VOLUME 3

TECHNICAL SPECIFICATIONS

I. CONSTRUCTION – CRAFTSMEN WORKS

1. TECHNICAL DESCRIPTION

1.1 Description and materials

• *Pedestrian path*

The pedestrian path is designed at a width of 2,4 meters and a length of approx. 1,5 km. At individual parts of the pedestrian path wooden beam stairs are designed for communication with surrounding grounds. At the beginning and at the end the path fits into existing communication corridors, which at the same time act as access point to this path. Low set posts are designed for these accessing areas, to prevent any entrance by motor vehicles – cars. In the section at the Pažanjski potok, the path splits into two directions, one that continues along the creek and another one that goes over the newly designed reinforced concrete, where it should connect onto existing vegetation and the jogging path in the zone beneath the Sports center.

The paving of the path will be done with stone slabs of 5 cm thickness, while the joints will be filled with cement milk. This stone slab pavement will be in parts interrupted with a pavement done of stone cubes, laid in two rows. In areas where the path widens – at connections of the pedestrian and the cycling paths, the pavement will be done with stone cubes only. The path will be lined with concrete curbstones in the color of the pavements. The curbstones are dimensions 15x20x10cm and will be laid along the entire path's length, in a concrete layer.

• *Cycling path*

The cycling path is designed at a width of 2,0 meters, with a length of 1,5 km. The cycling path runs parallel to the pedestrian path and a green strip, which at the same acts as dividing element between the two paths. At access points to the cycling and the pedestrian paths low set posts will be installed, to prevent cars driving onto these surfaces. The cycling path will be properly marked with horizontal and vertical signs.

The upper surface layer of the cycling path will be done of asphalt, in two layers. The first layer, applied onto the tampon level is the bituminized, carrying layer of 6 cm thickness and the upper layer, is the wearing layer of 4 cm thickness. The cycling path is lined with curbstones in the color of the stone pavements. The curb stones are of dim.15x20x10cm and laid along the entire path, into concrete.

• *Furniture (benches, fountain, waste baskets and stairs)*

Benches will be aligned along the entire path length, on both the right and left sides of the pedestrian path and around wider areas – plateaus. The benches are designed of natural materials (wood) with metal supporting elements. Two models of benches are designed. One model is used in the green strip and the other on the right side of the pedestrian path and on the wider parts – plateaus. Detailed description and dimensions of benches are given in the preliminary measures, graphic part of documentation and bill of quantities.

The fountain is set into the crossing of the promenade, the area at the Pažanjski creek. Basically, the fountain has dimensions 30x50cm, height 100cm. The fountain is designed of stainless steel (orange color), all joints welded. The fountain has all necessary fittings and elements.

Waste baskets will be of circular design, of a diameter of 54 cm and a height of 80 cm, with three hollow, round rollers for: paper, glass and plastic. The basic bench structure is steel sheeting, onto which curved, wooden laths of 3x3 cm are fixed.

2. TECHNICAL REPORT - TRAFFIC

2.1 Existing status

In a part of the planned promenade route an embankment has already been built as part of the regional road Bablja Greda – Vladoš (mini bypass around Kolašin) and it is planned that on this partially completed section a promenade is constructed (cycling and pedestrian path with all necessary facilities).

The project covers the promenade in three parts/sections:

Section 1-1, length l = 999.659m;
Section 2-2, length l = 253.246m;
Section 3-3, length l = 38.980m;

On the entire length of the promenade, a lining with concrete curbstones dimensions 15/20/80 cm is designed made of concrete MB 50, which will elevate the cycling and pedestrian paths some 5 cm above the surrounding green grounds. At the connection between the cycling and pedestrian paths and at the access areas to objects, the curbstones will be set at same level as the path 15/20/80cm.

The following structure is designed for the cycling path:
- bottom layer as carrying layer-tampon made of crushed stone aggregate 0-31.5, d = 25cm
- upper, carrying layer – bituminized, crushed stone aggregate BNS22, d = 6cm
- wearing layer made of asphalt concrete AB11, d = 4cm

The following structure is designed for the pedestrian path:
- bottom layer as carrying layer-tampon made of crushed stone aggregate 0-31.5, d = 25cm
- cement mortar d = 5cm
- stone slabs d = 5cm

A part of the pedestrian paths, connections to the cycling path and the plateau at the planned stairs, in front of objects and similar will be built with the following structure:
- bottom layer as carrying layer-tampon made of crushed stone aggregate 0-31.5, d = 25cm
- cement mortar d = 5cm
- stone cubes – granite 10x10x5cm = 5cm

The communication signs (horizontal and vertical) are done in accordance with applicable construction solutions and valid regulations and standards and it makes an integral part of the project's documentation.
The main architectural designs, the designs of hydro-technical installations, electric installations and landscaping designs in the promenade area are all integral parts of the project.

