distribution cabinet for public lighting RO-JO-1 made of polyester and equipped with door and lock and its mounting on concrete base at height of 0.2 m above ground level. The item includes delivery and casting of concrete base for distribution cabinet. The distribution cabinet consists of three compartments for installation of the following equipment: - 1 single-pole two-position change over switch, 16 A - 2 single-pole, three-position change over switches, 16 A - 1 contactor, 500 V, 63 A - 1 ripple control contactor - alternatively FOREL - 1 bulb, 60 W, 220 V - 3 fuses, NV-0 250/50 A - 4 three-pole safety staffs, NV-0 125/3x25 A - 1 direct electricity meter - metering group 10-60 A - 3 automatic fuses, 10 A - small electrical and installation materials for connecting the bus bars to guard and neutral rails, etc. The item includes installation and connection of all equipment in distribution cabinet, functional testing and putting into operation. All materials and work included.	complete	2	239,355.66	478,711.32
1.1.03.24	16.5.5.2	Placing of potential barrier around the standalone distribution cabinet. The barrier shall be made of galvanized strip FeZn 25x4 mm buried into a trench around the distribution cabinet foundation and connected to common earth electrode for outdoor lighting system. Civil works included.	complete	2	37,120.73	74,241.46
1.1.03.25	16.5.5.2	Delivery, laying into excavated trench or cable conduit and connection of 1 kV, PP00-A, 4x35 mm ² + 2.5 mm ² feeder cables for outdoor lighting system from ROJO-1 and ROJO-2 (distribution cabinets for public lighting system) to lighting poles according to in/out principle. The item also includes procurement and placing of PVC warning tape at depth of 0.5 m from the cable. Procurement and fitting of lead clamps with impressed cable characteristics: type, voltage, section and year of cable laying. Marks shall be placed at both ends of hard plastic ('juvidur') pipes and in cable trench at every 5 m of cable length. All materials and work included.	m'	5248	1,060.83	5,567,235.84
1.1.03.26	16.1.2.2 16.1.2.3	Delivery, laying into excavated trench or cable conduit and connecting PP00-A 4x70 mm ² cable from low-voltage switchgear in pole-mounted transformer station 10/0.4 to distribution cabinet for outdoor lighting ROJO-1 and ROJO-2. The item includes procurement and laying of 2 PVC warning tapes - first tape at depth of 0.3 m from the cable and the other tape at 0.5 m from the cable. Procurement and fitting of lead clamps with impressed cable characteristics: type, voltage, section and year of cable laying. Marks shall be placed at both ends of hard plastic ('juvidur') pipes and in cable trench at every 5 m of cable length. All materials and work included.	m'	775	1,924.43	1,491,433.25
1.1.03.27	1.1.03.27	Procurement, delivery and placing of FeZn 25x4 mm galvanized strip for safety earthing in the same trench in parallel with the cable. All metal poles for outdoor lighting and distribution cabinets ROJO-1 and ROJO-2 shall be connected to the strip.	m'	5085	584.33	2,971,318.05
1.1.03.28	1.1.03.28	Procurement, delivery and fitting of SRPS NB4 936 cross member into its housing (K-U-K) which will be than grouted with bitumen. Housing shall be placed next to each pole at point of earthing strip detaching and joining.	pcs	160	1,001.84	160,294.40
TOTAL ELECTRICAL AND INSTALLATION WORKS:						48,016,163.05
1.1.03.29	16.5.5.7	SUNDRIES Geodetic survey of cable lines and entering of underground installations into the cadastral plan. Control of performed works, carrying out all required tests and issuing relevant certificates and putting into operation.	lump sum		853,372.91	853,372.91
TOTAL SUNDRIES:						853,372.91
PUBLIC LIGHTING SYSTEM AT "PREDEJANE INTERCHANGE":						57,538,564.32

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
1.1.02.00		1kV FEEDER CABLE FOR POWER SUPPLY TO TOLL STATION				
		CIVIL WORKS				
1.1.02.01	16.1.2.2	Excavation of 80 cm deep and 40 cm wide trench for laying of 1 kV cable. Filling of trench with fine-grained earth (sand) in 20 cm thick layer. Trench backfilling including earth compaction and leveling.	m'	16	739.17	7,391.70
1.1.02.02	1.1.02.02	For developed land, delivery and placing of markers for cable route, cable conduits and crossing points with underground installations.	pc	3	5,042.39	15,127.17
1.1.02.03	16.1.2.3	Delivery and laying of hard plastic ('juvidur') pipes, F 4x110 mm	m'	8	3,504.15	28,033.20
TOTAL CIVIL WORKS:						50,552.07
		ELECTRICAL AND INSTALLATION WORKS				
1.1.02.04	16.1.2.2 16.1.2.3	Delivery, laying into excavated trench or cable conduit and connecting of 1 kV, PP00-A 4x70 mm ² cable. The item also includes procurement and placing of PVC warning tape at depth of 0.5 m from the cable. Procurement and fitting of lead clamps with impressed cable characteristics, type, voltage, section and year of cable laying. Marks shall be placed at both ends of hard plastic ('juvidur') pipes in cable trench at every 5 m of cable length. All materials and work included. Cable shall be laid from 10/0.4 kV pole-mounted transformer station to cable termination box in the toll station service building.	m'	38	1,924.43	73,128.34
TOTAL ELECTRICAL AND INSTALLATION WORKS:						73,128.34
		SUNDRIES				
1.1.02.05	16.1.2.6 16.1.2.7	Geodetic survey of cable lines and entering of underground installations into the cadastral plan. Control of performed works, carrying out all required tests and issuing relevant certificates and putting into operation.	lump sum		938,710.20	938,710.20
TOTAL SUNDRIES						938,710.20
TOTAL 1kV FEEDER CABLE FOR POWER SUPPLY TO TOLL STATION:						1,062,390.61

SUMMARY DESIGN OF LIGHTING SYSTEM AT "PREDEJANE" GRADE-SEPARATED JUNCTION AND POWER SUPPLY TO TOLL STATIONS		
1.1.01.00	PUBLIC LIGHTING SYSTEM AT "PREDEJANE" INTERCHANGE	57,538,564.32
1.1.02.00	1kV FEEDER CABLE FOR POWER SUPPLY TO TOLL STATION	1,062,390.61
TOTAL DESIGN OF LIGHTING SYSTEM AT "PREDEJANE" GRADE-SEPARATED JUNCTION AND POWER SUPPLY TO TOLL STATIONS		58,600,954.93

**10 kV, Al/C 3x50/8 mm² OVERHEAD FEEDER CABLE
10/0.4 kV, 100 kVA MTS AT "PREDEJANE" INTERCHANGE**

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
01.01.00		10 kV, Al/C 3x50/8 mm² OVERHEAD FEEDER CABLE				
		CIVIL WORKS				
01.01.01	16.2.2	Construction of reinforced concrete block foundation for the new mast 12/1600. Foundation shall be of prismatic shape with a square base, 0.9 m x 0.9 m, embedding depth 2.2 m. The item includes: earth excavation, placing formwork, fixing rebars, construction of fine-grained sand base and sealing with concrete, class MB20. All materials and work included.	complete	1	155,815.61	155,815.61
01.01.02	16.2.2	Construction of reinforced concrete block foundation for the new mast 12/1000. Foundation shall be of prismatic shape with a square base, 0.8 m x 0.8 m, embedding depth 2.2 m. Foundation appearance is shown on the separate drawing. The item includes: earth excavation, placing formwork, fixing rebars, construction of fine-grained sand base and sealing with concrete, class MB20. All materials and work included.	complete	1	127,751.09	127,751.09
TOTAL CIVIL WORKS:						283,566.70
		ELECTRICAL AND INSTALLATION WORKS				
01.01.03	16.2.2	Delivery and planting of new terminal mast 12/1600 of reinforced concrete. <u>All materials and work included.</u>	pc	1	640,245.81	640,245.81
01.01.04	16.2.2	Delivery and erection of new angle tension tower 12/1000 of reinforced concrete. <u>All materials and work included.</u>	pc	1	555,396.99	555,396.99
01.01.05	16.2.4.8	Installation of earth electrode for the mast. The item includes earth excavation, procurement and installation of Ø10 mm earth electrode of galvanized iron. The earth electrode shall have two rings: one ring will be placed at depth of 0.5 m and at distance of 1 m from the mast edge while the other ring will be placed at depth of 0.8-1 m and at distance of minimum 2 m from the mast edge, as shown on the drawing. <u>All materials and work included.</u>	complete	2	37,658.97	75,317.94
01.01.06	16.2.4.8 16.2.4.5	The following equipment shall be delivered and mounted onto newly designed mast 12/1600 (1') to be planted on the transmission line route: - top concrete cantilever for horizontal arrangement of conductors, which shall support single tension string insulators, 6 pcs. - spur cantilever - 10 kV double tension insulator string for spur line feeding 10/0.4 kV MTS (mast transformer station) - 3 pcs. Other accessories necessary for fixing the equipment. The item also includes connection of the existing Al/C conductors to newly designed mast. <u>All materials and work included.</u>	complete	1	248,949.20	248,949.20



Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
01.01.07	16.2.4.8 16.2.4.5.	The following equipment shall be delivered and mounted onto newly designed mast 12/1000 (2'): - concrete cantilever for tensioning of conductors - 10 kV double tension insulator string - 3 pcs - 10 kV single tension insulator string - 3 pcs. Other accessories necessary for fixing the equipment. All materials and work included	complete	1	179,470.89	179,470.89
01.01.08	01.01.08	Delivery and mounting of Al/C 3x50/8mm ² strand - spur line from the existing overhead line via mast inserted into the very route to 10/0.4 kV MTS at "Predejane interchange" All materials and work included	m	120	1,859.90	223,188.00
TOTAL ELECTRICAL AND INSTALLATION WORKS:						1,922,568.83
SUNDRIES						
01.01.09	01.01.09	Control of performed works and putting into operation.	lump sum		855,051.25	855,051.25
01.01.10	01.01.10	Switching off the voltage and safeguarding the site.	lump sum		436,463.41	436,463.41
TOTAL SUNDRIES:						1,291,514.66
TOTAL 10 kV, Al/C 3x50/8 mm² OVERHEAD FEEDER CABLE:						3,497,650.19
01.02.00		10/0.4 kV, Al/C 3x50/8 mm² OVERHEAD FEEDER CABLE				
CIVIL WORKS						
01.02.01	16.2.2	Construction of reinforced concrete block foundation for the new mast 11/1600. Foundation shall be of prismatic shape with a square base, 1.2x1.2x2.0 m. The item includes: earth excavation, placing formwork, fixing rebars, construction of fine-grained sand base, sealing with concrete, class MB20 and laying Ø60 mm plastic pipes for cables and earthing strip. All materials and work included	complete	1	806,787.68	806,787.68
01.02.02	16.2.2	Excavation of earth to place safety earth electrode, backfilling and compaction of earth in 15 cm thick layers.	m ³	6.5	2,651.62	17,235.53
01.02.03	16.2.2	Procurement, transport and planting of reinforced concrete mast, 11 m high (9 m above the foundation level), 1600 daN peak force with all necessary supporting cantilevers for MTS equipment (100 kVA output power) and suitable top concrete tension cantilever for Al/C 3x50/8 mm ² strands. All materials and work included	pc	1	1,468,962.50	1,468,962.50
TOTAL CIVIL WORKS:						2,292,985.71
ELECTRICAL AND INSTALLATION WORKS						
01.02.04	01.02.04	Delivery and installation of three-pole switch disconnector with lightning arresters	complete	1	138,238.65	138,238.65
01.02.05	01.02.05	Delivery, installation and connection of outdoor 10/0.4 kV, 100 kVA transformers with reduced power losses.	complete	1	1,104,715.66	1,104,715.66
01.02.06	01.02.06	Installation of single-pole base for high-voltage fuse on isolators located on the primary transformer side	pcs	3	20,020.27	60,060.81
01.02.07	01.02.07	Delivery and installation of high-voltage 10 kV, 16 A fuse-link	pcs	3	8,640.55	25,921.65
01.02.08	01.02.08	Installation and connection of bus bars Cu Ø13 mm (connection between the switch disconnector and transformer)	complete	1	53,387.99	53,387.99
01.02.09	01.02.09	Delivery and laying of PP00 3x95+50 mm ² , 1 kV cable line to connect power transformer and low-voltage distribution cabinet including connection of the line ends	m'	5	9,831.33	49,156.65
01.02.10	01.02.10	Delivery and installation of low-voltage lightning arrester, 500 V, 5 kA	pcs	3	38,254.37	114,763.11
01.02.11	01.02.11	Delivery and mounting of outdoor low-voltage distribution cabinet made of polyester, IP54 protection class, for the following equipment: - low-voltage copper bus bars, 30 mm x 5 mm, - three-pole switch, 250 A, 400 V with electromagnetic and thermal releases, - 3 measuring current transformers, 150/5A/A - 3 ammeters with maxigraph, 0-6 A - 3 low-voltage terminals via three-pole disconnecting fuse bars, 400 A, - bases for 250 A nominal current with 80 A fuse-links - 9 pcs. - 1 socket with safety contact, 10 A, 250 V, - 6 A fuse-link for ammeters and bulb - 4 pcs. - 10 A fuse-link for socket - 1 pc. - 1 light switch, 10 A and 1 light fitting with 60 W bulb, - hardware and electric bonds - 1 set - other non-specified small materials	complete	1	610,454.12	610,454.12
01.02.12	01.02.12	Installation of common earth electrode for MTS. The earth electrode shall be installed in the form of two concentric contours made of copper wire, 35 mm ² minimum section, around MTS foundation. They shall be placed in earth according to drawings in graphical documentation. Probes (galvanized iron pipes, 2.5" diameter, 3 m long) shall be placed in apexes of external contour	complete	1	127,155.71	127,155.71
TOTAL ELECTRICAL AND INSTALLATION WORKS:						2,283,854.35
SUNDRIES						
01.02.13	01.02.13	Making necessary connections, non-specified small materials, all necessary tests and measurements in the transformer station and issuing relevant test certificates. Technical inspection and putting transformer station into operation	lump sum		158,022.05	158,022.05
TOTAL SUNDRIES:						158,022.05
TOTAL 10/0.4 kV, 100 kVA MTS:						4,734,862.11

SUMMARY 10 kV, Al/C 3x50/8 mm² OVERHEAD FEEDER CABLE and 10/0.4 kV, 100 kVA MTS AT "PREDEJANE" INTERCHANGE		
01 01 00	10 kV, Al/C 3x50/8 mm ² OVERHEAD FEEDER CABLE	3,497,650.19
01 02 00	10/0.4 kV, 100 kVA MTS AT "PREDEJANE" INTERCHANGE	4,734,862.11
TOTAL 10 kV, Al/C 3x50/8 mm² OVERHEAD FEEDER CABLE and 10/0.4 kV, 100 kVA MTS AT "PREDEJANE" INTERCHANGE:		8,232,512.30

Overhead low-voltage network

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
01.00.00		Overhead low-voltage network, 1 kV, Al/C 4x35/6mm² for power supply to Bunavejsko settlement from km 882+471 to km 883+516 of the highway				
01.01.00		Civil works				
01 01 01	01 01 01	Dismantling of the existing mast of low-voltage network and transport to the nearest warehouse as directed by the Investor (up to distance of 5 km)	pcs	24	20,735.48	497,651.52
01 01 02	16 2 2	Construction of reinforced concrete block foundation for the new mast 9/1000. Foundation shall be of prismatic shape with a square base, 0.9 m x 0.9 m, embedding depth 1.8 m. The item includes: earth excavation, placing formwork and sealing with concrete, class MB20. All materials and work included.	complete	2	47,549.29	95,098.58
TOTAL CIVIL WORKS:						592,750.10
01.02.00		Electrical and installation works				
01 02 01	01 02 01	Dismantling of the existing mast equipment and Al/C conductor as well as transport to the nearest warehouse as directed by the Investor (up to distance of 5 km)	complete	24	27,172.34	652,136.16
01 02 02	16 2 2	Delivery and erection of new reinforced concrete terminal mast 9/1000 according to the supplier's design. The mast shall be delivered together with suitable cantilever for horizontal arrangement of conductors including all needed supports for equipment to be mounted onto mast. All materials and work included.	pc	1	152,777.82	152,777.82
01 02 03	16 2 4 8 16 2 4 5	The following equipment shall be delivered and mounted onto new reinforced concrete terminal steel lattice mast 9/1000: - single tension insulator string with long rod insulators, 10 kV - 3 pcs. The item also includes equipment supports and accessories necessary for fixing equipment to supports. All materials and work included.	complete	1	52,852.51	52,852.51
01 02 05	16 2 4 8	Installation of earth electrode for the mast. The item includes earth excavation, procurement and installation of Ø10 mm earth electrode of galvanized iron. The earth electrode shall have two rings: one ring will be placed at depth of 0.5 m and at distance of 1 m from the mast edge while the other ring will be placed at depth of 0.8-1 m and at distance of 2 m at least from the mast edge, as shown on the drawing. All materials and work included.	complete	1	38,849.75	38,849.75
01 02 06	01 02 06	Control of performed works, carrying out all required tests and issuing relevant certificates and putting into operation.	lump sum		913,148.92	913,148.92
01 02 07	01 02 07	Switching off the voltage and safeguarding the site.	lump sum		448,380.45	448,380.45
TOTAL ELECTRICAL AND INSTALLATION WORKS:						2,258,145.61
Overhead low-voltage network, 1 kV, Al/C 4x35/6mm² for power supply to Bunavejsko settlement from km 882+471						2,850,895.71
02.00.00		Overhead low-voltage network, 1 kV, Al/C 4x35/6mm² for power supply to "Mahala Paševluka" settlement at km 882+841				
02.01.00		Civil works				
02 01 01	02 01 01	Dismantling of the existing mast of low-voltage network and transport to the nearest warehouse as directed by the Investor (up to distance of 5 km)	pcs	6	20,735.48	124,412.88
02 01 02	16 2 2	Construction of reinforced concrete block foundation for the new mast 9/1000. Foundation shall be of prismatic shape with a square base, 0.9 m x 0.9 m, embedding depth 1.8 m. The item includes: earth excavation, placing formwork, laying Ø110 mm pipes for cables and sealing with concrete, class MB20. All materials and work included.	complete	3	157,960.31	473,880.93
02 01 03	16 2 4 2	Excavation of 0.8 m deep and 0.4 m wide trench for laying one 1 kV cable line	m	153	851.62	130,297.86
02 01 04	16 2 4 3	Delivery and laying of 4xØ110 mm hard plastic ("Juvidur") pipes to draw cables under the highway.	m	57	3,146.54	179,352.78
TOTAL CIVIL WORKS:						907,944.45
02.02.00		Electrical and installation works				
02 02 01	02 02 01	Dismantling of the existing mast equipment and Al/C conductor as well as transport to the nearest warehouse as directed by the Investor (up to distance of 5 km)	complete	7	20,735.48	145,148.36
02 02 02	16 2 2	Delivery and erection of new reinforced concrete terminal mast 9/1000 according to the supplier's design. The mast shall be delivered together with suitable cantilever for horizontal arrangement of conductors including all needed supports for equipment to be mounted onto mast. All materials and work included.	pc	3	157,960.31	473,880.93
02 02 03	16 2 4 8	Installation of earth electrode for the mast. The item includes earth excavation, procurement and installation of Ø10 mm earth electrode of galvanized iron. The earth electrode shall have two rings: one ring will be placed at depth of 0.5 m and at distance of 1 m from the mast edge while the other ring will be placed at depth of 0.8-1 m and at distance of 2 m at least from the mast edge, as shown on the drawing. All materials and work included.	complete	3	38,849.75	116,549.25

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
02.02.04	16.2.4.8 16.2.4.5	The following equipment shall be delivered and mounted onto new reinforced concrete terminal steel lattice mast 9/1000: - 3 cable termination boxes, 1 kV - 3 lightning arresters, 1 kV - 3 single tension insulator strings, 1 kV Other accessories necessary for fixing equipment to supports. The item also includes connection of the existing Al/C conductors to newly designed mast.	complete	3	147,534.50	442,603.50
02.02.05	02.02.05	<u>All materials and work included</u> Delivery and laying of 1 kV PP 00-A 4x150 mm ² cable line into excavated cable trench under the highway through hard plastic ("Juvidur") pipes. The item includes procurement and filling of 20 cm thick bed made of fine grained earth or sand, procurement and placing of 2 PVC warning tapes, one at the depth of 0.3 m from the cable and the other at 0.5 m from the cable. Procurement and placing of lead clamps with impressed cable characteristics: type, voltage, section and year of cable laying. Marks shall be placed at both ends of hard plastic ("Juvidur") pipes and in cable trench at every 5 m of cable length. Trench backfilling, compaction of earth in layers and connection of cable ends. Procurement and placing of cable line markers for undeveloped land.	m	311	3,974.19	1,235,973.09
02.02.06	16.2.4.2	Delivery and assembly of protective gutter for 2 m long cable. The gutter shall be made of 2x(100x50x10) sections according to designed detail.	pcs	4	11,107.24	44,428.96
02.02.07	16.2.4.6 16.2.4.7	Geodetic survey of cable lines and entering of underground installations into the cadastral plan. Control of performed works, carrying out all required tests and issuing relevant certificates and putting into operation.	lump sum		913,088.09	913,088.09
02.02.08	02.02.08	Switching off the voltage and safeguarding the site.	lump sum		448,380.45	448,380.45
TOTAL ELECTRICAL AND INSTALLATION WORKS:						3,820,052.63
Overhead low-voltage network, 1 kV, Al/C 4x35/6mm² for power supply to "Mahala Paševluka" settlement at km						4,727,997.08

SUMMARY Overhead low-voltage network			
01.00.00	Overhead low-voltage network, 1 kV, Al/C 4x35/6mm ² for power supply to Bunavejsko settlement from km 882+471 to km 883+516 of the highway		2,850,895.71
02.00.00	Overhead low-voltage network, 1 kV, Al/C 4x35/6mm ² for power supply to "Mahala Paševluka" settlement at km 882+841		4,727,997.08
TOTAL Overhead low-voltage network:			7,578,892.79

DESIGN FOR DISPLACEMENT AND PROTECTION OF THE EXISTING TELECOMMUNICATION SYSTEM

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
Note: All items referred to material include its delivery.						
12.5.04.00	COLLISION 4 - THE EXISTING TELECOMMUNICATION OPTIC CABLE RUNNING IN PARALLEL WITH PLANNED HIGHWAY ALIGNMENT from 881+175.00 km to 881+475.00 km					
Collision 4 - material						
12.5.04.01	15.4.1.	PVC pipe, 1xØ110	m	580	200.93	116,539.40
12.5.04.02	15.4.1.	Plug for pipe, Ø110 mm	pcs	4	300.47	1,201.88
12.5.04.03	15.4.1.	Comb for two pipes, Ø110 mm	pcs	60	223.97	13,438.20
12.5.04.04	15.4.1.	PVC cable shield, 1 m	pcs	290	262.67	76,174.30
12.5.04.05	15.4.1.	Concrete post for marking straight cable route	pcs	5	772.35	3,861.75
12.5.04.06	15.4.1.	Concrete post for marking turning points in cable route	pcs	2	772.35	1,544.70
12.5.04.07	15.4.1.	Identification and warning tape with aluminum backing	m	290	13.82	4,007.80
12.5.04.08	15.4.1.	Sand	m ³	52.2	1,376.04	71,829.29
Collision 4 - works						
12.5.04.09	15.4.2.2	Routing	m	290	2.76	800.40
12.5.04.10	12.5.04.10	Detection of the existing cable routes by cable detector and pegging out.	m	290	193.55	56,129.50
12.5.04.11	15.4.2.2	Manual excavation of 0.6 m x 1.2 m trench in III category earth	m	290	390.78	113,326.20
12.5.04.12	15.4.2.2	Backfilling of 0.6 m x 1.2 m trench and compaction of earth in layers	m	290	269.13	78,047.70
12.5.04.13	12.5.04.13	Placing combs into trench	pcs	60	211.06	12,663.60
12.5.04.14	15.4.2.2	Spreading of sand in trench	m	290	49.77	14,433.30
12.5.04.15	15.4.2.2	Laying and casing the existing Ø40 PE hoses into Ø110 pipes in excavated trench	m	580	59.90	34,742.00
12.5.04.16	12.5.04.16	Plugging of Ø110 mm pipe	pcs	4	125.34	501.36
12.5.04.17	15.4.2.3	Placing concrete post for marking pipe ends and turning points in cable route	pcs	7	893.09	6,251.63
12.5.04.18	15.5.2	Electrical measurements on optic cable after protection	pc	1	43,699.52	43,699.52
12.5.04.19	12.5.04.19	Preparation of as-built technical documentation	m	290	306.91	89,003.90
12.5.04.20	12.5.04.20	Geodetic surveys and mapping up to 1 km	m	290	846.08	245,363.20
12.5.04.21	15.4.1	Placing identification and warning tape with aluminum backing	m	955	54.38	51,932.90
TOTAL COLLISION 4:						1,035,492.53
12.5.05.00	COLLISION 5 - THE EXISTING TELECOMMUNICATION OPTIC CABLE RUNNING IN PARALLEL WITH PLANNED HIGHWAY ALIGNMENT at 882+875.00					
Collision 5 - material						
12.5.05.01	15.4.1	PVC pipe, 1xØ110	m	50	200.93	10,046.50
12.5.05.02	15.4.1	Plug for pipe, Ø110 mm	pcs	4	300.47	1,201.88
12.5.05.03	15.4.1	Comb for two pipes, Ø110 mm	pcs	5	223.97	1,119.85
12.5.05.04	15.4.1	PVC cable shield, 1 m	pcs	25	262.67	6,566.75
12.5.05.05	15.4.1	Concrete post for marking straight cable route	pcs	2	772.35	1,544.70
12.5.05.06	15.4.1	Identification and warning tape with aluminum backing	m	25	13.82	345.50
12.5.05.07	15.4.1	Sand	m ³	4.5	1,376.04	6,192.18
12.5.05.08	15.4.1	Concrete MB-20	m ³	2	8,623.96	17,247.92

Summary DESIGN FOR DISPLACEMENT AND PROTECTION OF THE EXISTING TELECOMMUNICATION SYSTEM			
12.5.04.00	COLLISION 4 - THE EXISTING TELECOMMUNICATION OPTIC CABLE RUNNING IN PARALLEL WITH PLANNED HIGHWAY ALIGNMENT from 881+175.00 km to 881+475.00 km		1,035,492.53
12.5.05.00	COLLISION 5 - THE EXISTING TELECOMMUNICATION OPTIC CABLE RUNNING IN PARALLEL WITH PLANNED HIGHWAY ALIGNMENT at 882+875.00		198,274.92
12.5.06.00	COLLISION 6 - THE EXISTING TELECOMMUNICATION OPTIC CABLE RUNNING IN PARALLEL WITH PLANNED HIGHWAY ALIGNMENT at 883+125.00		306,417.90
12.5.07.00	COLLISION 7 - THE EXISTING TELECOMMUNICATION OPTIC CABLE RUNNING IN PARALLEL WITH PLANNED HIGHWAY ALIGNMENT from km 883+700.00 to km 883+925.00		829,795.01
TOTAL DESIGN FOR DISPLACEMENT AND PROTECTION OF THE EXISTING TELECOMMUNICATION			2,369,980.36

DESIGN OF OCS RECONSTRUCTION AND OVERPASS EARTHING

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
DISMANTLING						
12.6.01.00		Dismantling of masts and breaking up mast foundations.	kg	425	452.54	192,329.50
12.6.01.01	12.6.01.01	Displacement of catenary equipment to new cantilevers	km	0.35	301,177.76	105,412.22
12.6.01.02	12.6.01.02	Replacement of droppers in the contact equipment	km	0.35	256,001.73	89,600.61
12.6.01.03	12.6.01.03	Dismantling of complete single cantilever assembly with brackets	pcs.	7	174,044.17	1,218,309.19
12.6.01.04	12.6.01.04	Dismantling of the existing earth conductors	pcs.	2	24,809.20	49,618.40
TOTAL DISMANTLING OF CONSTRUCTION EQUIPMENT:						1,655,269.91
EARTH WORKS						
12.6.02.00	12.6.02.01	Marking of mast foundations, portals and anchors including removal and replacement of crushed stone for ballast bed	pcs.	2	211,094.84	422,189.68
12.6.02.02	12.6.02.02	Excavation of foundation pits for masts, portals, and anchors, 0-2 m deep without strutting in: a. II-III soil category	m ³	4.1	2,633.18	10,796.04
12.6.02.03	12.6.02.03	Backfilling and compaction of earth around foundations, spreading and compaction of remaining earth around foundations.	m ³	0.7	1,169.59	818.71
12.6.02.04	12.6.02.04	Haulage of surplus material of all categories with loading and unloading to the distance of: a. 5-20 m	m ³	3.4	910.60	3,096.04
TOTAL EARTH WORKS:						436,900.47
CONCRETING						
12.6.03.00	12.6.03.01	Casting of foundations for masts, portals and anchors with concrete MB15. Concrete shall be mixed mechanically and compacted by poker vibrator.	m ³	4.7	20,957.60	98,500.72
12.6.03.02	12.6.03.02	Increase of concreting costs for shuttering.	m ²	5.9	3,174.19	18,727.72
12.6.03.03	12.6.03.03	Finishing of exposed foundation faces with 2 cm thick coat on average of cement mortar 1:3 mix.	m ²	6.3	1,482.95	9,342.59
12.6.03.04	12.6.03.04	Delivery and installation of anchors for footed masts m 36/830 mm	pcs.	8	1,896.78	15,174.24
TOTAL CONCRETING:						141,745.27
MAST AND PORTALS						
12.6.04.00	12.6.04.01	Delivery and erection of all masts.	kg	468	913.37	427,457.16
12.6.04.01	12.6.04.02	Inscription of marks on masts including TOR height, mast number and distance between inner mast face and the track centre line.	pcs.	2	910.60	1,821.20
TOTAL MAST AND PORTALS:						429,278.36
ELECTRICAL AND INSTALLATION WORKS						
12.6.05.00	12.6.05.01	Complete single cantilever assembly with brackets for twin channel mast or equipment support				
12.6.05.01		a. Delivery of material and equipment	pcs.	7	9,100.46	63,703.22
		b. Installation	pcs.	7	3,709.67	25,967.69
TOTAL ELECTRICAL AND INSTALLATION WORKS:						89,670.91
RETURN CONDUCTOR AND EARTHING						
12.6.06.00	12.6.06.01	Delivery and fitting of rail bond of bare copper strand, 35 mm ² section. Measurement and payment per each rail bond of: b. L= 220 mm	pcs.	80	4,058.06	324,644.80
12.6.06.02	12.6.06.02	Delivery and fitting of complete spark-gap for earthing of metal structures. Measurement and payment per one spark-gap	pcs.	3	34,830.40	104,491.20
12.6.06.03	12.6.06.03	Delivery and installation of bare galvanized iron strand, 95 mm ² section, on supports for connecting metallic structures to be earthed. Measurement per: a. one strand	pcs.	9	47,018.41	423,165.69
		b. meter of strand length	m'	145	1,192.63	172,931.35
12.6.06.04	12.6.06.04	Delivery and fitting of earthing assembly for OCS supporting structures or other metallic structures out of tunnels to rail of bare galvanized iron strand, 95 mm ² section, buried in the formation. The strand is fitted with cable shoe at one end and the other end is welded to rail. Measurement per one earthing strand of: a. L=3500 mm b. L=5000 mm c. Variable length of: - one strand - meter of strand length	pc. pc. pcs. m'	1 1 3 40	231,300.36 330,428.43 21,125.34 1,192.63	231,300.36 330,428.43 63,376.02 47,705.20

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
12.6.06.05	12.6.06.05	Delivery and installation of angles 50x50x1600 mm to serve as mechanical protection	pcs	6	2,919.82	17,518.92
12.6.06.06	12.6.06.06	Delivery and placing of plate with electrical hazard warning sign according to YR catalogue 951101	pcs	8	1,057.14	8,457.12
TOTAL RETURN CONDUCTOR AND EARTHING:						1,724,019.09
12.6.07.00		SUNDRIES				
12.6.07.01	12.6.07.01	Inspection of completed works and OCS energizing	lump sum		294,261.62	294,261.62
12.6.07.02	12.6.07.02	Works on the existing 25 kV electrical network and safety measures on the site	lump sum		1,098,381.10	1,098,381.10
TOTAL SUNDRIES:						1,392,642.72

SUMMARY DESIGN OF OCS RECONSTRUCTION AND OVERPASS EARTHING						
12.6.01.00		DISMANTLING				1,655,269.91
12.6.02.00		EARTH WORKS				436,900.47
12.6.03.00		CONCRETING				141,745.27
12.6.04.00		MAST AND PORTALS				429,278.36
12.6.05.00		ELECTRICAL AND INSTALLATION WORKS				89,670.91
12.6.06.00		RETURN CONDUCTOR AND EARTHING				1,724,019.09
12.6.07.00		SUNDRIES				1,392,642.72
TOTAL DESIGN OF OCS RECONSTRUCTION AND OVERPASS EARTHING:						5,869,526.73

08.02. TELECOMMUNICATION INSTALLATIONS – CIVIL ENGINEERING PART

08.02.01. Manholes

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.02.01.01.		EARTH WORKS				
08.02.01.01.01	13.2.2	Excavation of II and III category earth with all needed supports and transport to stockpiling area Payment per m ³ of "net" excavated earth	m ³	144	1,168.66	168,287.04
08.02.01.01.02	08.02.01.01.02	Placing and compaction of 10 cm thick sub-base made of gravel and sand mix around telephone manhole	m ²	2.7	2,121.66	5,728.48
08.02.01.01.03	13.2.4	Backfilling of over-excavated area with earth in 30 cm thick layers including compaction of each layer to modulus of compressibility Ms=30 MPa and backfilling of abandoned manholes. Payment per m ³ of compacted earth	m ³	110.25	353.92	39,019.68
TOTAL EARTH WORKS:						213,035.20
08.02.01.02.		WORKS ON PLAIN AND REINFORCED CONCRETE				
08.02.01.02.01	8.10	10 cm thick blinding course made of lean concrete MB15 under the bottom plate	m ²	3.7	6,871.89	25,425.99
08.02.01.02.02	8.10	10 cm thick layer made of lean concrete MB 20 around telephone manholes to serve as a platform for any installation and urgent works on telecommunication cable conduits.	m ²	4.23	8,623.96	36,479.35
08.02.01.02.03	8.10	Reinforced concrete MB 30, V-6 impermeability, M-150 frost resistance for bottom manhole plate	m ²	5.4	9,829.49	53,079.25
08.02.01.02.04	8.10	Reinforced concrete MB 30, V-6 impermeability, M-150 frost resistance for 15 cm thick manhole walls.	m ²	16.2	9,829.49	159,237.74
08.02.01.02.05	8.10	Sloping layer of lean concrete MB 15 and 10 cm thick leveling layer of lean concrete MB 15 under the bottom plate	m ²	0.72	6,871.89	4,947.76
TOTAL WORKS ON PLAIN AND REINFORCED CONCRETE:						279,170.09
08.02.01.03.		REINFORCEMENT WORKS				
08.02.01.03.01	13.5.1	Measurement includes all labor, procurement and transport, wire-brushing, cutting, mechanical bending and fixing of reinforcing bars according to designed details and quality. Payment per kg of fixed reinforcing bars RA 400/500-2	kg	2693	94.93	255,646.49
TOTAL REINFORCEMENT WORKS:						255,646.49
08.02.01.04.		MASONRY WORKS				
08.02.01.04.01	08.02.01.04.01	Making wall of bricks laid on edge in cement mortar to protect vertical waterproofing layer Payment per m ² of protected surface. The price includes procurement and transport of all needed material and masonry.	m ²	144	4,261.75	613,692.00
TOTAL MASONRY WORKS:						613,692.00
08.02.01.05.		SUNDRIES				
08.02.01.05.01	08.02.01.05.01	Placing waterproofing layer of bitulite, two coats of hot bitumen and one coat of "Condor IV" band over external concrete surfaces. Payment per m ² of finished and protected surface. The price includes procurement, transport and incorporation of materials, overlappings and all works in situ.	m ²	166	7,276.49	1,207,897.34
08.02.01.05.02	08.02.01.05.02	Procurement, transport and fitting of lids for telephone manholes. Payment per one fully fitted lid for heavy traffic with a frame for double lid.	pcs	20	14,537.32	290,746.40
08.02.01.05.03	08.02.01.05.03	Making funnel-like openings for newly designed manholes - 2 Ø 110 pipes	pcs	20	2,204.60	44,092.00
08.02.01.05.04	08.02.01.05.04	Delivery and mounting of prefabricated cantilevers and cantilever supports Cantilever supports - 2 per one manhole Cantilevers - (1 per one support)	pcs	40	701.38	28,055.20
			pcs	40	5,305.07	212,202.80
TOTAL SUNDRIES:						1,782,993.74
TOTAL MANHOLES (08.02.01.):						3,144,537.52

08.02.02. Telecommunication cable conduit route

08.02.02.01.		MATERIAL				
08.02.02.01.01	15.4.2.1.	Plug for PVC pipes, Φ110 mm	pcs	116	300.47	34,854.52
08.02.02.01.02	15.4.2.1.	Comb for 2 PVC pipes, Φ110 mm	pcs	266	184.33	49,031.78
08.02.02.01.03	15.4.2.1.	PVC pipe, Φ110 mm, L=6.00 m	pcs	89	200.93	17,882.77
08.02.02.01.04	15.4.2.1.	Comb for 4 HDPE pipe, Φ50 mm	pcs	4,601	223.97	1,030,485.97
08.02.02.01.05	15.4.2.1.	HDPE pipe, 4xΦ50 mm	m'	18,404	63.59	1,170,310.36
08.02.02.01.06	15.4.2.1.	Rubber ring for PVC pipes, Φ110 mm	pcs	89	389.86	34,697.54
08.02.02.01.07	15.4.2.2	Yellow warning tape for P.O. cables, 8 cm	kg	348	344.70	119,955.60
TOTAL MATERIAL:						2,457,218.54
08.02.02.02.		EARTH WORKS				
08.02.02.02.01	15.4.2.2	Excavation of III category earth to depth of 2 m	m ³	2,718	345.62	939,395.16
		90% mechanical excavation	m ³	302	1,094.93	330,668.86
		10% hand excavation				
TOTAL EARTH WORKS:						1,270,064.02
08.02.02.03.		BUILDING MATERIAL				
08.02.02.03.01	15.4.2.2	Procurement and transport of sand to telecommunication cable conduit route	m ³	1,430	1,376.04	1,967,737.20
TOTAL BUILDING MATERIAL:						1,967,737.20
08.02.02.04.		WORKS ON TELECOMMUNICATION CABLE ROUTE				
08.02.02.04.01	15.4.2.2	Routing	m	4,868	2.76	13,435.68
08.02.02.04.02	15.4.2.2	Backfilling with sand of trench bottom for telecommunication cable conduit and area around and above PVC pipe including wetting and compaction	m ³	1,430	409.21	585,170.30
08.02.02.04.03	15.4.2.2	Backfilling of trench for telecommunication cable conduit, area next to manhole and trench under the pavement with over-excavated material including compaction in 20 cm thick layers.	m ³	1,640	353.92	580,428.80
08.02.02.04.04	15.4.2.2	Haulage of surplus material	m ³	1,590	823.04	1,308,633.60
08.02.02.04.05	15.4.2.1	Laying of 4 HDPE pipes, Φ50	m	18,404	59.90	1,102,399.60
08.02.02.04.06	15.4.2.1	Laying of 2 pipes, Φ110 mm into excavated trench	m	533	59.90	31,926.70
08.02.02.04.07	15.4.2.2	Placing a warning tape	m	4,868	54.38	264,721.84
08.02.02.04.08	15.4.2.1	Sealing of pipes, Φ110 mm	pcs	116	125.34	14,539.44
TOTAL WORKS ON TELECOMMUNICATION CABLE ROUTE:						3,901,258.96
TOTAL TELECOMMUNICATION CABLE CONDUIT ROUTE (08.02.02.):						9,596,275.72

08.02. Summary – telecommunication installations – civil engineering part

08.02.01. MANHOLES		3,144,537.52
08.02.02. TELECOMMUNICATION CABLE CONDUIT ROUTE		9,596,275.72
TOTAL telecommunication installations – civil engineering part (08.02.):		12,740,813.24