3. TECHNICAL CONSTRUCTION TERMS

3.1. MARKING OF TRAFFIC SURFACES BY A LAND SURVEYOR

3.1.1 Description

This work comprises the pegging-off of all elementary points defined by project design, all land survey measurements in respect of transfer of data from the project design onto the site and maintenance of the pegged off marks at site, during the entire period of construction until handing over of the works to the investor. This work also includes taking over and maintaining all basic land survey maps, photos and drawings, pegging off at site after the investor introduced the contractor into the site. The scope of this work must comply fully with all construction works requirements, control of works, calculations and other.

3.1.2 Handing over and taking over the promenade route

The investor hands over to the contractor the pegged off site, with all elementary points marked and accompanied by written data. The points must be marked at site with wooden pegs 4x4 cm (on the traffic lane head pins with a hole in the middle). The main points must have a nail on the peg. Handing over is done based on a protocol. The investor will hand over to the contractor the polygon points, for which little concrete posts were made of 12x12x50 cm, with a hole in the middle and underground center.

The contractor is obligated to secure all polygon points and rappers. If any data at site is lost or changed (polygon points, rappers), the contractor is obligated to renew these at own costs. The accuracy of renewal of points may also be checked by the supervising body.

3.1.3 Control during work

The contractor must control the data in respect of pegging-off points and permanently renew all markings and signs at site during the entire duration of the works, disregarding the cause of damage to these points. The contractor must submit all data on pegging off the site to the supervising body and also enable this body to use all pegs for own purposes.

3.1.4 Pegging off the buildings

Based on project design data, the contractor must peg-off all objects and if necessary propose the supervising engineer a drawing on the pegging-off with all other necessary data. Setting up the cross profiles, insurance of the pegged off axis and the control must be adjusted to the requirements of the building’s construction.

3.2 CUTTING INTO EXISTING ASPHALT STRUCTURES FOR CONNECTION OF NEW SURFACES

3.2.1 Description

This item contains the works of cutting into the existing asphalt layers with a motor saw and cutting into the bottom, carrying layer with adequate machinery at certain distance from the edge of the existing driving lane, all in accordance with the project design. The demolition, loading and disposal of rubble from these works is done by the contractor to a landfill designated by the investor. This item also includes implementation of measures of safety for the traffic during the works and outside the working hours.

3.2.2 Construction works

In accordance with the drawings attached hereto, the cutting into the existing asphalt layers is done along a line at a distance of minimum 0,50 meters from the edges of the existing driving lane and after removal of these layers the cutting works continue into the existing bottom layer, at a distance of 0,20 meters from the edge of the existing driving lane.

The cutting into the asphalt is done vertically, with a motor saw and then a part of the asphalt layers, from the line of the cut towards the existing driving lane edge is crushed with

an adequate mechanical tool and pushed aside by a bulldozer, loaded into trucks and disposed at a landfill outside the construction site.

The cutting into the bottom layer is done displaced from the initial cuts and can be done with a bulldozer or grader. Part of the bottom carrying layer is pushed from the cut line towards the edge of the existing driving lane by bulldozer or is immediately loaded onto trucks and disposed at a landfill outside the construction site.

3.2.3 Notes

Excavation of the bedding layer at connection to the driving lane must be to an elevation point that is min. 5 cm below than the bedding surface in the existing driving lane.

3.3 GRINDING OFF EXISTING DRIVING LANE LAYER

3.3.1 Description and work

This item includes mechanical grinding of the existing driving lane at places defined by project design (connection of existing asphalted road with planned promenade).

From the marked surfaces, a grinding machine is grinding off the driving lane surface layer at a width of 0,3 met and a depth of d=4cm. The ground surfaces must be cleaned with compressed air and sprayed with an emulsion before a new layer of asphalt is installed.

The work contains grinding, transport and disposal of removed material, cleaning, purchase and application of bituminized emulsion.