12.09. Displacement and protection of lineside telecommunication cables

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
Note: All items related to material include delivery						
12.09.04.	COLLISION 4 - ITEMS OF THE BILL OF QUANTITIES ARE NOT AVAILABLE					
12.09.05.	COLLISION 5 - Cables are affected by construction of embankment on the left track side					
12.09.05.01. Collision 5 - material						
12.09.05.01.01	15.4.1	One STA 3x4x1 2VF+8x4x1 2NF+12x4x0 9NF cable, with 55mm diameter	m	420	1,338.25	562,065.00
12.09.05.01.02	15.4.1	SPZ 21x0.9	m	420	1,929.03	810,192.60
12.09.05.01.03	15.4.1	PNK 3x10mm ²	m	420	1,026.73	431,226.60
12.09.05.01.04	15.4.1	Straight joint on STA cable, code N1626, without measurement of coupling, accessories and material included	pc	2	16,141.93	32,283.86
12.09.05.01.05	15.4.1	Pupinized joint on STA cable with measurement of coupling and making diagram of crossing points, accessories and material included.	pc	1	68,035.91	68,035.91
12.09.05.01.06	15.4.1	Joint on SPZ cable with heat-shrink coupling	pc	2	6,109.68	12,219.36
12.09.05.01.07	15.4.1	Joint on PNK cable with heat-shrink coupling	pc	2	6,109.68	12,219.36
12.09.05.01.08	15.4.1	Brick for separation of PNK cables from other cables in a trench	pc	2280	171.43	390,860.40
12.09.05.01.09	12.09.05.01.09	Yellow PVC pipes, 110 mm dia., 6 m long	pc	8	1,205.53	9,644.24
12.09.05.01.10	15.4.1	Sand	m ³	29	1,376.04	39,905.16
TOTAL COLLISION 5 - material:						2,368,652.49
12.09.05.02. Collision 5 - works						
12.09.05.02.11	15.4.2.2	Routing	m	420	2.76	1,159.20
12.09.05.02.12	15.4.2.2	Excavation of 0.8x0.5 m trench, placing PVC shields and yellow PVC warning tape, backfilling and compaction in minimum three layers and haulage of surplus earth to specified stockpiling area	m	420	627.65	263,613.00
12.09.05.02.13	12.09.05.02.13	Construction of passage under the track	m	10	1,565.90	15,659.00
12.09.05.02.14	15.4.2.3	Laying STA cable in a trench	m	420	59.90	25,158.00
12.09.05.02.15	15.4.2.3	Laying SPZ cable in a trench	m	420	59.90	25,158.00
12.09.05.02.16	15.4.2.3	Laying PNK cable in a trench	m	420	59.90	25,158.00
12.09.05.02.17	12.09.05.02.17	Installation of straight cable joint on STA cable without measurement of coupling	pc	2	4,848.85	9,697.70
12.09.05.02.18	12.09.05.02.18	Installation of pupinized joint	pc	1	75,078.31	75,078.31
12.09.05.02.19	12.09.05.02.19	Installation of joint on SPZ cable	pc	2	5,342.86	10,685.72
12.09.05.02.20	12.09.05.02.20	Installation of joint on PNK cable	pc	2	5,342.86	10,685.72
12.09.05.02.21	12.09.05.02.21	Placing bricks in a soldier course	pc	2280	171.43	390,860.40
System switch off/on						
12.09.05.02.22	12.09.05.02.22	Signaling/safety systems	compl	1	161,963.98	161,963.98
12.09.05.02.23	12.09.05.02.23	1. Central traffic control	compl	1	271,927.07	271,927.07
12.09.05.02.24	12.09.05.02.24	2. Station interlocking	compl	1	36,942.84	36,942.84
12.09.05.02.25	12.09.05.02.25	3. Level crossing control	compl	1	21,450.68	21,450.68
Telecommunication systems						
12.09.05.02.26	12.09.05.02.26	1. HF system Z12 Niš – Leskovac – Skopje	compl	1	124,480.13	124,480.13
12.09.05.02.27	12.09.05.02.27	2. Selective dispatch system - traffic	compl	1	54,818.41	54,818.41



Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
12.09.05.02.28	12.09.05.02.28	3. Selective dispatch system - electric traction	compl	1	74,211.03	74,211.03
12.09.05.02.29	12.09.05.02.29	4. Radio dispatch system	compl	1	46,043.30	46,043.30
		Power supply systems				
12.09.05.02.30	12.09.05.02.30	1. Central electric traction control	compl	1	177,130.80	177,130.80
		Measurement, testing and documentation				
12.09.05.02.31	15.5.2	Measurement of a cable drum	compl	1	812.91	812.91
12.09.05.02.32	15.4.2.2	Identification of cable route by detector and recording	m	450	193.55	87,097.50
12.09.05.02.33	15.5.2	Measurement of finished cable installation between two stations	compl	1	59,585.23	59,585.23
12.09.05.02.34	15.5.2	Measurement of SPZ cable	compl	1	41,276.48	41,276.48
12.09.05.02.35	15.5.2	Measurement of PNK cable	compl	1	41,276.48	41,276.48
12.09.05.02.36	12.09.05.02.36	As-built design of cable works with measurement protocols	compl	1	75,835.91	75,835.91
12.09.05.02.37	12.09.05.02.37	As-built design of civil works	compl	1	46,043.30	46,043.30
TOTAL COLLISION 5 - works:						2,173,809.10
TOTAL COLLISION 5:						4,542,461.59
12.09.06.	COLLISION 6 - Cables are affected by construction of embankment on the left track side					
12.09.06.01. Collision 6 - material						
12.09.06.01.01	15.4.1.	One STA 3x4x1.2VF+8x4x1.2NF+12x4x0.9NF cable, with 55mm diameter	m	250	1,338.25	334,562.50
12.09.06.01.02	15.4.1.	SPZ 21x0.9	m	250	1,929.03	482,257.50
12.09.06.01.03	15.4.1.	PNK 3x10mm ²	m	250	1,026.73	256,682.50
12.09.06.01.04	15.4.1.	Straight joint on STA cable, code N1626, without measurement of coupling, accessories and material included	pc	2	16,141.93	32,283.86
12.09.06.01.05	15.4.1.	Straight joint on STA cable with measurement of capacitive coupling and making diagram of crossing points, accessories and material included	pc	1	40,767.72	40,767.72
12.09.06.01.06	15.4.1.	Joint on SPZ cable with heat-shrink coupling	pc	2	6,109.68	12,219.36
12.09.06.01.07	15.4.1.	Joint on PNK cable with heat-shrink coupling	pc	2	6,109.68	12,219.36
12.09.06.01.08	15.4.1.	Brick for separation of PNK cables from other cables in a trench	pc	2280	171.43	390,860.40
12.09.06.01.09	15.4.1.	Sand	m ³	29	1,376.04	39,905.16
TOTAL COLLISION 6 - material:						1,601,758.36
12.09.06.02. Collision 6 - works						
12.09.06.02.10	15.4.2.2	Routing	m	570	2.76	1,573.20
12.09.06.02.11	15.4.2.2	Excavation of 0.8x0.5 m trench, placing PVC shields and yellow PVC warning tape, backfilling and compaction in minimum three layers and haulage of surplus earth to specified stockpiling area	m	570	627.65	357,760.50
12.09.06.02.12	15.4.2.3	Construction of passage under the track	m	20	1,565.90	31,318.00
12.09.06.02.13	15.4.2.3	Laying STA cable in a trench	m	250	59.90	14,975.00
12.09.06.02.14	15.4.2.3	Laying SPZ cable in a trench	m	250	59.90	14,975.00
12.09.06.02.15	12.09.06.02.15	Laying PNK cable in a trench	m	250	59.90	14,975.00
12.09.06.02.16	12.09.06.02.16	Installation of straight cable joint on STA cable without measurement of coupling	pc	2	4,848.85	9,697.70
12.09.06.02.17	12.09.06.02.17	Installation of straight cable joint on STA cable with measurement of capacitive coupling	pc	1	90,731.75	90,731.75
12.09.06.02.18	12.09.06.02.18	Installation of joint on SPZ cable	pc	2	5,342.86	10,685.72
12.09.06.02.19	12.09.06.02.19	Installation of joint on PNK cable	pc	2	5,342.86	10,685.72
12.09.06.02.20	12.09.06.02.20	Placing bricks in a soldier course	pc	2280	171.43	390,860.40
		System switch off/on				
12.09.06.02.21	12.09.06.02.21	Signaling/safety systems	compl	1	161,963.98	161,963.98
12.09.06.02.22	12.09.06.02.22	1. Central traffic control	compl	1	271,927.07	271,927.07
12.09.06.02.23	12.09.06.02.23	2. Station interlocking	compl	1	36,942.84	36,942.84
12.09.06.02.24	12.09.06.02.24	3. Level crossing control	compl	1	21,450.68	21,450.68
		Telecommunication systems				
12.09.06.02.25	12.09.06.02.25	1. HF system Z12 Niš - Leskovac - Skopje	compl	1	124,480.13	124,480.13
12.09.06.02.26	12.09.06.02.26	2. Selective dispatch system - traffic	compl	1	54,818.41	54,818.41
12.09.06.02.27	12.09.06.02.27	3. Selective dispatch system - electric traction	compl	1	74,211.03	74,211.03
12.09.06.02.28	12.09.06.02.28	4. Radio dispatch system	compl	1	46,043.30	46,043.30
		Power supply systems				
12.09.06.02.29	15.5.2	1. Central electric traction control	compl	1	177,130.80	177,130.80
		Measurement, testing and documentation				
12.09.06.02.30	15.5.2	Measurement of a cable drum	compl	1	812.91	812.91
12.09.06.02.31	15.5.2	Identification of cable route by detector and recording	m	280	193.55	54,194.00
12.09.06.02.32	15.5.2	Measurement of finished cable installation between two stations	compl	1	59,585.23	59,585.23
12.09.06.02.33	15.5.2	Measurement of SPZ cable	compl	1	41,276.48	41,276.48
12.09.06.02.34	15.5.2	Measurement of PNK cable	compl	1	41,276.48	41,276.48
12.09.06.02.35	12.09.06.02.35	As-built design of cable works with measurement protocols	compl	1	75,835.91	75,835.91
12.09.06.02.36	12.09.06.02.36	As-built design of civil works	compl	1	46,043.30	46,043.30
TOTAL COLLISION 6 - works:						2,236,230.54
TOTAL COLLISION 6 - material+works:						3,837,988.90
12.09. Displacement and protection of the existing lineside telecommunication cables						
12.09.05. COLLISION 5 - Cables are affected by construction of embankment on the left track side						4,542,461.59
12.09.06. COLLISION 6 - Cables are affected by construction of embankment on the left track side						3,837,988.90
TOTAL Displacement and protection of the existing lineside telecommunication cables						8,380,450.49

12. SUMMARY – Technical infrastructure	
DESIGN OF LIGHTING SYSTEM AT "PREDEJANE" GRADE-SEPARATED JUNCTION AND POWER SUPPLY TO TOLL STATIONS	58,600,954.93
10 kV, Al/C 3x50/8 mm ² OVERHEAD FEEDER CABLE and 10/0.4 kV, 100 kVA MTS AT "PREDEJANE" INTERCHANGE	8,232,512.30
Overhead low-voltage network	7,578,892.79
DESIGN FOR DISPLACEMENT AND PROTECTION OF THE EXISTING TELECOMMUNICATION SYSTEM	2,369,980.36
DESIGN OF OCS RECONSTRUCTION AND OVERPASS EARTHING	5,869,526.73
TELECOMMUNICATION INSTALLATIONS – CIVIL ENGINEERING PART	12,740,813.24
Displacement and protection of lineside telecommunication cables	8,380,450.49
SUB-TOTAL	103,773,130.84
Unforeseen work (5% of sub-total)	5,188,656.54
TOTAL TECHNICAL INFRASTRUCTURE (12.):	108,961,787.38

10. Landscaping of road land strip

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
14.01.00	14.01.00	LANDSCAPING				
14.01.02	14.01.02	Procurement and planting of 10-12 year old plantlets of high deciduous trees. Cylindrical planting pits, 1.00x1.00 m shall be excavated, detritus, barren soil and other damaging substances removed from the pit and plantlets bedded with mix of humus, peat fertilizer and sand in approximate proportion 6:3:1 to 2/3 of pit volume. The top third of pit shall be enriched with peat fertilizer of prescribed quantity (25 kg per plantlet). Sand content in the mix depends on soil substrate structure. Plantlets shall be fixed to rod of specified height with rounded top placed prior to covering up the clods taking care not to damage the root system. After planting ground shall be bowl-shaped and plantlets abundantly watered. Other operations shall be performed in accordance with attached General conditions of landscaping.				
		TILIA ARGENTEA	pcs.	22	5,943.78	130,763.16
		ACER PLATANOIDES	pcs.	11	5,943.78	65,381.58
		FRAXINUS ANGUSTIFOLIA	pcs.	28	5,943.78	166,425.84
		SALIX VITELINA "PENDULA"	pcs.	16	5,943.78	95,100.48
14.01.04	14.01.04	Procurement and planting of 6-8 year old plantlets of medium high and small deciduous trees. Cylindrical planting pits, 0.80x0.80 m shall be excavated, detritus, barren soil and other damaging substances removed from the pit and plantlets bedded with mix of humus, peat fertilizer and sand in approximate proportion 6:3:1 to 2/3 of pit volume. The top third of pit shall be enriched with peat fertilizer of prescribed quantity (15 kg per plantlet). Sand content in the mix depends on soil substrate structure. After planting ground shall be bowl-shaped and plantlets abundantly watered. Plantlets shall be baled for transport to prevent drying of root system. Other operations shall be performed in accordance with attached General conditions of landscaping.				
		CRATAEGUS NIGRA	pcs.	59	4,929.95	290,867.05
		ACER CAMPESTRE	pcs.	38	4,929.95	187,338.10
		FRAXINUS ORNUS	pcs.	33	4,929.95	162,688.35
		PRUNUS CERASIFERA "NIGRA"	pcs.	47	4,929.95	231,707.65
		CORILUS AVELLANA	pcs.	32	4,929.95	157,758.40
		SAMBUCUS NIGRA	pcs.	33	4,929.95	162,688.35
		CORNUS MAS "VARIEGATA"	pcs.	63	4,929.95	310,586.85
		COTINUS COGGYGRIA	pcs.	23	4,929.95	113,388.85
		SYRINGA VULGARIS	pcs.	18	4,929.95	88,739.10
14.01.05	14.01.05	Procurement and planting of 3-5 year old plantlets of deciduous shrubs and creepers. Cylindrical planting pits, 0.4x0.4 m shall be excavated and plantlets bedded by using mix of humus, peat fertilizer and sand in approximate proportion 6:3:1 to 2/3 of pit volume. The top third of pit shall be enriched with peat fertilizer of prescribed quantity (3 kg per plantlet). Sand content in the mix depends on soil substrate structure. Appropriate number of plantlets shall be bedded in the area of one m ² depending on the sort. Other operations shall be performed in accordance with attached General conditions of landscaping.				
		VIBURNUM OPULUS "ROSEUM"	pcs.	171	769.58	131,598.18
		CORNUS ALBA	pcs.	923	769.58	710,322.34
		CORNUS SANGUINEA	pcs.	387	769.58	297,827.46
		TAMARIX PENTANDRA	pcs.	403	769.58	310,140.74
		PHILADELPHUS CORONARIUS	pcs.	241	769.58	185,468.78
		SPIRAEA X VANHOUTTEI	pcs.	398	769.58	306,292.84
		ROSA RUGOSA	pcs.	208	769.58	160,072.64
		FORSYTHIA X INTERMEDIA	pcs.	864	769.58	664,917.12
		BUDDLEIA DAVIDII	pcs.	319	769.58	245,496.02
		LONICERA TATARICA	pcs.	481	769.58	370,167.98
		LONICERA CAPRIFOLIUM	pcs.	18	769.58	13,852.44

No.	Description	Unit	Nominal quantity	Rate	Extended amount
D201	Cement	t	200.00	7,451.61	1,490,322.00
D202	Mild steel reinforcing bar up to 16 mm diameter	t	100.00	59,612.88	5,961,288.00
D203	Mild steel reinforcing bar above 16 mm diameter	t	100.00	59,612.88	5,961,288.00
D204	Aggregate for pavement base	m3	500.00	794.47	397,235.00
D205	Gravel	m3	500.00	1,192.63	596,315.00
D206	Lime	kg	200.00	76.50	15,300.00
D207	Mortar	m3	200.00	3,576.96	715,392.00
D208	Concrete aggregate				
D208.1	0-4 mm	m3	500.00	894.01	447,005.00
D208.2	4-8 (0-8) mm	m3	500.00	894.01	447,005.00
D208.3	8-16 mm	m3	500.00	894.01	447,005.00
D208.4	16-32 (22) mm	m3	500.00	894.01	447,005.00
D209	Asphalt aggregate, limestone				
D209.1	0-4 mm	m3	500.00	894.01	447,005.00
D209.2	4-8 (0-8) mm	m3	500.00	894.01	447,005.00
D209.3	8-16 mm	m3	500.00	894.01	447,005.00
D209.4	16-32 (22) mm	m3	500.00	894.01	447,005.00
D210	Asphalt aggregate, igneous				
D210.1	0-4 mm	m3	500.00	1,192.63	596,315.00
D210.2	4-8 (0-8) mm	m3	500.00	1,192.63	596,315.00
D210.3	8-16 mm	m3	500.00	1,192.63	596,315.00
D210.4	16-22 mm	m3	500.00	1,192.63	596,315.00
D211	Planed softwood	m3	50.00	21,361.28	1,068,064.00
D212	Sawn softwood	m3	50.00	17,883.86	894,193.00
D213	Plywood	m3	50.00	34,774.18	1,738,709.00
D214	Gas oil	l	1,000.00	99.54	99,540.00
D215	Bitumen	t	200.00	59,612.88	11,922,576.00
	Subtotal				36,821,522.00
D150	Allow % percent* of Subtotal for Contractor's overhead, profit, etc.				736,430.44
Total for Daywork: Materials					37,557,952.44

a. To be entered by the bidder

No.	Description	Nominal quantity (hours)	Basic hourly rental rate	Extended amount
D301	Excavator, face shovel, or dragline:			
D301.1	Up to and including 1 m ³	500.00	2,230.42	1,115,210.00
D301.2	Over 1 m ³ to 2 m ³	400.00	2,433.18	973,272.00
D301.3	Over 2 m ³	100.00	3,041.47	304,147.00
D302	Tractor, including bull or angle dozer:			
D302.1	Up to and including 150 kW	500.00	2,534.56	1,267,280.00
D302.2	Over 150 kW to 200 kW	400.00	2,534.56	1,013,824.00
D302.3	Over 200 kW to 250 kW	200.00	3,649.77	729,954.00
D303	Tractor with ripper:			
D303.1	Up to and including 200 kW	400.00	3,041.47	1,216,588.00
D303.2	Over 200 kW to 250 kW	200.00	4,055.30	811,060.00
D304	Roller	200.00	2,027.65	405,530.00
D305	Shovel	200.00	4,055.30	811,060.00
D306	Crane	200.00	11,152.07	2,230,414.00
D307	Pneumatic hammer	200.00	4,258.06	851,612.00
D308	Pneumatic drill	200.00	608.29	121,658.00
D309	Draining unit	200.00	4,562.21	912,442.00
D310	Loader	200.00	3,244.24	648,848.00
D311	Truck:			
D311.1	up to and including 10 t	500.00	1,824.89	912,445.00
D311.2	over 10 to 20 t	500.00	2,433.18	1,216,590.00
D312	Power generator up to 25 kVA	200.00	2,230.42	446,084.00
Total for Daywork: Equipment				15,988,018.00

Amount (RSD)	Amount (RSD)	% Foreign
1. Total for Daywork: Labour	4,685,839.20	
2. Total for Daywork: Materials	37,557,952.44	
3. Total for Daywork: Equipment	15,988,018.00	
Total for Daywork	58,231,809.64	

Price Analyses





КОРИДОРИ СРБИЈЕ

No: 5094/02-1

Date: 10.09.2012

JV Trace and Mostovik
Attn. Mr. Tsvetan Ivanov Tsonev
71 "James Bouchier" blvd, 1407 Sofia
Bulgaria

REFERENCE: Serbia, Corridor X Highway Project, Construction of Highway E75
Section: Grdelica (Gornje Polje) – Caricina Dolina, LOT 1 and LOT 2
ICB No: CORR.X.E75.EIB.PACK1.ICB

SUBJECT: Clarification of Financial Bid

Dear Sir,

As your company submitted Bids for Construction of Highway E75, Section: Grdelica (Gornje Polje) – Caricina Dolina, LOT 1: Road and bridges from Grdelica to Tunnel Predejane and LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina. ICB No: CORR.X.E75.EIB.PACK1.ICB, we are asking you to submit clarification in accordance with ITB 27, in order to complete the evaluation of your Bids, namely:

- Complete unit price analyses, detailing all its integral parts, the cost of materials, labor, equipment, transport, design overheads (logistic, safety, etc.), and any other aspect that influence directly or indirectly its formation.

This analysis is necessary in order to eliminate, by any means, endangering of the Contract implementation due to incompleteness of cost elements, obligations and procedures. In particular, it should demonstrate that high quality, up-to-date materials and equipment would be used in accordance with the Technical Specifications and Design and in compliance with all valid norms, regulations and standards in the country where works will be carried out.

Therefore, please provide us with analysis of offered unit prices for the following items:

I. CIVIL ENGINEERING DESIGN

01.01. HIGHWAY ALIGNMENT

Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
01.01.02. EARTH WORKS						
01.01.02.02	3.2.	Bulk excavation and transport (including topsoil stripping and stockpiling, excavation of soil of low bearing capacity, topsoiling and grassing) Excavation in III and IV category soil with loading, transport and unloading of material from the excavation or borrow pit 1000 m - 3000 m	m ³	39 671,00	85,00	3.372 035,00
		Excavation in V and VI category soil with loading, transport and unloading of material from the excavation or borrow pit 1000 m - 3000 m	m ³	33 025,00	202,76	6.696 149,00
01.01.02.04	3.4.	Construction of embankment (including topsoil stripping, construction of stepped side cuts, shoulder central part, leveling, topsoiling and grassing of embankment slopes)	m ³	178 902,00	87,05	15.573 419,10
01.01.04. SUB-BASES						
01.01.04.02	6.2 AS- 6.2.2	Procurement and placing of 0/63 mm crushed stone as rolled sub-base of pavement structure. Broken stone layer shall be placed onto finished subgrade accepted by the Supervising Engineer. Stone of this size shall meet requirements of SRPS U.E 9020. Payment per 1 m ³ of placed material including procurement and transport. • d=70 cm	m ³	61 982,00	754,74	46 780 294,68

01.01.04.04	AS-0.2.2	Placing and rolling the sub-base of 0:3:1.5 mm crushed stone onto rolled subgrade accepted by the Engineer. Rolling shall be performed until even surface is achieved according to designed gradients and crossfalls with tolerance of ± 1 cm. Thickness: d=10 cm, d=18 cm, d=30 cm, d=38 cm	m ³	27 743,00	754,74	20 938 751,82
01.01.06. ASPHALT PAVEMENT						
01.01.06.01	9.3	Placing of bituminous base course BNS 229A (Bu 60) consisting of stone aggregate d= 8 cm d= 8-8= 16 cm	m ²	17 719,00	889,91	15 768 315,29
			m ³	53 509,00	1.779,83	95 236 923,47

2. BRIDGES

CONCRETE, METALWORK AND PILES						
Item No	T.S.	Work Description	Unit	Quantity	Unit Price	Total
08.09. BRIDGE AT km 881+101.843						
PILES						
08.09.01.10	13.4.2	Construction of Ø120 cm piles with concrete, class MB 50, M-150, V-3. Payment per m ³ of completed pile.	m ³	1 126,00	33.326,15	37 525 244,80
CONCRETE						
08.09.02.20	13.4.3.3	Bridge deck over prefabricated girders made of reinforced concrete, class II, MB 40, M-150, V-6	m ²	1 937,28	12.217,10	23 667 943,49
08.09.02.25	13.4.4	Prefabricated main girders made of prestressed concrete, class II MB 50, M-150, V-3	m ³	1 901,00	16.905,27	32 136 918,27
METALWORK						
08.09.03.02	13.5.1	Ribbed rebars RA 400/500-2	kg	2 210 378,00	70,66	156 185 309,48
BRIDGE WATERPROOFING						
08.09.04.02	13.10.2	Insulating coat on pavement top	m ²	9 277,30	881,72	8 179 980,96
08.10. BRIDGE at km 881+705.810						
CONCRETE						
08.10.02.19	13.4.4	Prestressed box bridge construction cast in situ. Concrete class II MB 50, M-150, V-3	m ³	3 988,00	18.046,08	71 967 767,04
METALWORK						
08.10.03.01	13.5.1	Ribbed rebars RA 400/500-2	kg	1 179 594,44	70,66	83 350 143,13
08.11. BRIDGE AT km 883+067.252						
PILES						
08.11.01.07	13.4.2	Construction of Ø150 cm piles with concrete, class MB 30, M-150, V-3. Payment per m ³ of completed pile.	m ³	478,00	41.656,92	19 912 007,76
CONCRETE						
08.11.02.14	13.4.3.3	Bridge deck over prefabricated girders made of reinforced concrete, class II, MB 45, M-150, V-6	m ²	2 289,00	12.724,01	29 125 258,89
08.11.02.18	13.4.4	Prefabricated main girders made of prestressed concrete, class II MB 50, M-150, V-3	m ³	2 350,00	16.905,27	39 727 384,50
08.11.02.19	13.4.4	Prestressed box bridge construction cast in situ. Concrete class II MB 45, M-150, V-3	m ³	2 516,00	22.858,16	57 511 130,56
METALWORK						
08.11.03.01		Reinforcement B500A	kg	1 605 246,00	70,66	113 426 682,36
08.11.03.02	13.5.1	Ribbed rebars RA 400/500-2	kg	140 916,00	70,66	9 957 124,56

3. CULVERTS AND SEPARATORS

8.5.1/12. Devices for water protection against pollution – separators						
Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
8.5.1/12.09.	8.5.1/12.09 Special spec.	Procurement, transport and installation of mineral oil separators provided with integrated BY-PASS, Purgator type or equivalent with the following capacities:				
		Qn/Qmax 10/100	pcs.	7,00	399.165,22	2 794 156,54
		Qn/Qmax 15/150	pcs.	6,00	462.303,95	2 773 823,70
		Qn/Qmax 20/200	pcs.	2,00	525.442,68	1 050 885,36
		Qn/Qmax 30/300	pcs.	3,00	588.581,42	1 765 744,26
		Qn/Qmax 50/500	pcs.	2,00	727.700,66	1 455 401,32

4. SUPPORTING STRUCTURES

07.22 Supporting structure made of walls and piles						
Item No.	T.S.	Work Description	Unit	Quantity	Unit Price	Total
07.22.14		REINFORCEMENT WORKS				
07.22.14.01	1) 1.2007	Pile reinforcement a) RA 400/500-2 ribbed bars Price includes procurement, cutting, bending and fixing of all necessary material including all related works. Measurement unit is kg	kg	69.346,00	78,85	5 467 932,10



5. TRAFFIC-TECHNICAL AND SERVICE EQUIPMENT FOR ROADS

11. Traffic-technical and service equipment for roads						
Item No	T.S.	Work Description	Unit	Quantity	Unit Price	Total
TRAFFIC EQUIPMENT - delivery + full installation						
11.3.04	12.6	Single sided distance barrier H2W4	m	2250	5,970.30	13,433,175.00
11.3.05		Single sided distance barrier H2W4* on the structure	m	4096	9,124.42	37,373,624.32

Your Clarification regarding above-mentioned issue applies to bid for LOT 2 and shall be submitted on Company's Memorandum signed by authorized person to sign the bid on behalf of JV.

This request has purpose to clarify your Bids and cannot change the price, scope or any other aspect of it.

Requested document shall be provided in English language as scanned documents by an e-mail until September 17, 2012. Hard copy document can be delivered after to the Employer's address:

Attn. Mr. Mihajlo Misić

Koridori Srbije d.o.o.

21 Kralja Petra Street, 11000 Belgrade, Republic of Serbia

E-mail: procurement@koridorisrbije.rs

Kind regards.

Director



Mihajlo Misić, Civ. Eng.



27



3022/12
13.09 12ТРЕЙС ГРУП ХОЛД АД
Max. No. 558, 13.09.12

Attn.:

Civ. Eng. Mihajlo Mišić
Director of Koridori SrbijeReference: Corridor X Highway Project, Serbia, Construction of Highway E75, Section:
Grdelica (Gornje Polje) – Caricina Dolina, Lot 1 and Lot 2, ICB No: CORRX.E75.EIB.PACK1.ICB

Subject: Clarification of Financial Bid

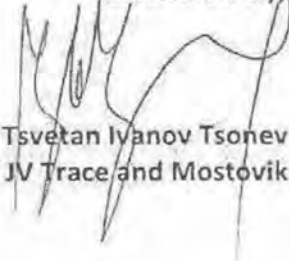
Dear Sir,

In connection to letter № 5094/12-1 (from 10.09.2012) of Koridori Srbije, and regarding Corridor X Highway Project, Serbia, Construction of Highway E75, Section: Grdelica (Gornje Polje) – Caricina Dolina, Lot 1 and Lot 2, ICB No: CORRX.E75.EIB.PACK1.ICB, and the request by the Employer for detailed clarification of the prices offered, we would kindly like to turn your attention to the following:

The analysis requested is currently being elaborated by the teams of the JV partners simultaneously in Bulgaria, Serbia and Russia. In order to synchronize the results of the teams' work in the three countries and given the importance of this Project and the necessity the analysis, required by the Employer, to be precise and clear, we kindly ask for extension of the deadline for submission of the aforementioned analysis until September 24th, 2012.

Due to the short terms we expect your prompt response to the email and fax of the JV, while thanking you about the same.

Yours sincerely,



Eng. Tsvetan Ivanov Tsonev
Empowered Representative of JV Trace and Mostovik

JV "TRACE MOSTOVIK"

Outg. № 005/ 14th September, 2012

To
Koridor Srbije d.o.o
Attn: Mr. Mihajlo Misic
21 Kralja Petra Street
11000 Belgrade, Serbia
E-mail: procurement@koridorisrbije.rs
Fax: +381 11 32 48 682

КОРИДОРНИ ПРОЈЕКТ АОО
БЕОГРАД
Бр. 5334/12
17.09.2012
Бр. ПРИЈЕМА _____

REFERENCE: Serbia, Corridor X Highway Project, Construction of Highway E75,
Section: Grdelica (Gornje Polje)- Caricina Dolina, LOT 1 and LOT 2, ICB
No: CORR.X.E75.EIB.PACK1.ICB

SUBJECT: Clarification to Financial Bid

Dear Mr. Mihajlo Mišić,

Regarding your letter with Ref. № 5094/12-1 from 10.09.2012, as well as under ITB 27 of the Tender documentation, hereby we present detailed analysis of the unit prices of the Bill of Quantities stated in the abovementioned letter.

The prices offered by us are based on objective circumstances concerning the following factors, which are determined as follows:

1. **Direct costs** - In the forming of the unit prices proposed in the offer of the JV were taken into consideration all inherent direct costs concerning the quality and the execution of the project in time. These costs were optimized by using the expertise of engineers and technical personnel of the JV, through detailed analysis of the projects, study of the route and preparation of a work plan which allows a maximum utilization of all production capacity. The direct costs are optimized on the basis of savings plan developed specifically for the current Project. We consider that the direct costs can be reduced by applying a series of engineering decisions and developments related to our experience in the implementation of several other major infrastructure projects without impacting the existing technical standards and quality requirements.

Unit prices offered in the bid were elaborated in complete accordance with the technical specifications set out in the tender documentation received by the Employer - based on the enclosed Bills of Quantities and project and in accordance with all applicable rules, regulations and standards in the country of execution of the works. Also in the formation of these prices was taken into consideration the fact that the works will be performed under the rules of FIDIC.

JV "TRACE MOSTOVIK"

2. **Provision of staff** – it should be considered that the companies involved in the JV have a highly qualified engineering and technical personnel which are completely able to implement certainly the most complex tasks in the field of road construction (more than 1000 employees including about 50 engineers, 20 surveyors, 60 foremen, 18 mechanics, 20 technicians, 130 machine operators, 225 drivers, 350 unskilled staff, 50 managers, etc.). It should be considered that the mentioned personnel in its majority is involved in the construction of major infrastructure projects and has excellent knowledge of the technical requirements and the relevant standards in the implementation of the current Project.
3. **Technical equipment** – it should be noted that technically the companies - partners in the JV are completely equipped with the latest machinery and equipment; have mobile plants for production of aggregates (crushers and equipment for separation), plants for concrete and asphalt production. The companies - partners in the JV dispose of their own machinery with over 500 units of equipment and production facilities /mobile concrete plants – 4 units, mobile crushing installations – 5 units, mobile asphalt plants -6 units. etc./, which is an objective factor that provides extremely favorable conditions in the execution of the contract and determines the value of our proposed prices.
4. **Long-lasting commercial relations** – the companies - partners in JV "TRACE MOSTOVIK" have established long-term business relationship with a number of suppliers of materials and services with which were negotiated exceptionally favorable conditions. The established durable commercial relations in the region lead to tangible reduction of direct costs involved in pricing and we consider this fact as a very favorable condition. In connection to this project were established also new commercial relations with suppliers of materials and services on the territory of the Republic of Serbia, with which exclusively advantageous terms were negotiated.
5. **Profit** – In the price bid submitted by JV "TRACE MOSTOVIK" was embedded normal rate of profit. We would like to emphasize that in times of economic crisis, low profit rates are determined by a greater corporate value, namely - retention of trained staff and specialists. This understanding has been crucial factor for us in determining the profit in the total price.
6. **Balanced bid** - All unit prices offered by us, in aggregate as a whole, are mutually balanced in such a way that the overall offer assures the technical and pricing requirements of the Employer and guarantees his security for the successful completion of the project with the required quality, price and term.

We believe that there are objective circumstances that will enable us to achieve exceptionally high quality in the performance of the contract. These circumstances are reflected in:

- Correct and precise pricing of all required types of work;
- Ability to achieve low cost price of the end product due to the high productivity of our completely renewed machinery;
- Extremely high professionalism and experience of the management of the project;
- High level of training of the personnel which will perform the works;
- Organization of works securing maximum compaction of employed resources and provision of high productivity at a constant level of costs;

TRACE
TRADING COMPANY

Handwritten signature and stamp. The stamp contains the text "С. ПРАВИЛНИК ОД 12.07.11" and the number "862/738".

JV "TRACE MOSTOVIK"

- Lack of embedded investment costs for purchase of equipment to perform the Contract;
- Existence of exceptionally good price terms from suppliers of basic materials and raw materials – long-standing direct contact with manufacturers;
- Possession of own machinery secured by our own service base for maintenance - these circumstances in their totality enable predictability of costs for repairs and maintenance and keeping of extremely low levels of their respective prices;
- Low and almost zero amortization deductions in respect to the equipment provided;
- Low profit rate;
- Achieved very competitive prices for the works to be performed by suppliers of materials and services;

Kind regards,

TSVETAN TSONEV
Authorized Representative
JV TRACE MOSTOVIK

TRACE
ТРЕК ТРЪТ КОМПА

Appendix: Analysis of unit prices of Bills of Quantities -35 pages.

UNIT PRICE ANALYSES

1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS

UNIT PRICE ANALYSIS ITEM No. 01.01.02.02

Bulk excavation and transport (Including topsoil stripping and stockpiling, excavation of soil of low bearing capacity, topsoiling and grassing)
Excavation in III and IV category soil with loading, transport and unloading of material from the excavation or borrow pit 1000 m - 3000 m

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,01333	1,00	330,77	4,41
					Total:	4,41

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Transport with a truck	t/km	2,18000	2,00	7,38	32,18
					Total:	32,18

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 301.3	Excavator with capacity over 2 m ³	Equ. shift	0,00127	1,00	27 035,28	34,33
D 302.2	Track roller bulldozer over 150 kW	Equ. shift	0,00125	0,50	22 529,44	14,08
					Total:	48,41

Summary unit price :	85,00
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TRACE
TRACING / TPVIT / XONAAA

TRACE
TRACING / TPVIT / XONAAA

664/733

**1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS**

UNIT PRICE ANALYSIS ITEM No. 01.01.02.02

*Bulk excavation and transport (Including topsoil stripping and stockpiling, excavation of soil of low bearing capacity, topsoiling and grassing)
Excavation in V and VI category soil with loading, transport and unloading of material from the excavation or borrow pit 1000 m - 3000 m*

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,14	1,00	330,77	46,31
	Unskilled labourer	w. shift	0,14	1,00	330,77	46,31
					Total:	92,62

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Materials for blasting operations	m ³	1,00	1,00	26,19	26,19
	Transport with a truck	t/km	2,00	2,00	7,38	29,52
					Total:	55,71

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Equipment for blasting operations	Equ. shift	1,00	1,00	22,79	22,79
	Excavation machinery for rock soils	Equ. shift	1,00	1,00	31,64	31,64
					Total:	54,43

Summary unit price : 202,76


 ΤΡΕΡΣ ΓΡΥΠΗ ΧΑΛΚΙΔΑΣ

 ΤΡΕΡΣ ΓΡΥΠΗ ΧΑΛΚΙΔΑΣ 665/733


 ΟΡΓΑΝΙΣΜΟΣ
 ΕΡΓΩΝ
 ΕΛΛΑΔΟΣ

1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (including topsoil stripping, construction of stepped side cuts, shoulder central part, levelling, topsoiling and grassing of embankment slopes)

Unitm³

№	Analysis №	Description	Unit	Quantity	Unit Price /RSD/	Total /RSD/
1	2	3	4	5	6	7
1	1.01.	Topsoil stripping: 22659 m ³	%	0,431	76,46	32,95
2	1.02.	Surplus topsoil: 11737 m ³	%	0,225	69,68	15,68
3	1.03.	Stepped side cuts: 3461 m ³	%	0,066	33,79	2,23
4	1.04.	Shoulder central part: 2528 m ³	%	0,048	61,92	2,97
5	1.05.	Topsoiling of slopes: 45674 m ²	%	0,175	65,78	11,51
6	1.06.	Topsoiling and grassing of shoulders: 8934 m ²	%	0,034	132,05	4,49
7	1.07.	Lining with stone the embankment slopes: 1889 m ² =944,5m ³	%	0,007	862,86	6,04
8	1.08.	Lining of slope with stone : 620 m ³	%	0,012	931,44	11,18

Summary unit price : 87,05

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 666/733



1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (including topsoil stripping, construction of stepped side cuts, shoulder central part, levelling, topsoiling and grassing of embankment slopes)

UNIT PRICE ANALYSIS No. 1.01. - Topsoil stripping

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,00615	1,00	330,77	2,03
Total:						2,03

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Transport with a truck	t/km	2,10000	3,00	7,38	46,49
Total:						46,49

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 305	Shovel	Equ. shift	0,00039	1,00	36047,12	14,06
D 304	Roller 8t	Equ. shift	0,00077	1,00	18023,52	13,88
Total:						27,94

Summary unit price: 76,46



1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (Including topsoil stripping, construction of stepped side cuts, shoulder central part, levelling, topsoiling and grassing of embankment slopes)

UNIT PRICE ANALYSIS No. 1.02. - Surplus topsoil

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,00800	1,00	330,77	2,65
					Total:	2,65

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Transport with a truck	t/km	0,95000	3,00	7,38	21,03
					Total:	21,03

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 305	Track roller bulldozer up to 150 kW	Equ. shift	0,00100	1,00	36047,12	36,05
	Roller 2,5 t	Equ. shift	0,00100	1,00	9948,30	9,95
					Total:	46,00

Summary unit price: 69,68

1. CIVIL ENGINEERING DESIGN
 01.01. HIGHWAY ALIGNMENT
 Item No. 01.01.02. - EARTH WORKS

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (including topsoil stripping, construction of stepped side cuts, shoulder central part, levelling, topsoiling and grassing of embankment slopes)

UNIT PRICE ANALYSIS No. 1.03. - Stepped side cuts

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,08000	1,00	330,77	26,46
					Total:	26,46

II. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Mechanical rammer	Equ. shift	0,00250	2,00	1466,10	7,33
					Total:	7,33

Summary unit price: 33,79

TRACE
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 TRACE
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 669/733



1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (Including topsoil stripping, construction of stepped side cuts, shoulder central part, levelling, topsoiling and grassing of embankment slopes)

UNIT PRICE ANALYSIS No. 1.04. - Shoulder central part

Unitm²

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,06400	1,00	330,77	21,17
					Total:	21,17

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Transport with a truck	t/km	1,76000	6,00	7,38	1,48
					Total:	1,48

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Roller 2,5 t	Equ. shift	0,00250	1,00	9948,30	24,87
	CAT-multifunctional excavator	Equ. shift	0,00125	1,00	11519,00	14,40
					Total:	39,27

Summary unit price: 61,92

**1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS**

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (Including topsoil stripping, construction of stepped side cuts, shoulder central part, levelling, topsoiling and grassing of embankment slopes)

UNIT PRICE ANALYSIS No. 1.05. - Topsoiling of slopes

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,04000	1,00	330,77	13,23
					Total:	13,23

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Transport with a truck	t/km	1,02000	6,00	7,38	45,17
					Total:	45,17

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Hand roller	Equ. shift	0,00100	1,00	837,75	0,84
	Bobcat	Equ. shift	0,00100	1,00	6544,95	6,54
					Total:	7,38