3.4 EXCAVATION OVER WIDE SURFACES WITH TRANSPORT

3.4.1 Description, scope and content of the works

This item includes all wide excavation works, in all materials in the ground that are defined as such by design. This item includes transport with disposal of material, i.e. pushing of excavated material into embankments, depositing locations or landfills – all depending on designation of these materials during the works. These works also include all excavation works in cut throughs, passages and wide excavations when constructing objects.

3.4.2 Provisions for construction works

- JUS U.E1.010 Excavation works in road construction.

3.4.3 Construction works

Basically, excavation works to be done with adequate machinery and other tools, so that manual excavation works are kept at a minimum. Excavation works in hard rock material to be done with a drilling machine, in depth or ordinary mining and repeated mining of major rocks, if the designated usage of such excavated materials demands this approach. Mechanical pushing must also be included, i.e. loading of material and transport to the place of usage, i.e. a landfill with discharging operation. All excavated material must comply with designated re-usage based on project design and these technical terms.

When performing the works, care must be taken that these works are properly done, that the balance is not disturbed or any of the embankment slopes from the project design damaged. Such case must be reported by the contractor and remedied immediately based on instructions of the supervising engineer, without claiming any compensation or indemnification for additional or unforeseen works.

During the excavation works, if possible all impacts or disturbances of the traffic (vehicles and pedestrian) flow must be kept at a minimum, which means that all necessary traffic and safety signalization as approved by the authorized body must be installed.

Permission for such signalization to be obtained by the contractor. In case there are disturbances the contractor must remedy these immediately at own cost.

3.4.4 Disposal of local material

If it is planned to use the material from the excavations, the n this material is to be used for construction of the embankments, i.e. this material must be deposited at a special location proposed or approved by the supervising body, if this is excess material.

3.4.5 Measurements

Measuring/calculation of the quantities for the excavation works is done based on real amount of cubic meters excavated, in natural condition, based on measuring the cross section profiles and after completion of all excavation works within the entire project quantity calculation, i.e. changes approved by the supervising engineer. Excess of excavated quantities – above the ones from the project design, will not be compensated if caused by mistake of the contractor.

Nests and hollows in the ground, between the layers and if not exceeding 1m2, will not be deducted from the definition of the surface, i.e. cubic meters quantity, while larger ones will be deducted from the individual measurement unit.

Hollows over 1 m2 will deducted from the quantities. All material excavated and used for other purposes, except for the embankment and if such material hasn't been replaced by a borrowing site, will be deducted when calculating the quantity of the overall excavated mass.

3.4.6 Payment

Payment will be done per cubic meter of excavated material in natural state, at unit price defined by contracted bill of quantities – separately for the individual types of soil and ground materials. This price includes all works on excavations, with loading, transport and discharge of material at designated site, based on distribution of masses.

The making of the shoulders is not charged or paid separately, nor are the works on making of these shoulders charged separately, because this work is included in the price of wide surface excavations, when these shoulders are built and filled by filling in and compacting of material.

If the sites where material is borrowed from are located outside the construction site, the quantity in cubic meters is calculated based on the quantity filled into the embankment in compacted state, for the portion of material from such borrowing sites based on the principle 1 m3 of compacted embankment equally to 1m3 of excavation at borrowing site.

3.5 MECHANICAL EXCAVATION OF HUMUS LAYER

Removal of the humus layer with disposal on the sides for subsequent usage is to be done mechanically, with cross-directional transport by pushing up to 50 meters distance.

The excavated humus to be deposited along both sides of the paths, in approximately equal piles. The humus must not be used for the building of the embankment, but only at the end of the works, to cover the slopes, trenches, canals, shoulders and borrowing sites with it for landscaping.

Excess humus material to be disposed at a site defined by the supervising engineer.

3.6 CONSTRUCTION OF THE EMBANKMENT

3.6.1 Scope and subject of works

The construction of the embankment means – filling up material, distribution, basic and fine leveling, wetting and compacting the material in the embankment – all based on dimensions from the project design. All these works must be completely done based on project designs, these technical terms and standard JUS U.E1.010 – ground works in road construction.

3.6.2 Material

For the construction of the embankment all inorganic materials of required quality will be used. The material for the embankment may also be collected from the cut ins.