Summary unit price: 65,78


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ОМ ОДГОВОРН
 МАДРИ

**1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS**

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (Including topsoil stripping, construction of stepped side cuts, shoulder central part, levelling, topsoiling and grassing of embankment slopes)

UNIT PRICE ANALYSIS No. 1.06. - Topsoiling and grassing of shoulders

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,04000	1,00	330,77	13,23
D 108	Unskilled labourer	w. shift	0,02000	1,00	330,77	6,62
					Total:	19,85

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Transport with a truck	t/km	1,02000	6,00	7,38	45,17
	grass seeds	kg	0,04000	1,00	130,90	5,24
					Total:	50,41

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	CAT-multifunctional excavator	Equ. shift	0,00500	1,00	11519,00	57,60
	Hand roller	Equ. shift	0,00500	1,00	837,75	4,19
					Total:	61,79

Summary unit price: 132,05

1. CIVIL ENGINEERING DESIGN
 01.01. HIGHWAY ALIGNMENT
 Item No. 01.01.02. - EARTH WORKS

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (including topsoil stripping, construction of stepped side cuts, shoulder central part, levelling, topsoiling and grassing of embankment slopes)

UNIT PRICE ANALYSIS No. 1.07. - Lining with stone the embankment slopes

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 102	Skilled mason	w. shift	1,60000	1,00	496,67	794,67
					Total:	794,67

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Transport with a truck	t/km	1,54000	6,00	7,38	68,19
					Total:	68,19

Summary unit price: 862,86

TRACE
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 673/733



ОДГОВОР
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1. CIVIL ENGINEERING DESIGN
 01.01. HIGHWAY ALIGNMENT
 Item No. 01.01.02. - EARTH WORKS

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (Including topsoil stripping, construction of stepped side cuts, shoulder central part, leveling, topsoiling and grassing of embankment slopes)

UNIT PRICE ANALYSIS No. 1.08. - Lining of slope with stone

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 102	Skilled mason	w. shift	1,62000	1,00	496,67	804,61
					Total:	804,61

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Cement mortar with delivery	m ³	0,02000	1,00	2932,10	58,64
	Transport with a truck	t/km	1,54000	6,00	7,38	68,19
					Total:	126,83

Summary unit price: 931,44



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1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.04. - SUB - BASES

UNIT PRICE ANALYSIS ITEM No. 01.01.04.02

Procurement and placing of 0/63 mm crushed stone as rolled sub-base of pavement structure. Broken stone layer shall be placed onto finished subgrade accepted by the Supervising Engineer. Stone of this size shall meet requirements of SRPS U.E 9020. Payment per 1 m3 of placed material including procurement and transport. d = 70 cm

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,04	1,00	330,77	12,04
D 108	Unskilled labourer	w. shift	0,04	1,00	330,77	12,04
					Total:	24,08

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Gravel 0-63	m ³	1,35	1,00	270,18	364,74
	Transport with a truck	t/km	2,23	6,00	7,38	98,74
	Water for road works	m ³	0,06	1,00	71,70	4,30
					Total:	467,78

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 305	Shovel	Equ. shift	0,0045	1,00	36047,12	163,65
D 304	Roller 8t	Equ. shift	0,0023	1,00	18023,52	40,91
D 304	Pneumatic roller 16R	Equ. shift	0,0023	1,00	18023,52	40,91
	Water carrier truck	Equ. shift	0,0011	1,00	15270,00	17,41
					Total:	262,88

Summary unit price: 754,74

TRACE
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1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.04. - SUB - BASES

UNIT PRICE ANALYSIS ITEM No. 01.01.04.03

Placing and rolling the sub-base of 0/31.5 mm crushed stone onto rolled subgrade accepted by the Engineer. Rolling shall be performed until even surface is achieved according to designed gradients and crossfalls with tolerance of ± 1 cm.

Thickness: d=10 cm, d=18 cm, d=30 cm, d=38 cm

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,03640	1,00	330,77	12,04
D 108	Unskilled labourer	w. shift	0,03640	1,00	330,77	12,04
					Total:	24,08

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Transport with a truck	t/km	2,23000	6,00	7,38	98,74
	Water for road works	m ³	0,06000	1,00	71,70	4,30
	Gravel 0-31,5	M ³	1,35000	1,00	270,18	364,74
					Total:	467,78

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 305	Shovel	Equ. shift	0,00454	1,00	36047,12	163,65
D 304	Roller 8t	Equ. shift	0,00227	1,00	18023,52	40,91
D 304	Pneumatic roller 16R	Equ. shift	0,00227	1,00	18023,52	40,91
	Water carrier truck	Equ. shift	0,00114	1,00	15270,00	17,41
					Total:	262,88

Summary unit price: 754,74

1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.06. - ASPHALT PAVEMENT

UNIT PRICE ANALYSIS ITEM No. 01.01.06.01.

Placing of bituminous base course BNS 22sA (Bit 60) consisting of stone aggregate

Unitt

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 101	Skilled asphalt finisher	w. shift	0,13	1,00	496,67	62,08
D 101	Skilled asphalt finisher	w. shift	0,02	1,00	496,67	7,75
					Total:	69,83

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	bituminous gravel	t	1,0100	1,00	4 226,17	4 268,43
	water	m ³	0,0100	1,00	71,70	0,72
	Transport with a truck	t/km	1,0100	12,00	7,38	89,45
					Total:	4 358,60

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Asphalt paver	Equ. shift	0,0025	1,00	61 266,00	153,17
D 304	Roller 8t	Equ. shift	0,0025	1,00	2 252,94	5,63
D 304	Pneumatic roller 16R	Equ. shift	0,0025	1,00	2 252,94	5,63
	Water carrier truck	Equ. shift	0,0025	1,00	15 270,00	38,18
	Joint cutter	Equ. shift	0,0025	0,50	3 141,60	3,93
					Total:	206,54

Summary unit price: 4 634,97

I.

Placing of bituminous base course BNS 22sA (Bit 60) consisting of stone aggregate						
	Unit	Quantity	Ratio	Unit Price /RSD/	Unit Price /RSD/ for m ²	
d= 8 cm	t	0,192		4 634,97	889,91	

II.

Placing of bituminous base course BNS 22sA (Bit 60) consisting of stone aggregate						
	Unit	Quantity	Ratio	Unit Price /RSD/	Unit Price /RSD/ for m ²	
d= 8 cm + 8 cm	t	0,384		4 634,97	1 779,83	

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UNIT PRICE ANALYSES

2. BRIDGES
CONCRETE, METALWORK AND PILES
08.09. BRIDGES AT km 881+101.843
PILES
Item No. 08.09.01.10

UNIT PRICE ANALYSES ITEM No. 08.09.01.10

Construction of Ø120 cm piles with concrete, class MB 30, M-150, V-3. Payment per m' of completed pile.

Unitm'

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D107	Skilled steelwork erector	w.shift	1,50000	1,00	494,67	742,01
	Driller	w.shift	2,00000	1,00	494,67	989,34
D100	Skilled concrete finisher	w.shift	2,00000	1,00	494,67	989,34
					Total	2720,69

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Construction of work site from crushed stone 0-120 mm	m3	0,30000	1,00	1466,07	439,82
	Construction of welded reinforcement set for piles and transport onsite	kr	130,00000	1,00	71,73	9324,90
	Foisture, loading and transportation 1 km of earth material	m3	1,15000	1,00	314,16	361,28
	Water	m3	0,10000	1,00	71,70	7,17
	Concrete MB 30, M-150, V-3-incl. transport	m3	1,15000	1,00	6806,75	7827,76
	Pile form saving reinforcement set /0,75/	m3	0,08000	1,00	7330,35	586,43
	Test	unit	0,00200	1,00	1361350,05	2722,70
					Total	21270,06

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Pilot machine φ1200	equ.shift	0,05000	1,00	154 002,45	7 700,12
	Crane	equ.shift	0,00200	1,00	12 390,90	24,78
	Concrete pump	equ.shift	0,10094	1,00	13 089,90	1 321,23
	Vibrator	equ.shift	0,10000	1,00	261,80	26,18
D312	Power generator 8,1-30 KB	equ.shift	0,10000	1,00	2 478,18	247,82
	Autowatercarrier	equ.shift	0,00100	1,00	15 270,00	15,27
					Total	9 335,40

Summary unit price : 33 326,15

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UNIT PRICE ANALYSES

2. BRIDGES
08.09. BRIDGES AT km 881+101.843
CONCRETE
Item No. 08.09.02.20

UNIT PRICE ANALYSES ITEM No. 08.09.02.20

Bridge deck over prefabricated girders made of reinforced concrete, class II, MB 40, M-150, V-6.

Unitm3

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D105,D106	Skilled carpenter	w.shift	3,00000	1,00	441,37	1324,11
D100	Skilled concrete finisher	w.shift	1,58000	1,00	496,67	784,74
					Total	2108,85

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Metalconstruction	m2	3,00000	1,00	78,54	235,62
D213	Plywood hydrophobic	m3	0,00150	1,00	38637,98	57,96
	Iron sheet galvanized 0.55 mm	m2	0,15000	1,00	227,85	34,18
	Formwork grease	kr	0,60000	1,00	91,50	54,90
	Fixators	bp	15,00000	1,00	10,47	157,05
	Scaffold	m3	6,00000	1,00	245,04	1470,24
D211	Joists	m3	0,00300	1,00	23734,76	71,20
	Water	m3	0,10000	1,00	71,70	7,17
	Concrete MB 40, M-150, V-6- incl. transportation	m3	1,01500	1,00	7174,31	7281,92
					Total	9370,24

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Crane	equ.shift	0,02400	1,00	12390,90	297,38
	Concrete pump	equ.shift	0,01400	1,00	13089,90	183,26
	Vibrator	equ.shift	0,08000	1,00	261,80	20,94
D312	Power generator 8,1-30 KB	equ.shift	0,08000	1,00	2478,18	198,25
	Autowatercarrier	equ.shift	0,00250	1,00	15270,00	38,18
					Total	738,01

Summary unit price : 12 217,10

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UNIT PRICE ANALYSES

2. BRIDGES
08.09. BRIDGES AT km 881+101.843
CONCRETE
Item No. 08.09.02.25

UNIT PRICE ANALYSES ITEM No. 08.09.02.25

Prefabricated main girders made of prestressed concrete, class II MB 50, M-150, V-3

Unitm3

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D107	Skilled steelwork erector	w.shift	0,50000	1,00	496,67	248,34
					Total	248,34

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Prefabricated main girders made of prestressed concrete, class II MB 50, M-150, V-3 /without reinforcement/	m3	1,00000	1,00	15744,54	15744,54
					Total	15744,54

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Crane 250 t	equ.shift	0,00920	1,00	99172,80	912,39
					Total	912,39

Summary unit price : 16 905,27

UNIT PRICE ANALYSES

2. BRIDGES
08.09. BRIDGES AT km 881+101.843
METALWORK
Item No. 08.09.03.02

UNIT PRICE ANALYSES ITEM No. 08.09.03.02

Ribbed rebars RA 400/500-2

Unitkg

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D107	Skilled steelwork erector	w.shift	0,00600	1,00	494,67	2,97
					Total	2,97

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D202,D203	Reinforcement formed RA 400/500-2	kg	1,00000	1,00	66,24	66,24
	Wire tie	kg	0,00300	1,00	70,00	0,21
					Total	66,45

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Crane	equ.shift	0,00010	1,00	12390,90	1,24
					Total	1,24

Summary unit price : 70,66

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TRACE
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UNIT PRICE ANALYSES

2. BRIDGES
08.09. BRIDGES AT km 881+101.843
BRIDGE WATERPROOFING
Item No. 08.09.04.02

UNIT PRICE ANALYSES ITEM No. 08.09.04.02

Insulating coat on pavement top

Unitm2

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Isolation worker	w.shift	0,60000	1,00	494,67	296,80
Total						296,80

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Primer	m2	0,40000	1,00	130,90	52,36
	Hydroisolation	m2	1,14000	1,00	467,16	532,56
Total						584,92

Summary unit price : 881,72

TRACE
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TRERIC TPYIT KOAA*AA

UNIT PRICE ANALYSES

2. BRIDGES
08.10. BRIDGES AT km 881+705.810
CONCRETE
Item No. 08.10.02.19

UNIT PRICE ANALYSES ITEM No. 08.10.02.19

*Prestressed box bridge construction cast in situ.
Concrete class II MB 45, M-150, V-3*

Unitm3

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Skilled carpenter	w.shift	6,33500	1,00	441,37	2796,08
	Skilled concrete finisher	w.shift	1,58000	1,00	494,67	781,58
					Total	3577,66

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Formwork grease	kg	0,88000	1,00	91,50	80,52
	Fixators	item	22,00000	1,00	10,47	230,34
	Outer Scaffolding	m2	4,40000	1,00	437,73	1926,01
	Inner scaffolding	m3	3,65200	1,00	245,04	894,89
	Water	m3	0,10000	1,00	71,70	7,17
	Concrete MB 50,M-150,V-3-incl. transportation	m3	1,01500	1,00	8511,86	8639,54
	Tabular scaffolding	m3	6,45000	1,00	311,54	2009,43
					Total	13787,90

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Crane	equ.shift	0,01936	1,00	12390,90	239,89
	Concrete pump	equ.shift	0,01400	1,00	13089,90	183,26
	Vibrator	equ.shift	0,08000	1,00	261,80	20,94
D312	Power generator 8,1-30 KB	equ.shift	0,08000	1,00	2478,18	198,25
	Autowatercarrier	equ.shift	0,00250	1,00	15270,00	38,18
					Total	680,52

Summary unit price : 48 046,08

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UNIT PRICE ANALYSES

2. BRIDGES
CONCRETE, METALWORK AND PILES
08.10. BRIDGES AT km 881+705.810
METALWORK
Item No. 08.10.03.01

UNIT PRICE ANALYSES ITEM No. 08.10.03.01

Ribbed rebars RA 400/500-2

Unitkg

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D107	Skilled steelwork erector	w.shift	0,00600	1,00	494,67	2,97
					Total	2,97

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D202,D203	Reinforcement formed RA 400/500-2	kg	1,00000	1,00	66,24	66,24
	Wire tie	kg	0,00300	1,00	70,00	0,21
					Total	66,45

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Crane	equ shift	0,00010	1,00	12390,90	1,24
					Total	1,24

Summary unit price : 70,66

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UNIT PRICE ANALYSES

2. BRIDGES
08.11. BRIDGES AT km 883+067.252
PILES
Item No. 08.11.01.07

UNIT PRICE ANALYSES ITEM No. 08.11.01.07

Construction of Ø150 cm piles with concrete, class MB 30, M-150, V-3. Payment per m' of completed pile.

UnitM

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D107	Skilled steelwork erector	w.shift	1,76000	1,00	494,67	870,62
	Driller	w.shift	2,00000	1,00	494,67	989,34
D100	Skilled asphalt finisher	w.shift	2,00000	1,00	494,67	989,34
					Total	2849,30

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Construction of work site from crushed stone 0-120 mm	m3	0,30	1,00	1466,07	439,82
	Construction of welded reinforcement set for piles and transport onsite	kg	176,00	1,00	71,73	12624,48
	Foisture, loading and transportation 1 km of earth material	m3	1,76	1,00	314,16	552,92
	Water	m3	0,10	1,00	71,70	7,17
	Concrete MB 30, M-150, V-3-incl transportataion	m3	1,79	1,00	6806,75	12190,89
	Pile fom saving reinforcement set /0,75/	m3	0,08	1,00	7330,35	586,43
	Test	item	0,002	1,00	1361350,05	2722,70
					Total	29124,41

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Pilot machine φ1500	equ.shift	0,05000	1,00	160958,40	8047,92
	Crane	equ.shift	0,00200	1,00	12390,90	24,78
	Concrete pump	equ.shift	0,10094	1,00	13089,90	1321,24
	Vibrator	equ.shift	0,10000	1,00	261,80	26,18
D312	Power generator 8,1-30 KB	equ.shift	0,10000	1,00	2478,18	247,82
	Autowatercarrier	equ.shift	0,00100	1,00	15270,00	15,27
					Total	9683,21

Summary unit price : 41 656,92


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UNIT PRICE ANALYSES

2. BRIDGES
08.11. BRIDGES AT km 883+067.252
CONCRETE
Item No. 08.11.02.14

UNIT PRICE ANALYSES ITEM No. 08.11.02.14

Bridge deck over prefabricated girders made of reinforced concrete, class II, MB 45, M-150, V-6.

UnitM3

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D105	Skilled joiner	w.shift	3,00000	1,00	441,37	1324,11
D100	Skilled concrete finisher	w.shift	1,58000	1,00	494,67	781,58
					Total	2105,69

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Metalconstruction	m2	3,00000	1,00	78,54	235,62
D213	Plywood hydrophobic	m3	0,00150	1,00	38637,98	57,96
	Iron sheet galvanized 0.55 mm	m2	0,15000	1,00	227,85	34,18
	Formwork grease	kg	0,60000	1,00	91,50	54,90
	Fixators	item	15,00000	1,00	10,47	157,05
	Scaffold	m3	6,00000	1,00	245,04	1470,24
D211	Joists	m3	0,00300	1,00	23734,76	71,20
	Water	m3	0,10000	1,00	71,70	7,17
	Concrete MB 45, M-150, V-6 - incl.	m3	1,01500	1,00	7676,84	7791,99
					Total	9880,31

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Crane	equ.shift	0,02400	1,00	12390,90	297,38
	Concrete pump	equ.shift	0,01400	1,00	13089,90	183,26
	Vibrator	equ.shift	0,08000	1,00	261,80	20,94
D312	Power generator 8,1-30 KB	equ.shift	0,08000	1,00	2478,18	198,25
	Autowatercarrier	equ.shift	0,00250	1,00	15270,00	38,18
					Total	738,01

Summary unit price : 12 724,01

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UNIT PRICE ANALYSES

2. BRIDGES
08.11. BRIDGES AT km 883+067.252
CONCRETE
Item No. 08.11.02.18

UNIT PRICE ANALYSES ITEM No. 08.11.02.18

Prefabricated main girders made of prestressed concrete, class II MB 50, M-150, V-3

UnitM3

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D107	Skilled steelwork erector	w.shift	0,50000	1,00	496,67	248,34
					Total	248,34

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Procurement and delivery of Prefabricated main girders made of prestressed concrete, class II MB 50, M-150, V-3 /without teinforcement /	m3	1,00000	1,00	15744,54	15744,54
					Total	15744,54

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Crane 250 t	equ.shift	0,00920	1,00	99172,80	912,39
					Total	912,39

Summary unit price : 16 905,27

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UNIT PRICE ANALYSES

2. BRIDGES
08.11. BRIDGES AT km 883+067.252
CONCRETE
Item No. 08.11.02.19

UNIT PRICE ANALYSES ITEM No. 08.11.02.19

*Prestressed box bridge construction cast in situ.
Concrete class II MB 45, M-150, V-3*

UnitM3

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D105	Skilled joiner	w.shift	9.86000	1,00	441,37	4351,91
D100	Skilled concrete finisher	w.shift	1,58200	1,00	494,67	782,57
						5134,48

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Formwork grease	кг	0.87990	1,00	91,50	80,51
	Fixators	бп	22,00000	1,00	10,47	230,34
	Outer Scaffolding	m2	4,40000	1,00	437,73	1926,01
	Inner Scaffolding	m3	3,66000	1,00	245,04	896,85
	Water	m3	0,10000	1,00	71,70	7,17
	Concrete MB 45, M-150, V-3-incl. transportation	m3	1,01500	1,00	7676,84	7791,99
	Tabular scaffolding	m3	18,20000	1,00	311,54	5670,03
						16602,90

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D306	Crane	equ.shift	0,05542	1,00	12390,90	686,70
	Concrete pump	equ.shift	0,01350	1,00	13089,90	176,71
	Vibrator	equ.shift	0,08000	1,00	261,80	20,94
D312	Power generator 8,1-30 KB	equ.shift	0,08000	1,00	2478,18	198,25
	Autowatercarrier	equ.shift	0,00250	1,00	15270,00	38,18
						1120,78

Summary unit price : 22 868,16

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UNIT PRICE ANALYSES

2. BRIDGES
08.11. BRIDGES AT km 883+067,252
METALWORK
Item No. 08.11.03.01

UNIT PRICE ANALYSES ITEM No. 08.11.03.01

Reinforcement B500A

Unitkg

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D107	Skilled steelwork erector	w.shift	0,00600	1,00	494,67	2,97
					Total	2,97

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D202,D203	Reinforcement formed RA 400/500-2	kg	1,00000	1,00	66,24	66,24
	Wire tie	kg	0,00300	1,00	70,00	0,21
					Total	66,45

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Crane	equ shift	0,00010	1,00	12390,90	1,24
					Total	1,24

Summary unit price :	70,66
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UNIT PRICE ANALYSES

2. BRIDGES
08.11. BRIDGES AT km 883+067,252
METALWORK
Item No. 08.11.03.02

UNIT PRICE ANALYSES ITEM No. 08.11.03.02

Ribbed rebars RA 400/500-2

Unitkg

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Skilled steelwork erector	w.shift	0,00600	1,00	494,67	2,97
					Total	2,97

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D202,D203	Reinforcement formed RA 400/500-2	kg	1,00000	1,00	66,24	66,24
	Wire te	kg	0,00300	1,00	70,00	0,21
					Total	66,45

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Crane	equ.shift	0,00010	1,00	12390,90	1,24
					Total	1,24

Summary unit price : 70,66

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UNIT PRICE ANALYSES

4. SUPPORTING STRUCTURES
07.22.14 REINFORCEMENT WORKS
METALWORK
Item No. 7.22.14.01.

UNIT PRICE ANALYSES ITEM No. 07.22.14.01.

Pile reinforcement
RA 400/500-2 ribbed bars.
Price includes procurement, cutting, bending and fixing of all necessary material including all related works. Measurement unit is kg

Unitkg

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Skilled steelwork erector	w.shift	0,02257	1,00	494,67	11,16
					Total	11,16

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D202,D203	Reinforcement formed RA 400/500-2	kg	1,00000	1,00	66,24	66,24
	Wire tie	kg	0,00300	1,00	70,00	0,21
					Total	66,45

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Crane	equ.shift	0,00010	1,00	12390,90	1,24
					Total	1,24

Summary unit price :	78,85
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ΑΔΑΡΒΟΡΗ

1. CULVERTS AND SEPARATORS
8.5.1 /12 DEVICES FOR WATER PROTECTION AGAINST POLLUTION - SEPARATORS
Item No. 8.5.1 / 12.09.

UNIT PRICE ANALYSIS for capacity Qn/Qmax 10/100

*Procurement, transport and installation of mineral oil separators provided with integrated BY-PASS, Purgator type or equivalent with the following capacities:
Qn/Qmax 10/100*

Unitpcs

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 107	Skilled steelwork erector	w. shift	16,00	1,00	496,67	7 946,72
D 107	Skilled steelwork erector	w. shift	4,00	1,00	496,67	1 986,68
					Total:	9 933,40

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Degreaser Kit Q max 10/100	set	1,00	1,10	339 091,76	373 000,94
	Truck	Equ. shift	1,00	1,00	16 230,88	16 230,88
					Total:	389 231,82

Summary unit price: 399 165,22

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1. CULVERTS AND SEPARATORS
8.5.1 /12 DEVICES FOR WATER PROTECTION AGAINST POLLUTION - SEPARATORS
Item No. 8.5.1 / 12.09.

UNIT PRICE ANALYSIS for capacity Qn/Qmax 15/150

*Procurement, transport and Installation of mineral oil separators provided with Integrated BY-PASS, Purgator type or equivalent with the following capacities:
Qn/Qmax 15/150*

Unitpcs

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 107	Skilled steelwork erector	w. shift	16,00	1,00	496,67	7 946,72
D 107	Skilled steelwork erector	w. shift	4,00	1,00	496,67	1 986,68
					Total:	9 933,40

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Truck	Equ. shift	1,00	1,00	16 230,88	16 230,88
	Degreaser Kit Q max 15/150	set	1,00	1,10	396 490,61	436 139,67
					Total:	452 370,55

Summary unit price: 462 303,95

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1. CULVERTS AND SEPARATORS
8.5.1 /12 DEVICES FOR WATER PROTECTION AGAINST POLLUTION - SEPARATORS
Item No. 8.5.1 / 12.09.

UNIT PRICE ANALYSIS for capacity Qn/Qmax 20/200

*Procurement, transport and installation of mineral oil separators provided with integrated BY-PASS, Purgator type or equivalent with the following capacities:
Qn/Qmax 20/200*

Unitpcs

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 107	Skilled steelwork erector	w. shift	16,00	1,00	496,67	7 946,72
D 107	Skilled steelwork erector	w. shift	4,00	1,00	496,67	1 986,68
					Total:	9 933,40

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Truck	Equ. shift	1,00	1,00	16 230,88	16 230,88
	Degreaser Kit Q max 20/200	set	1,00	1,10	453 889,45	499 278,40
					Total:	515 509,28

Summary unit price: 525 442,68

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1. CULVERTS AND SEPARATORS
8.5.1 /12 DEVICES FOR WATER PROTECTION AGAINST POLLUTION - SEPARATORS
Item No. 8.5.1 / 12.09.

UNIT PRICE ANALYSIS for capacity Qn/Qmax 30/300
<i>Procurement, transport and Installation of mineral oil separators provided with Integrated BY-PASS, Purgator type or equivalent with the following capacities: Qn/Qmax 30/300</i>

Unitpcs

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 107	Skilled steelwork erector	w. shift	16,00	1,00	496,67	7 946,72
D 107	Skilled steelwork erector	w. shift	4,00	1,00	496,67	1 986,68
					Total:	189,80

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Truck	Equ. shift	1,00	1,00	16 230,88	16 230,88
	Degreaser Kit Q max 30/300	set	1,00	1,10	520 146,13	572 160,74
					Total:	588 391,62

Summary unit price:	588 581,42
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10M ΟΔΓΩΡ

1. CULVERTS AND SEPARATORS
8.5.1 /12 DEVICES FOR WATER PROTECTION AGAINST POLLUTION - SEPARATORS
Item No. 8.5.1 / 12.09.

UNIT PRICE ANALYSIS for capacity Qn/Qmax 50/500

*Procurement, transport and installation of mineral oil separators provided with integrated BY-PASS, Purgator type or equivalent with the following capacities:
Qn/Qmax 50/500*

Unitpcs

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 107	Skilled steelwork erector	w. shift	16,00	1,00	496,67	7 946,72
D 107	Skilled steelwork erector	w. shift	4,00	1,00	496,67	1 986,68
						9 933,40

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Truck	Equ. shift	1,00	1,00	16 230,88	16 230,88
	Degreaser Kit Q max 50/500	set	1,00	1,10	637 760,34	701 536,38
						717 767,26

Summary unit price: 727 700,66

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UNIT PRICE ANALYSES

5. TRAFFIC TECHNICAL AND SERVICE EQUIPMENT FOR ROADS
11. trAFFIC TECHNICAL SERVICE EQUIPMENT FOR ROADS
Item No. 11.3.04

UNIT PRICE ANALYSES ITEM No. 11.3.04

*Single sided distance barrier
H2W4* on the structure*

Unitm'

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w.shift	2,55600	1,00	330,77	845,45
						845,45

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	splint L=4300mm	unit	0,250	1,00	4 970,68	1 242,67
	column H=1900mm	unit	0,250	2,00	1 972,35	986,18
	beam "C 180x3mm" L=3998mm	unit	0,250	1,00	8 090,00	2 022,50
	console for single wall	unit	0,250	2,00	962,62	481,31
	connector handle column	unit	0,250	2,00	273,43	136,72
	connecting elements	set	0,250	1,00	870,46	217,62
						5 087,00

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 312	Power generator	equ.shift	0,012	1,00	2 478,24	29,74
D 308	Pneumatic drill	equ.shift	0,012	1,00	675,88	8,11
						37,85

Summary unit price : 5 970,30

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UNIT PRICE ANALYSES

5. TRAFFIC TECHNICAL AND SERVICE EQUIPMENT FOR ROADS
11. trAFFIC TECHNICAL SERVICE EQUIPMENT FOR ROADS
Item No. 11.3.05

UNIT PRICE ANALYSES ITEM No. 11.3.05

*Single sided distance barrier
H2W4* on the structure*

Unitm'

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w.shift	4,00000	1,00	330,77	1 323,08
					Total	1 323,08

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	splint L=4300MM	unit	0,250	1,00	4 970,68	1 242,67
	column H=790MM	unit	0,250	3,00	2 539,68	1 904,76
	beam "C180x4"MM L=3998MM	unit	0,250	1,00	10 947,56	2 736,89
	console distancer	unit	0,250	3,00	880,70	660,53
	connecting element console column	unit	0,250	3,00	317,46	238,10
	connecting elements	set	0,250	1,00	1 126,47	281,62
	pin M16x150,nuts	set	0,250	3,00	399,39	299,54
	resin for anchors	unit	0,250	3,00	532,51	399,38
					Total	7 763,49

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 312	Power generator	equ.shift	0,012	1,00	2 478,24	29,74
D 308	Pneumatic drill	equ.shift	0,012	1,00	675,88	8,11
					Total	37,85

Summary unit price : 9 124,42

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TRERIC TPYTI XOLA*AA

698/733



КОРИДОРИ СРБИЈЕ

No. 6389/12-A

Date: 29.10.2012

JV Trace and Mostovik
Attn. Mr. Tsvetan Ivanov Tsonev
71 "James Bourchier" Blvd. 1407 Sofia
Bulgaria

REFERENCE: Serbia, Corridor X Highway Project, Construction of Highway E75
Section: Grdelica (Gornje Polje) – Caricina Dolina, LOT 1 and LOT 2
ICB No: CORR.X.E75.EIB.PACK1.ICB

SUBJECT: Clarification of Financial Bid No.2

Dear Sir,

As your company submitted Bids for Construction of Highway E75, Section: Grdelica (Gornje Polje) – Caricina Dolina, LOT 1: Road and bridges from Grdelica to Tunnel Predejane and LOT 2: Road and bridges from Tunnel Predejane to Caricina Dolina, ICB No: CORR.X.E75.EIB.PACK1.ICB, we are asking you to submit clarification in accordance with ITB 27, in order to eliminate, by any means and without any doubt, endangering of the Contract implementation due to incompleteness of cost elements, obligations and procedures.

Therefore, please provide additional explanations regarding price analysis that you sent to us as a reply to Clarification No.1 on September 14, 2012 (our no. 5334/12 dated September 17, 2012) as follows:

1. For item 01.01.02.02 - "Excavation in Category III and IV ..." please provide further clarification and more detailed analysis of the cost for transport by truck and truck performance (turnaround time), as well as clarification for performance and price for bulldozers and excavators during excavation and loading (show given values in the column "Quantity")
2. For item 01.01.02.04 please provide explanation of your analysis, since the share of cost for machinery and labor cannot be seen from your price analysis, clarify.
3. For item 01.01.04.02 please provide detailed analysis of the cost for crushed stone 0/31.5 mm (364.74 RSD) and the analysis of equipment performance for construction of lower base course of pavement.
4. For item 08.09.02.20 it is necessary to provide analysis of the cost for elevation of the prefabricated girder, i.e. cost for crane hiring and its performance of 0.024 h/m³. Explain performance of concrete pump 0.014h/m³. Provide detailed structure of the time to perform operations of elevation and installing of prefabricated girders with crane and provide performance of 0.024 h/m³. Explain in details the cost of concrete work with concrete class II MB 40, with all input parameters (purchase of concrete with additives, transport, delivery of equipment and tools, blowing of formwork before concreting, internal transport, concrete laying, dispersal, curing etc. all that makes concrete price concreting in given circumstances). Clarify price for formwork and scaffold for construction of prefabricated girders.
5. For item 08.09.02.25 please provide detailed analysis for prefabricated main girders made of prestressed concrete without reinforcing (your price is 15,744.54 RSD)

6. For item 08.09.03.02 please provide detailed analysis of price for production of reinforcement formed RA 400/500-2, clarify performance of workers 0.006 h/kg of reinforcement. Price for procurement of reinforcing rib material is 66.24 RSD, and all other costs in this item (transport, cutting, folding and binding) are 4.21 RSD/kg, please clarify detailed structure of other expenses.
7. For items 11.3.04 and 11.3.0 it is necessary to provide further clarification of price analysis for the requested barrier H2W4 and H2W4 on the structure. Please provide characteristics of manufacturer for barrier for which you made price analysis. Protective barrier has special significance for traffic safety and it is necessary to comply with all requests and recommendations. The barrier must meet EN1317 part 1 to 5 and the barrier's manufacturer and safety barrier itself has to have CE mark and all required certification (attest documentation).

Your Clarification regarding above-mentioned issue applies to bid for LOT 2 and shall be submitted on Company's Memorandum signed by authorized person to sign the bid on behalf of JV.

This request has purpose to clarify your Bid and cannot change the price, scope or any other aspect of it.

Requested document shall be provided in English language as scanned documents by an e-mail until November 5, 2012. Hard copy document can be delivered after to the Employer's address:

Koridori Srbije d.o.o.

21 Kralja Petra Street, 11000 Belgrade, Republic of Serbia

E-mail: procurement@koridorisrbije.rs

Kind regards,

Director

D. Zurovcic
Dmitar Durovic



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JV "TRACE MOSTOVIK"

Outg. №006/9th November, 2012

KOPR...
E75...
E75...
E75...

To
Koridor Srbije d.o.o
Attn: Mr. Mihajlo Misić
21 Kralja Petra Street
11000 Belgrade, Serbia
E-mail: procurement@koridorisrbije.rs
Fax: +381 11 32 48 682

REFERENCE: Serbia, Corridor X Highway Project, Construction of Highway E75,
Section: Grdelica (Gornje Polje)- Caricina Dolina, LOT 1 and LOT 2, ICB
No: CORRX.E75.EIB.PACK1.ICB

SUBJECT: Clarification №2 to Financial Bid

Dear Mr. Mihajlo Misić,

Regarding your letter with Ref. № 6389/12-1 dated 29th October, 2012 as well as under ITB 27 of The Tender documentation, hereby JV TRACE MOSTOVIK provides additional explanations regarding price analysis that JV TRACE MOSTOVIK sent as a reply to Clarification No.1 as follows:

Item 01.01.02.02

Bulk excavation and transport (including topsoil stripping and stockpiling, excavation of soil of low bearing capacity, top soiling and grassing) Excavation in III and IV category soil with loading, transport and unloading of material from the excavation borrow pit 1000m – 3000m

Clarification

Value 2.18 in column "Quantity" represents quantity of excavated soil per 1 m³ in dense condition.

That means 1.97 t/m^3 (average volumetric weight of soil III and IV category) x 1.11 (K of blowing) = 2.18 t/m^3 .

Value 2 in column "Ratio" represents average transport distance in kilometers = 2 km.

Value 7.38 in column "Unit price" is price is the price for transport by truck in RSD per ton.

Excavator goes with 6 trucks with capacity 30 tons each one. For transportation of 787 m³ of soil excavated (which is 1708 tons) at average transport distance of 2 km, for 6 trucks, 10 courses of a truck are estimated. For these 10 courses average 300 tons of soil are going to be transported by each truck. The time estimated for 1 course of a truck is 20 minutes (8+6+2+4), time for loading is average 8 minutes. 10 courses x 8 minutes for excavation and loading x 6 trucks = 480 minutes = 8 hours.

Value 0.00127 in column "Quantity" is defined by the capacity of an excavator for one equipment shift (machine shift, equ shift) and was estimated by dividing 1 equ shift to the excavator capacity.

1 / 5

JV "TRACE MOSTOVİK"

The accepted performance is 787 m³ per equ shift or: 1 equ shift : 787 m³ = 0.00127 equ shift/1 m³, given that the theoretical performance limit of the excavator, estimated for this soil category, is 1000 m³/equ shift.

The bulldozer is foreseen for scuffling of the soil excavated after it has been transported to a depot, or as quantity it is: 1 equ shift : 800 m³ = 0,00125 equ shift/ for 1 m³.

Productiveness of the excavator for scuffling on depot/ borrowpit is 1600 m³ per equ shift, but given that the soil excavated by the excavator is 787 m³/ equ shift, we have accepted 1/2 shift for scuffling which is shown in column "Ratio" - 0.5

See Appendix №1- 2 pages

Item 01.01.02.04

Construction of embankment (including topsoil stripping, construction of stepped side cuts, shoulder central part, leveling, topsoiling and grassing of embankment slopes)

Clarification

Complex analysis consists of eight sub-analysis.

In every sub-analysis all expenses for equipment and labor are shown.

In Column "Quantity" time to execute certain job is shown (for equipment – Equ. Shift per m³, for labor- w. shift/m³).

In column "Coeff." Is shown transport distance in kilometers.

In column "Unit price" price for unit expense of time to execute certain job for certain equipment and labor.

See Appendix №2- 9 pages

Item 01.01.04.02

Procurement and placing of 0/63 mm crushed stone as rolled sub-base of pavement structure. Broken stone layer shall be placed onto finished subgrade accepted by the Supervising Engineer. Stone of this size shall meet requirements of SRPS U.E 9020. Payment per 1 m³ of placed material including procurement and transport d=70

Clarification

The quantity of 2.23 refers to the required tonnage crushed stone 0/31.5 for the construction of 1 m³ compacted pavement. (1,65 t/m³ x 1,35 (K compaction) that is delivered from the depot for crushing to the site.

The quantity 1.35 is a result of the dividing the rate for the crushed stone in compacted condition per t/m³ to the volumetric weight of the crushed stone 0/31.5 (accepted 1.65 t/m³)

The data were obtained based on laboratory testing protocol of the compaction of the crushed stone pavement with compression plate in the construction of similar pavements.

The price of the crushed stone 0/31.5 is in the offer as a product of crushing of the rock from the site and delivered to the depot for a remaking. The rest of the costs are for transportation from the place of blasting to the depot of crushing.

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The productivity that we have set for the complex unit is 220 m³/equ. shift for the shovel and 1/2 equ. shift for a reaching of the compaction of the pavement with two rollers - static and pneumatic roller. For the shovel the quantity is 1 equ. shift: 220 m³/ equ. shift = 0,00454 equ. shift/1m³; for the static roller the quantity is 1/2 equ.shift:220 m³/equ. shift = 0,00227 equ. shift/1m³; for the pneumatic roller the quantity is 1/2 equ. shift: 220 m³/ equ. shift =0.00227 equ. shift /1 m³.

The water carrier truck provides the required amount of water used for humidification of the crushed stone. For 220 m³ crushed stone are required 13.200 m³ water that is delivered by two runs of the truck, which is the reason to be provided 1/4 equ. shifts for the water carrier truck. The quantity is 1/4 equ. shift: 220 m³/equ.shifts = 0,00114 equ. shifts/1 m³

See Appendix №3- 3 pages

Item 08.09.02.20

Bridge deck over prefabricated girders made of reinforcement concrete, class II, MB 40, M-150, V-6

Clarification

The analysis relates to the supply and laying of concrete class II, 40 MB, M-150, V-6 for bridge slab above prefabricated girders /including formwork and scaffolding/ and manufacture, supply and installation of the girders are shown in the analysis of item 08.09.02.25.

Analysis of item 08.09.02.20 is complex unit price and includes the following types of construction works:

Formwork of bridge slab

The share of formwork in 1 m³ of concrete is 3 m². The norms in the analysis of formwork apply to implementation of formwork in a form ready for installation and dismantling of formwork, spreading over it an oil formwork, installation of pipes, plastic spacers for reinforcement, putting paste on plywood panels, as well as installation of galvanized steel used for formwork. Formwork forms are being assembled (installed), dismantled and moved mechanically, mandatory with a crane. The norm of usage of the crane with this purpose is 0.008 machine shift (equipment shift = equ shift)/m² formwork. In complex price it is embedded a cost of 0.024 equ shift/m³ concrete, which is /0.008 equ shift/m² x 3 m²/m³ = 0.024 equ shift/m³/ - 1 machine shift = 8 hours.

Manufacture, supply and laying of concrete MB 40, M-150, V-6 for bridge slab

The performance of the concrete pumps for laying of 1 m³ concrete, embedded in the analysis, is 0.014 machine shift or 71 m³ concrete/ day. This includes stabilization of concrete pump and orientation of the rolling trunk to the height of the place of putting the concrete, taking the concrete from the vehicle, the pumps' loading with concrete solution and its application in the formwork, manual pushing of concrete in the corners and in places with dense reinforcement, compaction of the layed concrete manually or mechanically, care of the concrete by pouring water from water carrier truck through a hose-pipe. For an explanation of the complex price of item 08.09.02.25 we enclose further analysis prices for concrete and formwork , as well as bill of quantity.

See Appendix №4- 3 pages

JV "TRACE MOSTOVIK"

Item 08.09.02.25

Prefabricated main girders made of prestressed concrete, class II MB 50, M-150, V3

Clarification

This is complex unit price including production of girders on ground near the site, their transportation to the place of their laying and installation.

The price does not include the reinforcement; neither the high strength steel, nor cables nor ducts. They are subject of other analyses.