3.6.3 Regulations for control of material quality

- JUS U.B1.010 – sampling
- JUS U.B1.012 – definition of ground moisture
- JUS U.B1.014 – definition of specific weight
- JUS U.B1.016 – definition of volume weight
- JUS U.B1.018 – definition of granulometric composition
- JUS U.B1.020 – definition of consistency limits
- JUS U.B1.024 – definition of flammable and organic materials
- JUS U.B1.038 – definition of optimum water content
- JUS.U.B1.042 - definition of Californian load bearing index

3.6.4 Delivery and filling up of material

Transport and filling up of material onto prepared basic ground or onto an already shaped layer of the embankment may start only after the supervising engineer approves the bottom layers.

Each individual layer must be distributed in the longitudinal direction horizontally, but to a maximum at an inclination that is equal to the designed, longitudinal inclination. In the cross direction, each layer must have a one –sided inclination of 2-5%. When bringing in the material for the building of the embankment, the transport vehicles must be as evenly distributed over the entire width of the planum.

3.6.5 Compacting

Each layer of the embankment must be compacted at full width, with an adequate mechanical tool, whereas the compacting must be done from the outside towards the inside /middle part of the embankment.

Each layer of the embankment must be wetted or dried to a humidity that complies with previous tests, at which a certain material must be compacted to a certain, requested level of density. Along with this, each layer of the embankment must be crushed mechanically.

The filling up of layers must be done in such a way, that layers in the longitudinal sense are if possible horizontal, so that sudden jumps in height between the individual layers are avoided and that the layers are done under an inclination where proper compacting is still possible.

The works on the embankment will be stopped at any moment when it is not possible to achieve the desired results, especially during rain or other bad atmospheric influences. In such cases the contractor is not entitled to claim indemnification or any separate compensation. Material for the embankment must not be brought and laid onto frozen surfaces or filled over ice and snow.

3.6.6 Measurements

The quantity of material installed into the embankment is measured in cubic meters, based on real quantities within the project design and including the core of the embankment.

3.6.7 Payment

The contracted prices must include all works on distribution, wetting or drying, compacting, leveling of the embankment slopes and shoulders with an accuracy of ± 5 cm in respect of the designed slopes, including all material and work, transports and movements of material and the contractor is not entitled to any additional charges for the construction of the embankment.

The calculation of quantities for the embankment is defined based on cross-sectional profiles and these quantities do not include the quantity of the humus layer on the embankment and shoulders. The calculation of quantities does include the part of the embankment that was constructed in the area where humus was removed from the underlying ground. If the layer of humus removed from under the embankment is bigger or smaller than the designed, then excess or less excavated material must be calculated based on previous evidence that is verified.

3.7 COMPACTING OF UNDERLYING GROUND – LEVELLING OF BOTTOM LAYER

3.7.1 Description

The underlying ground is natural ground on which the embankment will be built. The work consists of compacting, possible loosening up for drying or wetting purposes, all in depths defined by project design.

3.7.2 Material

For the bedding, all inorganic materials defined under these technical terms will be used.

3.7.3 Regulations applicable for material quality control

- JUS U.B1.010 – sampling
- JUS U.B1.012 – definition of ground moisture
- JUS U.B1.014 – definition of specific weight
- JUS U.B1.016 – definition of volume weight
- JUS U.B1.018 – definition of granulometric composition
- JUS U.B1.020 – definition of consistency limits
- JUS U.B1.024 – definition of flammable and organic materials
- JUS U.B1.038 – definition of optimum water content
- JUS.U.B1.042 - definition of Californian load bearing index

3.7.4 Evenness

The evenness (planum) of the bottom layer must be such, that maximum deviations from the design, measured from the plane are 30 mm.

The elevation points for the final bedding layer at any point may deviate from the designed up to a max. of 30 mm. The elevation of the individual measurement points must be defined with levels and the points will be designated by the supervising engineer.

3.7.5 Compacting of the bedding

The entire width of the bedding layer – planum must be mechanically or chemically stabilized in accordance with the project design.

3.7.6 Regulations applicable for control of quality of materials

- JUS U.B1.010 – sampling
- JUS U.B1.012 – definition of ground moisture
- JUS U.B1.016 – definition of volume weight
- JUS U.B1.046 – definition of module of density properties with circular plate method

3.7.7 Approval of works

The acceptance of the works on the bedding will be done by the supervising engineer, immediately before the next phase of works.