In the amount of 15 744, 54 RSD are included the following types of construction works:

Framework for prefabricated girders – 4,40 m² per 1 m³ of concrete – total amount of 5068,23 RSD./including labor, materials and equipment/

Concrete class II MB 50, M-150, V-3, supply from own concrete plant /installed on the site/ and laying the concrete in the girder – total amount of 9728,06 RSD. / including labor, materials and equipment/

Transportation of the girders from the site to the place of its installation – total amount of 948,25 RSD per 1m³ girder.

All listed amounts are for the production and the transportation of 1 m³ prefabricated girder /without reinforcement/ – total amount of 15 744,54 RSD.

4. The installation of the girders include the labor of the installers in the amount of 248,34 RSD and equipment - crane 250 tons - amount of 912,39 RSD per 1m³ girder.

Recapitulation:

Value for the installation per 1 m³ girder - 1160,73 RSD.

Value for the production and the delivery of 1 m³ girder - 15744,54 RSD

Total amount for 1 m³ girder - 16 905,27 RSD (without the reinforcement)

See Appendix №5- 2 pages

Item 08.09.03.02

Ribbed rebars RA 400/500-2

Clarification

In the price **66,24 RSB/kg** are included: the delivery and the fabrication of steel in industrial plant for reinforcement, cutting, folding and binding in according to the project as, well as the delivery of the reinforcement to the site.

In the price **4,21 RSD/kg** are included: the transportation of the prepared shaped material to the lifting mechanism to 30 m average horizontal distance, as well as a vertical climbing through a crane, installation, splicing and binding in a form ready for concreting.

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Reinforcement formed RA 400/500-2 /The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed./

Skilled steelwork erector/installation of reinforcement/ take part in transportation of the prepared shaped material to the lifting mechanism to 30 m average horizontal distance, installation, splicing and binding in a form ready for concreting.

See Appendix №6- 3 pages

Item 11.3.04 and Item 11.03.05
Single sided distance barrier H2W4* on the structure

See Appendix №7- 6 pages

Kind regards,

TSVETAN TSONEV
Authorized Representative
JV TRACE MOSTOVIK



UNIT PRICE ANALYSES

1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS

UNIT PRICE ANALYSIS ITEM No. 01.01.02.02

Bulk excavation and transport (including topsoil stripping and stockpiling, excavation of soil of low bearing capacity, topsoiling and grassing)
Excavation in III and IV category soil with loading, transport and unloading of material from the excavation or borrow pit 1000 m - 3000 m

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,01333	1,00	330,77	4,41
					Total:	4,41

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Transport with a truck	t/km	2,18000	2,00	7,38	32,18
					Total:	32,18

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 301.3	Excavator with capacity over 2 m ³	Equ. shift	0,00127	1,00	27 035,28	34,33
D 302.2	Track roller bulldozer over 150 kW	Equ. shift	0,00125	0,50	22 529,44	14,08
					Total:	48,41

Summary unit price :	85,00
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UNIT PRICE ANALYSES

1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS

UNIT PRICE ANALYSIS ITEM No. 01.01.02.02

Bulk excavation and transport (including topsoil stripping and stockpiling, excavation of soil of low bearing capacity, topsoiling and grassing) Excavation in III and IV category soil with loading, transport and unloading of material from the excavation or borrow pit 1000 m - 3000 m

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,01333	1,00	330,77	4,41
Total:						4,41

II. Materials

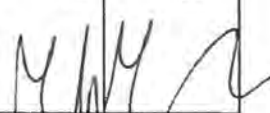
Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Transport with a truck	t/km	2,18000	2,00	7,38	32,18
			Value 2.18 represents quantity of excavated soil per 1 m3 in dense condition. Or: 1.97 t/m3 (average volumetric weight of soil III-IV category) x 1.11 (K of blowing) = 2.18 t/m3. <i>Clarification:</i> Excavator goes with 6 trucks with capacity 30 tons each one. For transportation of 787 m3 of soil excavated (which is 1708 tons) at average transport distance of 2 km, for 6 trucks, 10 courses of a truck are estimated. For these 10 courses average 300 tons of soil are going to be transported by each truck. The time estimated for 1 course of a truck is 20 minutes (8+6+2+4), time for loading is average 8 minutes. 10 courses x 8 minutes for excavation and loading x 6 trucks = 480 minutes = 8 hours	Value 2 represents average transport distance in kilometers = 2 km.	That is the price for transport by truck	
Total:						32,18

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 301.3	Excavator with capacity over 2 m ³	Equ. shift	0,00127	1,00	27 035,28	34,33
			The quantity of 0.00127 is defined by the capacity of an excavator for one equipment shift (machine shift, equ shift) and was estimated by dividing 1 equ shift to the excavator capacity. The accepted performance is 787 m3 per equ shift or: 1 equ shift : 787 m3 = 0.00127 equ shift/1 m3, given that the theoretical performance limit of the excavator, estimated for this soil category, is 1000 m3/equ shift.			
D 302.2	Track roller bulldozer over 150 kW	Equ. shift	0,00125	0,50	22 529,44	14,08
			The bulldozer is foreseen for scuffing of the soil excavated after it has been transported to a depot or as quantity it is: 1 equ shift : 800 m3 = 0,00125 equ shift/ for 1 m3.	Productiveness of the excavator for scuffing on depots 1600 m3 per equ shift, but given that the soil excavated by the excavator is 787 m3/ equ shift, we have accepted 1/2 shift for scuffing which is shown in column "Ratio" - 0.5	Total:	48,41

Summary unit price 65,067

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 ТРЕПС ГРУП КОЛАД АА
 707/733

1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (Including topsoil stripping, construction of stepped side cuts, shoulder central part, levelling, topsoiling and grassing of embankment slopes)

Unitm³

Nº	Analysis Nº	Description	Unit	Quantity	Unit Price /RSD/	Total /RSD/
1	2	3	4	5	6	7
1	1.01.	Topsoil stripping: 22659 m ³	%	0,431	76,46	32,95
2	1.02.	Surplus topsoil: 11737 m ³	%	0,225	69,68	15,68
3	1.03.	Stepped side cuts: 3461 m ³	%	0,066	33,79	2,23
4	1.04.	Shoulder central part: 2528 m ³	%	0,048	61,92	2,97
5	1.05.	Topsoiling of slopes: 45674 m ²	%	0,175	65,78	11,51
6	1.06.	Topsoiling and grassing of shoulders: 8934 m ²	%	0,034	132,05	4,49
7	1.07.	Lining with stone the embankment slopes: 1889 m ² =944,5m ³	%	0,007	862,86	6,04
8	1.08.	Lining of slope with stone : 620 m ³	%	0,012	931,44	11,18

Summary unit price : 87,05

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 708/733

1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (Including topsoil stripping, construction of stepped side cuts, shoulder central part, levelling, topsoiling and grassing of embankment slopes)

UNIT PRICE ANALYSIS No. 1.01. - Topsoil stripping

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,00615	1,00	330,77	2,03
					Total:	2,03

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Transport with a truck	t/km	2,10000	3,00	7,38	46,49
					Total:	46,49

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 305	Shovel	Equ. shift	0,00039	1,00	36 047,12	14,06
D 304	Roller 8t	Equ. shift	0,00077	1,00	18 023,52	13,88
					Total:	27,94

Summary unit price: 76,46

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TRACE
ΤΡΕΣΙΣ ΓΡΥΠ ΧΟΛΑΡΑ
 709/733

1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (Including topsoil stripping, construction of stepped side cuts, shoulder central part, levelling, topsoiling and grassing of embankment slopes)

UNIT PRICE ANALYSIS No. 1.02. - Surplus topsoil

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,01	1,00	330,77	2,65
					Total:	2,65

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Transport with a truck	t/km	0,95	3,00	7,38	21,03
					Total:	21,03

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 305	Track roller bulldozer up to 150 kW	Equ. shift	0,00	1,00	36 047,12	36,05
	Roller 2,5 t	Equ. shift	0,00	1,00	9 948,30	9,95
					Total:	46,00

Summary unit price: 69,68

TRACE
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TRACE
 ΤΡΕΠΟΛΙΤΙΚΗ ΚΟΛΛΑΦΑ
 710/733

**1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS**

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (including topsoil stripping, construction of stepped side cuts, shoulder central part, levelling, topsoiling and grassing of embankment slopes)

UNIT PRICE ANALYSIS No. 1.03. - Stepped side cuts

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,08	1,00	330,77	26,46
					Total:	26,46

II. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Mechanical rammer	Equ. shift	0,00	2,00	1466,10	7,33
					Total:	7,33

Summary unit price: 33,79

000004


TRACE
TRACING & DESIGN

1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (Including topsoil stripping, construction of stepped side cuts, shoulder central part, levelling, topsoiling and grassing of embankment slopes)

UNIT PRICE ANALYSIS No. 1.04. - Shoulder central part

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,06	1,00	330,77	21,17
					Total:	21,17

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Transport with a truck	t/km	1,76	6,00	7,38	1,48
					Total:	1,48

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Roller 2,5 t	Equ. shift	0,00250	1,00	9948,30	24,87
	CAT-multifunctional excavator	Equ. shift	0,00125	1,00	11519,00	14,40
					Total:	39,27

Summary unit price: 61,92

000005

TRACE
 ТРЕЙС ГРУП ХОЛД*АА


TRACE
 ТРЕЙС ГРУП ХОЛД*АА
 712733

1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (including topsoil stripping, construction of stepped side cuts, shoulder central part, levelling, topsoiling and grassing of embankment slopes)

UNIT PRICE ANALYSIS No. 1.05. - Topsoiling of slopes

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,040	1,00	330,77	13,23
					Total:	13,23

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Transport with a truck	t/km	1,020	6,00	7,38	45,17
					Total:	45,17

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Hand roller	Equ. shift	0,001	1,00	837,75	0,84
	Bobcat	Equ. shift	0,001	1,00	6 544,95	6,54
					Total:	7,38

Summary unit price: 65,78

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TRACE
 ТРЕЌОС ТРЌИТ ХОЛАН*АА
 713/733
 ТРЕЌОС ТРЌИТ ХОЛАН*АА



1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (including topsoil stripping, construction of stepped side cuts, shoulder central part, leveling, topsoiling and grassing of embankment slopes)

UNIT PRICE ANALYSIS No. 1.06. - Topsoiling and grassing of shoulders

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,040	1,00	330,77	13,23
D 108	Unskilled labourer	w. shift	0,020	1,00	330,77	6,62
					Total:	19,85

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Transport with a truck	t/km	1,020	6,00	7,38	45,17
	grass seeds	kg	0,040	1,00	130,90	5,24
					Total:	50,41

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	CAT-multifunctional excavator	Equ. shift	0,005	1,00	11 519,00	57,60
	Hand roller	Equ. shift	0,005	1,00	837,75	4,19
					Total:	61,79

Summary unit price: 132,05

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TRACE
 ТРЕЙС ГРУП ХОЛД*АА


TRACE
 ТРЕЙС ГРУП ХОЛД*АА
 714/733



**1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS**

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (including topsoil stripping, construction of stepped side cuts, shoulder central part, levelling, topsoiling and grassing of embankment slopes)

UNIT PRICE ANALYSIS No. 1.07. - Lining with stone the embankment slopes

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 102	Skilled mason	w. shift	1,60	1,00	496,67	794,67
					Total:	794,67

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Transport with a truck	t/km	1,54	6,00	7,38	68,19
					Total:	68,19

Summary unit price: 862,86

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TRACE
 ΤΡΕΡΙΣ ΓΡΥΠ ΧΟΛΑΪΑΑ
 ΤΡΕΡΙΣ ΓΡΥΠ ΧΟΛΑΪΑΑ 715/733

ΕΠΙΧΕΙΡΗΣΙΑΚΟ
ΛΟΓΟΤΥΠΟ

1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.02. - EARTH WORKS

COMPLEX UNIT PRICE ANALYSIS ITEM No. 01.01.02.04

Construction of embankment (including topsoil stripping, construction of stepped side cuts, shoulder central part, leveling, topsoiling and grassing of embankment slopes)

UNIT PRICE ANALYSIS No. 1.08. - Lining of slope with stone

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 102	Skilled mason	w. shift	1,62	1,00	496,67	804,61
					Total:	804,61

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Cement mortar with delivery	m ³	0,02	1,00	2 932,10	58,64
	Transport with a truck	t/km	1,54	6,00	7,38	68,19
					Total:	126,83

Summary unit price: 931,44

TRACE
 ТРЕИС ГРУП ХОЛД*АА

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TRACE
 ТРЕИС ГРУП ХОЛД*АА
 716/733



1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.04. - SUB - BASES

UNIT PRICE ANALYSIS ITEM No. 01.01.04.02

Procurement and placing of 0/63 mm crushed stone as rolled sub-base of pavement structure. Broken stone layer shall be placed onto finished subgrade accepted by the Supervising Engineer. Stone of this size shall meet requirements of SRPS U.E 9020. Payment per 1 m³ of placed material including procurement and transport d = 70 cm

Unitm³

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,04	1,00	330,77	12,04
D 108	Unskilled labourer	w. shift	0,04	1,00	330,77	12,04
					Total:	24,08

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Gravel 0-63	m ³	1,35	1,00	270,18	364,74
	Transport with a truck	t/km	2,23	6,00	7,38	98,74
	Water for road works	m ³	0,06	1,00	71,70	4,30
					Total:	467,78

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 305	Shovel	Equ. shift	0,0045	1,00	36 047,12	163,65
D 304	Roller 8t	Equ. shift	0,0023	1,00	18 023,52	40,91
D 304	Pneumatic roller 16R	Equ. shift	0,0023	1,00	18 023,52	40,91
	Water carrier truck	Equ. shift	0,0011	1,00	15 270,00	17,41
					Total:	262,88

Summary unit price: 754,74

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TRACE
 ТРЕНД ТРЕНИ КОМПАНИ
 717733

1. CIVIL ENGINEERING DESIGN
01.01. HIGHWAY ALIGNMENT
Item No. 01.01.04. - SUB - BASES

UNIT PRICE ANALYSIS ITEM No. 01.01.04.02

Procurement and placing of 0/63 mm crushed stone as rolled sub-base of pavement structure. Broken stone layer shall be placed onto finished subgrade accepted by the Supervising Engineer. Stone of this size shall meet requirements of SRPS U.E 9020. Payment per 1 m³ of placed material including procurement and transport. d = 70 cm

Unitm³**I. Labour**

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w. shift	0,04	1,00	330,77	12,04
D 108	Unskilled labourer	w. shift	0,04	1,00	330,77	12,04
Total:						24,08

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Gravel 0-63	m ³	1,35	1,00	270,18	364,74
			The quantity 1.35 is a result of the dividing the rate for the crushed stone in compacted condition per t/m ³ to the volumetric weight of the crushed stone 0/31.5 (accepted 1.65 t/m ³) The data were obtained based on laboratory testing protocol of the compaction of the crushed stone pavement with compression plate in the construction of similar pavements. Explanation. The price of the crushed stone 0/31.5 is in the offer as a product of crushing of the rock from the site and delivered to the depot for a remaking. The rest of the costs are for transportation from the place of blasting to the depot of crushing.			
	Transport with a truck	t/km	2,23	6,00	7,38	96,74
			The quantity of 2.23 refers to the required tonnage crushed stone 0/31.5 for the construction of 1 m ³ compacted pavement. (1,65 t/m ³ x 1,35 (K compaction) that is delivered from the depot for crushing to the site.	6 km - The number 6 presents the accepted average transport distance from the depot of crushing to the site = 6 km.		
	Water for road works	m ³	0,06	1,00	71,70	4,30
Total:						467,78

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 305	Shovel	Equ. shift	0,0045	1,00	36 047,12	163,65
D 304	Roller 8t	Equ. shift	0,0023	1,00	18 023,52	40,91
D 304	Pneumatic roller 16R	Equ. shift	0,0023	1,00	18 023,52	40,91

TRACE
 ТРЕЈС ГРУП ХОЛД АА

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TRACE
 ТРЕЈС ГРУП ХОЛД АА
 718/733



			The productivity that we have set for the complex unit is 220 m ³ /equ. shift for the shovel and 1/2 equ. shift for a reaching of the compaction of the pavement with two rollers - static and pneumatic roller. For the shovel the quantity is 1 equ. shift: 220 m ³ /equ. shift = 0,00454 equ. shift/1m ³ ; for the static roller the quantity is 1/2 equ. shift: 220 m ³ /equ. shift = 0,00227 equ. shift/1m ³ ; for the pneumatic roller the quantity is 1/2 equ. shift: 220 m ³ /equ. shift = 0,00227 equ. shift /1 m ³ .			
	Water carrier truck	Equ. shift	0,0011	1,00	15 270,00	17,41
					Total:	262,88

Summary unit price: 754,74

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TRACE
 ТРЕЙС ТРВИ ХОЛД АА
 ТРЕЙС ТРВИ ХОЛД 719/733

НОМ ОЛГОБОЛГО
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UNIT PRICE ANALYSES

2. BRIDGES
08.09. BRIDGES AT km 881+101.843
CONCRETE
Item No. 08.09.02.20

UNIT PRICE ANALYSES ITEM No. 08.09.02.20

Bridge deck over prefabricated girders made of reinforced concrete, class II, MB 40, M-150, V-6.

Unitm3

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D105,D106	Skilled carpenter	w.shift	3,00000	1,00	441,37	1324,11
D100	Skilled concrete finisher	w.shift	1,58000	1,00	496,67	784,74
					Total	2108,85

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Metalconstruction	m2	3,00000	1,00	78,54	235,62
D213	Plywood hydrophobic	m3	0,00150	1,00	38637,98	57,96
	Iron sheet galvanized 0.55 mm	m2	0,15000	1,00	227,85	34,18
	Formwork grease	kr	0,60000	1,00	91,50	54,90
	Fixators	бp	15,00000	1,00	10,47	157,05
	Scaffold	m3	6,00000	1,00	245,04	1470,24
D211	Joists	m3	0,00300	1,00	23734,76	71,20
	Water	m3	0,10000	1,00	71,70	7,17
	Concrete MB 40, M-150, V-6- incl. transportaion	m3	1,01500	1,00	7174,31	7281,92
					Total	9370,24

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Crane	equ.shift	0,02400	1,00	12390,90	297,38
	Concrete pump	equ.shift	0,01400	1,00	13089,90	183,26
	Vibrator	equ.shift	0,08000	1,00	261,80	20,94
D312	Power generator 8,1-30 KB	equ.shift	0,08000	1,00	2478,18	198,25
	Autowatercarrier	equ.shift	0,00250	1,00	15270,00	38,18
					Total	738,01

Summary unit price : 12 217,10

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TRACE
ТРЕСЦ ПУТНОСТВА

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ТРЕСЦ ПУТНОСТВА



Bill of quantities № 08.09.02.20
Complex unit price

Bridge deck over prefabricated girders made of reinforced concrete, class II, MB 40, M-150, V-6.

№	Basis	Description	Unit	Quantity	Unit Price /RSD	Total /RSD
1	2	3	4	5	6	7
1	A	Installation and dismantling of formwork, bridge deck	m2	3,00	1234,21	3702,64
2	B	Placing Concrete MB 40, M-150, V-6 from Bridge deck over prefabricated girders	m3	1,00	8514,46	8514,46

Bridge deck over prefabricated girders made of reinforced concrete, class II, MB 40, M-150, V-6. **12 217,10**

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TRACE
 ТРАС (П)Т ХОЛДІНГ
 721733
 ТРАС (П)Т ХОЛДІНГ

Bridge deck over prefabricated girders made of reinforced concrete, class II, MB 40, M-150,V-6

Complex unit price

A. Installation and dismantling of formwork, bridge deck			From Unit 1 m2			From Unit 3 m2		
			/RSD			/RSD		
Basis	Description	Unit	Quantity	Unit Price	Total	Quantity	Unit Price	Total
I. Labour								
D105.D106	Skilled carpenter	w.shift	1,00	441,37	441,37	3	441,37	1324,11
Total			441,37			1324,11		
II. Materials								
Basis	Description	Unit	Quantity	Unit Price	Total	Quantity	Unit Price	Total
	Metalconstruction	m2	1,00000	78,54	78,54	3	78,54	235,62
D213	Plywood hydrophobic	m3	0,00050	38637,98	19,32	0,0015	38637,98	57,96
	Iron sheet galvanized.0.55 mm	m2	0,05000	227,85	11,39	0,15	227,85	34,18
	Formwork grease	kg	0,20000	91,5	18,3	0,6	91,5	54,9
	Fixators	no	5,00000	10,47	52,35	15	10,47	157,05
	Scaffold	m3	2,00000	245,04	490,08	6	245,04	1470,24
D211	Joists	m3	0,00100	23734,76	23,73	0,003	23734,76	71,2
Total			693,71			2081,15		
III. Equipment								
Basis	Description	Unit	Quantity	Unit Price	Total	Quantity	Unit Price	Total
	Crane	equ shift	0,008	12390,9	99,13	0,024	12390,9	297,38
Total			99,13			297,38		

Total installation and dismantling of formwork, bridge deck

1234,21

3702,64

B. Placing Concrete MB 40, M-150, V-6 from Bridge deck over prefabricated girders			From Unit 1 m3			From Unit 1 m3		
			/RSD			/RSD		
Basis	Description	Unit	Quantity	Unit Price	Total	Quantity	Unit Price	Total
I. Labour								
D100	Skilled concrete finisher	w.shift	1,58	496,67	784,74	1,58	496,67	784,74
Total			784,74			784,74		
II. Materials								
Basis	Description	Unit	Quantity	Unit Price	Total	Quantity	Unit Price	Total
	Water	m3	0,10	71,7	7,17	0,1	71,70	7,17
	Concrete MB 40, M-150, V-6-incl. transportaion	m3	1,015	7174,31	7281,92	1,015	7174,31	7281,92
Total			7289,09			7289,09		
III. Equipment								
Basis	Description	Unit	Quantity	Unit Price	Total	Quantity	Unit Price	Total
	Concrete pump	equ shift	0,01400	13089,90	183,26	0,01400	13089,90	183,26
	Vibrator	equ shift	0,08000	261,80	20,94	0,08000	261,80	20,94
D312	Power generator 8,1 -30 KB	equ shift	0,08000	2478,18	198,25	0,08000	2478,18	198,25
	Autowatercarrier	equ shift	0,00250	15270,00	38,18	0,00250	15270,00	38,18
Total			440,63			440,63		

Total reinforced concrete, class II, MB 40, M-150,V-6

8514,46

8514,46

A+B Bridge deck over prefabricated girders made of reinforced concrete, class II, MB 40, M-150,V-6/including formwork 3m2/

Total from 1m3

12217,10

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УПРАВЛЕНИЕ ПО СТРОИТЕЛЬСТВУ

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TRACE
ТРЕПС ГР/ПТ. ХОЛД*АА
7221733

UNIT PRICE ANALYSES

2. BRIDGES
08.09. BRIDGES AT km 881+101.843
CONCRETE
Item No. 08.09.02.25

UNIT PRICE ANALYSES ITEM No. 08.09.02.25

Prefabricated main girders made of prestressed concrete, class II MB 50, M-150, V-3

Unitm3

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D107	Skilled steelwork erector	w.shift	0,50000	1,00	496,67	248,34
					Total	248,34

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Prefabricated main girders made of prestressed concrete, class II MB 50, M-150, V-3 /without reinforcement/	m3	1,00000	1,00	15744,54	15744,54
					Total	15744,54

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Crane 250 t	equ.shift	0,00920	1,00	99172,80	912,39
					Total	912,39

Summary unit price : 16 905,27

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Prefabricated main girders made of prestressed concrete, class II MB 50, M-150,

Complex unit price 08.09.02.25

From Unit 1 m3

I. Labour			/RSD		
Basis	Description	Unit	Quantity	Unit Price	Total
D107	Skilled steelwork erector/installation of beams /	w.shift	0,50	496,67	248,34
Total:					248,34

II. Materials			/RSD		
Basis	Description	Unit	Quantity	Unit Price	Total
	Complex unit price from making a polygon beams/ without reinforcement, Patented high-strength prestressing strands with all anchors, base plates and protective tubes for cables/				
1	Concrete, class II MB 50, M-150, delivery and installation	m3	1,00	9728,06	9728,06
2	Formwork and removal for prestressed beams, including labor and materials	m2	4,40	1151,87	5068,23
3	Transport beams a polygon the site	m3	1,00	948,25	948,25
Total :					15744,54

Procurement and delivery of Prefabricated main girders made of prestressed concrete, class II MB 50, M-150, V-3 /without reinforcement /

III. Equipment			/RSD		
Basis	Description	Unit	Quantity	Unit Price	Total
	Crane 250 t /installation of beams /	equ shift	0,0092	99172,80	912,39
Total:					912,39

Prefabricated main girders made of prestressed concrete, class II MB 50, M-150,

Total: 16905,27

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724/733



UNIT PRICE ANALYSES

2. BRIDGES
08.09. BRIDGES AT km 881+101.843
METALWORK
Item No. 08.09.03.02

UNIT PRICE ANALYSES ITEM No. 08.09.03.02

Ribbed rebars RA 400/500-2

Unitkg

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D107	Skilled steelwork erector	w.shift	0,00600	1,00	494,67	2,97
					Total	2,97

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D202,D203	Reinforcement formed RA 400/500-2	kg	1,00000	1,00	66,24	66,24
	Wire tie	kg	0,00300	1,00	70,00	0,21
					Total	66,45

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	Crane	equ.shift	0,00010	1,00	12390,90	1,24
					Total	1,24

Summary unit price : 70,66

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 ТРЕЅО ГРУП КОЛД АА
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 ТРЕЅО ГРУП КОЛД АА

UNIT PRICE ANALYSES ITEM No. 08.09.03.02

Ribbed rebars RA 400/500-

Unit 1 kg

I. Labour

Basis	Наименование	Unit	/RSD		
			Quantity	Unit Price	Total
D107	Skilled steelwork erector/installation of reinforcement/	w.shift	0,00600	496,67	2,97
Total:					2,97

II. Materials

Basis	Наименование	Unit	Quantity	Unit Price	Total
D202.D203	Reinforcement formed RA 400/500-2 /The price includes procurement, cutting, bending and fixing of reinforcing bars in	kg	1,00000	66,24	66,24
	Wire tie	kg	0,00300	70,00	0,21
Total:					66,45

III. Equipment

Basis	Наименование	Unit	Quantity	Unit Price	Total
	Crane/ installation of reinforcement /	qu.shi	0,00010	12390,90	1,24
Total:					1,24

Ribbed rebars RA 400/500-

Total:

70,66

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ТРЕЈС ГРУП ХОЛАНДА

726/733



Ribbed rebars RA 400/500-

Unit 1 kg

I. Labour

Basis	Наименование	Unit	/RSD		
			Quantity	Unit Price	Total
D107	Skilled steelwork erector/installation of reinforcement/	w.shift	0,00600	496,67	2,97
Total:					2,97

II. Materials

Basis	Наименование	Unit	Quantity	Unit Price	Total
D202.D203	Reinforcement formed RA 400/500-2 /The price includes procurement, cutting, bending and fixing of reinforcing bars in the construction, fully as designed./	kg	1,00000	66,24	66,24
	Wire tie	kg	0,00300	70,00	0,21
Total:					66,45

III. Equipment

Basis	Наименование	Unit	Quantity	Unit Price	Total
	Crane/ installation of reinforcement /	equ.shif	0,00010	12390,90	1,24
Total:					1,24

Ribbed rebars RA 400/500-

Total:

70,66

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TRACE
 ТРЕСЦ ТРИТ КОЛЛА'АА
 ТРЕСЦ ТРИТ КОЛЛА'АА
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UNIT PRICE ANALYSES

5. TRAFFIC TECHNICAL AND SERVICE EQUIPMENT FOR ROADS
 11. trAFFIC TECHNICAL SERVICE EQUIPMENT FOR ROADS
 Item No. 11.3.04

UNIT PRICE ANALYSES ITEM No. 11.3.04

Single sided distance barrier
 H2W4* on the structure

Unitm'

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unscilled labourer	w.shift	2,55600	1,00	330,77	845,45
						845,45

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	splint L=4300MM	unit	0,250	1,00	4 970,68	1 242,67
	column H=1900MM	unit	0,250	2,00	1 972,35	986,18
	beam "C 180x3MM" L=3998MM	unit	0,250	1,00	8 090,00	2 022,50
	console for single wall	unit	0,250	2,00	962,62	481,31
	connector handle column	unit	0,250	2,00	273,43	136,72
	connecting elements	set	0,250	1,00	870,46	217,62
						5 087,00

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 312	Power generator	equ.shift	0,012	1,00	2 478,24	29,74
D 308	Pneumatic drill	equ.shift	0,012	1,00	675,88	8,11
						37,85

Summary unit price : 5 970,30

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TRACE
 ТРЕК ЕДИТ КИТАААА

TRACE
 ТРЕК ЕДИТ КИТАААА
 728/733

UNIT PRICE ANALYSES

5. TRAFFIC TECHNICAL AND SERVICE EQUIPMENT FOR ROADS
11. trAFFIC TECHNICAL SERVICE EQUIPMENT FOR ROADS
Item No. 11.3.05

UNIT PRICE ANALYSES ITEM No. 11.3.05

**Single sided distance barrier
H2W4* on the structure**

Unitm'

I. Labour

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 108	Unskilled labourer	w.shift	4,00000	1,00	330,77	1 323,08
					Total	1 323,08

II. Materials

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
	splint L=4300MM	unit	0,250	1,00	4 970,68	1 242,67
	column H=790MM	unit	0,250	3,00	2 539,68	1 904,76
	beam "C180x4"MM L=3998MM	unit	0,250	1,00	10 947,56	2 736,89
	console distancer	unit	0,250	3,00	880,70	660,53
	connecting element console column	unit	0,250	3,00	317,46	238,10
	connecting elements	set	0,250	1,00	1 126,47	281,62
	pin M16x150,nuts	set	0,250	3,00	399,39	299,54
	resin for anchors	unit	0,250	3,00	532,51	399,38
					Total	7 763,49

III. Equipment

Basis	Description	Unit	Quantity	Ratio	Unit Price /RSD/	Total /RSD/
D 312	Power generator	equ.shift	0,012	1,00	2 478,24	29,74
D 308	Pneumatic drill	equ.shift	0,012	1,00	675,88	8,11
					Total	37,85

Summary unit price : 9 124,42

000002


TRACE
TRAFIC I PVII XOLA*AA
TRACE
TRAFIC I PVII XOLA*AA
729/733





BUILDING RESEARCH INSTITUTE (N I S I) Ltd.
EC - NOTIFIED BODY FOR CONSTRUCTION PRODUCTS
Nr. 2032

1818 Sofia, BULGARIA, 86 Nikola Petkov Blvd, tel.+359 2 856 10 82, fax +359 2 955 96 38, e-mail:
nisi_sofia@abv.bg

EC-CERTIFICATE
OF CONFORMITY
No 2032-CPD-11.13

In compliance with the Directive 89/106/EEC of the Council of European Communities of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to the construction products (Construction Products Directive - CPD), amended by the Directive 93/68/EEC of the Council of European Communities of 22 July 1993, it has been stated that the construction

STEEL GUARD RAILS

With increased containment on impact, with grade (class) of containment H2, class in accordance with area of performance W4 and level of severity of impact A according to EN 1317-2:2010

With trade name Jupiter Bridge Rail H2W4 (JBR H2W4)

Used as a system for restriction of the motion of vehicles in the traffic lane, with declared technical characteristics in accordance with the Supplement, released on the market by:

"PASS KO" Ltd.

Town of Plovdiv, Okolovrasten pat, area of Komatevo, lot 15006
were produced in

the production unit of "JUPITER 05" Ltd., address:

Town of Plovdiv, Okolovrasten pat, area of Komatevo, lot 15006 and No 156A Peshtersko shose str.

is submitted by the manufacturer to the initial type-testing of the product and a factory production control and that the Notified body No 2032 "NISI" Ltd has performed the initial inspection of the factory and of the factory production control and performs the continuous surveillance, assessment and approval of the factory production control.

This certificate attests that all provisions concerning the attestation of factory production control described in Annex ZA and table ZA 1.b of the standards

EN 1317-5:2007+A1:2009

This certificate was first issued on 31st March 2011 and remains valid as long as the conditions laid down in the harmonised technical specification in reference or the manufacturing conditions in the factory or the FPC itself are not modified significantly.

General Manager of NISI Ltd
Dr.Eng.Rumen Guglev, assoc.prof.

Sofia, 6th June 2011

There are two Annexes of this Certificate that are Integrants.

URACE
РЕГИСТРИРАНА

000003

URACE
РЕГИСТРИРАНА 730/733





НАУЧНОИЗСЛЕДОВАТЕЛСКИ СТРОИТЕЛЕН ИНСТИТУТ- НИСИ ЕООД
НОТИФИЦИРАНО ЛИЦЕ ЗА ОЦЕНЯВАНЕ НА СЪОТВЕТВИЕТО НА СТРОИТЕЛНИ ПРОДУКТИ

Разрешение на МРРБ № CPD 10 - NB 2032 към ЕК от 14.04.2008 год.
Идентификационен номер NB 2032 от регистъра на Европейската комисия

Република България, София 1618, бул. "Никола Петков" № 86, тел.: (02) 856 10 82, факс: (02) 955 96 38, e-mail: nisi_sofia@abv.bg

ЕС-СЕРТИФИКАТ
ЗА СЪОТВЕТВИЕ

№ 2032-CPD-11.13

В съответствие с Директива 89/106/ЕЕС на Съвета на Европейската общност от 21 декември 1988 г. за хармонизиране на законите, наредбите и административните разпоредби на страните членки по отношение на строителните продукти (Construction Products Directive – CPD), изменена с Директива 93/68/ЕЕС на Съвета на ЕО от 22 юли 1993 г., въведена в българското законодателство с част втора на Наредбата за съществените изисквания към строежите и оценяване съответствието на строителните продукти, е установено, че строителните продукти

СТОМАНЕНИ ПРЕДПАЗНИ ОГРАДИ

с повишена способност за задържане при удар, със степен (клас) на задържане H2, клас според зоната на действие W4 и ниво на сила на удар А по EN 1317-2:2010

с търговско наименование Jupiter Bridge Rail H2W4 (JBR H2W4),

използвани като система за ограничаване движението на превозни средства на пътното платно, с декларирани технически характеристики съгласно Приложението,

пуснати на пазара от

“ПАСС КО” ООД

гр.Пловдив, Околовръстен път, кв. Коматево, имот 15006,

са произведени в

Производствената база на „ЮПИТЕР 05” ООД с адрес:

гр.Пловдив, Околовръстен път, кв. Коматево, имот 15006 и ул. „Пещерско шосе” № 156А

в условията на въведена и функционираща система за производствен контрол и провеждане на текущо изпитване на пробни образци по утвърден план за изпитване.

Нотифицираното лице NB 2032 “НИСИ”ЕООД е извършило първоначално изпитване на типа на продукта за определените в EN 1317-2:2010 съществени характеристики, провело е първоначална проверка (одит) на производствения контрол и осъществява постоянен контрол (надзор), оценка и одобряване на провеждания от производителя производствен контрол.

Сертификатът удостоверява, че са удовлетворени всички изисквания по отношение на експлоатационните характеристики на продукта за оценяване на съответствието, определени с приложение ZA, таблица ZA.1.b на

EN 1317-5:2007+A1:2009

Този сертификат е издаден за първи път на 31.03.2011 год. и остава валиден при условие, че изискванията на хармонизираната техническа спецификация се изпълняват, не се влошават условията на производство и се упражнява ефективен производствен контрол в съответствие с въведената документирана система.

Управител на НИСИ:



гр.София, 06.06.2011 год.

Към сертификата има приложение от 3 стр., което е неразделна част от него.

000004





BUILDING RESEARCH INSTITUTE (N I S I) Ltd.
EC - NOTIFIED BODY FOR CONSTRUCTION PRODUCTS
Nr. 2032

1618 Sofia, BULGARIA, 88 Nikola Petkov Blvd, tel.+359 2 856 10 82, fax +359 2 955 96 38, e-mail:
nisi_sofia@abv.bg

EC-CERTIFICATE
OF CONFORMITY
No 2032-CPD-11.14

In compliance with the Directive 89/106/EEC of the Council of European Communities of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to the construction products (Construction Products Directive - CPD), amended by the Directive 93/68/EEC of the Council of European Communities of 22 July 1993, it has been stated that the construction

STEEL GUARD RAILS

With increased containment on impact, with grade (class) of containment H2, class in accordance with area of performance W4 and level of severity of impact A according to EN 1317-2:2010

With trade name Jupiter Guard Rail H2W4 (JGR H2W4)

Used as a system for restriction of the motion of vehicles in the traffic lane, with declared technical characteristics in accordance with the Supplement, released on the market by:

"PASS KO" Ltd.

Town of Plovdiv, Okolovrasten pat, area of Komatevo, lot 15006

were produced in

the production unit of "JUPITER 05" Ltd., address:

Town of Plovdiv, Okolovrasten pat, area of Komatevo, lot 15006 and No 156A Peshtersko shose str.

is submitted by the manufacturer to the initial type-testing of the product and a factory production control and that the Notified body No 2032 "NISI" Ltd has performed the initial inspection of the factory and of the factory production control and performs the continuous surveillance, assessment and approval of the factory production control.

This certificate attests that all provisions concerning the attestation of factory production control described in Annex ZA and table ZA 1.b of the standards

EN 1317-5:2007+A1:2009

This certificate was first issued on 31st March 2011 and remains valid as long as the conditions laid down in the harmonised technical specification in reference or the manufacturing conditions in the factory or the FPC itself are not modified significantly.

General Manager of NISI Ltd
Dr.Eng.Rumen Guglev, assoc.prof.

Sofia, 6th June 2011

There are two Annexes of this Certificate that are integrants.

IRACE
ИЗПР. ПР. КОМ. АА

000005

IRACE
ИЗПР. ПР. КОМ. АА

ОГРАНИЧЕ
Коп.



НАУЧНОИЗСЛЕДОВАТЕЛСКИ СТРОИТЕЛЕН ИНСТИТУТ- НИСИ ЕООД
НОТИФИЦИРАНО ЛИЦЕ ЗА ОЦЕНЯВАНЕ НА СЪОТВЕТСТВИЕТО НА СТРОИТЕЛНИ ПРОДУКТИ

Решение на МРРБ № СРД 10 - NB 2032 към ЕК от 14.04.2008 год.
Идентификационен номер NB 2032 от регистъра на Европейската комисия

Република България, София 1618, бул. "Никола Петков" № 96, тел.: (02) 856 10 82, факс: (02) 955 96 38, e-mail: nisl_sofia@abv.bg

ЕС-СЕРТИФИКАТ
ЗА СЪОТВЕТСТВИЕ

№ 2032-CPD-11.14

В съответствие с Директива 89/106/ЕЕС на Съвета на Европейската общност от 21 декември 1988 г. за хармонизиране на законите, наредбите и административните разпоредби на страните членки по отношение на строителните продукти (Construction Products Directive – CPD), изменена с Директива 93/68/ЕЕС на Съвета на ЕО от 22 юли 1993 г., въведена в българското законодателство с част втора на Наредбата за съществените изисквания към строежите и оценяване съответствието на строителните продукти, е установено, че строителните продукти

СТОМАНЕНИ ПРЕДПАЗНИ ОГРАДИ

с повишена способност за задържане при удар, със степен (клас) на задържане H2, клас според зоната на действие W4 и ниво на сила на удар В по EN 1317-2:2010

с търговско наименование Jupiter Guard Rail H2W4 (JGR H2W4),

използвани като система за ограничаване движението на превозни средства на пътното платно, с декларирани технически характеристики съгласно Приложението,

пуснати на пазара от

“ПАСС КО” ООД

гр.Пловдив, Околовръстен път, кв. Коматево, имот 15006,

са произведени в

Производствената база на „ЮПИТЕР 05“ ООД с адрес:

гр.Пловдив, Околовръстен път, кв. Коматево, имот 15006 и ул. „Пещерско шосе“ № 156А

в условията на въведена и функционираща система за производствен контрол и провеждане на текущо изпитване на пробни образци по утвърден план за изпитване.

Нотифицираното лице NB 2032 "НИСИ"ЕООД е извършило първоначално изпитване на типа на продукта за определените в EN 1317-2:2010 съществени характеристики, провело е първоначална проверка (одит) на производствения контрол и осъществява постоянен контрол (надзор), оценка и одобряване на провеждания от производителя производствен контрол.

Сертификатът удостоверява, че са удовлетворени всички изисквания по отношение на експлоатационните характеристики на продукта за оценяване на съответствието, определени с приложение ZA, таблица ZA.1.b на

EN 1317-5:2007+A1:2009

Този сертификат е издаден за първи път на 31.03.2011 год. и остава валиден при условие, че изискванията на хармонизираната техническа спецификация се изпълняват, не се влошават условията на производство и се упражнява ефективен производствен контрол в съответствие с въведената документирана система.

Управител на НИСИ:

гр.София, 06.06.2011 год.

Към сертификата има приложение от 3 стр., което е неразделна част от него

000006