When approving works, all requirements from these technical terms must be met. Any deficiencies or faults in respect of these technical terms must be remedied by the contractor, at own expense.

3.8 MECHANICALLY STABILISED LOWER – CARRYING (TAMPON) LAYER

3.8.1 Description of works

These works consist of purchase, distribution and compacting. The thickness of the installed and compacted layer is 25cm under the cycling and pedestrian paths, all based on main project design.

3.8.2 Construction

The lower carrying layer is to be installed on top of the bedding, prepared in accordance with the requirements and these technical terms. Only when the supervising engineer approves this bedding layer and done works, the contractor is entitled to start bringing in the material for the lower carrying layer. After the material has been brought to the site, it must be distributed, properly leveled – all at a thickness o reach the required layer after compacting of material. The compacting is done with adequate vibrating machines.

3.8.3 Quality control

The quality control contains preliminary and control tests and analysis of material and control of installed and compacted layers.

3.8.4 Control of the installed layer

The control is done by testing the level of relative compactness in relation to the modified Proctor procedure, at least on every 500 m2. Compactness level Sz (%) >98%.

3.9 CARRYING LAYER OF BITUMENIZED GRAVEL BNS 22

3.9.1 Description

This item includes preparation, installation and compacting of the mixture of mineral materials and bitumen, in a layer of a thickness of d = 6 cm.

3.9.2 Basic materials

For the construction of the carrying layer of bituminized material, the following must be prepared: sand- gravel, stone powder, biding material Bit 60.

3.9.3 Quality of basic materials

3.9.3.1 Sand - gravel

The material must comply with the requirements set forth for physical – mechanical and mineralogical – petrographic properties of the particles, all as per JUS U.E9.021;

3.9.3.2 Stone powder

Stone powder must comply full to the criteria contained in JUS B.B3.045.

3.9.3.3 Bitumen

Bitumen may be of type Bit 45 or Bit 60. The bitumen must fully comply with the criteria of JUS U.M3.010 for the defined type of bitumen.

3.9.4 Emulsion

For connection between the layers a semi-stabile emulsion in accordance with JUS U.M3.024 is to be used or an anionic emulsion based on JUS U.M3.022

3.9.5 Mixture

The asphalt mixture must have a bitumen content of approx. 3.5-4%. The lines of sieving the mineral mixture must be within the required limits.

3.9.6 Physical – mechanical properties of the asphalt mixture

The asphalt mixture compacted into Marshall moulds at 155-160oC and mineral mixture of extracted asphalt mass must comply with defined requirements.

Deviations above the required values are prohibited. In case the deviations remain permanent, the supervising engineer and the investor have to give their opinions in this regard, so that adequate measures are launched to maintain the designed quality of the works, i.e. to define the measures to be applied for calculation of the performed works.

3.9.7 Technology

3.9.7.1 Preparation of the underground

The asphalt layer can be installed onto an underground that is dry and not frozen. Prior to the start of the works, the underground must be properly washed, cleaned with steel brushes and blown clean with air compressors. After cleaning of this underground, the evenness is measured. In parts where the evenness of the underground level deviates more than 20 mm against the designed, the contractor has to perform remedy works in accordance with the requirements from the project design.

Prior to the making of the asphalt layer, an emulsion must be applied at a quantity of 150 g of bitumen binder per m2. The type of emulsion depends on the type of underground it is applied onto.

3.9.7.2 Production and transport of asphalt mixture

The temperature of the bitumen must be 150-170ºC. The temperature of the stone aggregate must not exceed the bitumen temperature, i.e. it must not be above 150ºC.The temperature of the asphalt mixture in the mixing machine must be between 150-170ºC (extraordinarily 175ºC). The asphalt mass must be covered during transport. The basic load of the vehicle must not exceed an axis load of 10 ton.

3.9.7.3 Installation of asphalt mixture

The asphalt layer is installed with a finisher and adequate tools – rollers, based on technology approved at the test surface.,

The temperature of the asphalt mixture at site of installation may not be below 130ºC or above 175ºC. The asphalt layer is rolled until the required compactness is achieved, which is controlled at site with an isotopic probe.

3.9.7.4 Joints between the surfaces

When continuing the works, after longer breaks in work or interruptions, the joint area must be cut off clean, through entire thickness and coated with bitumen emulsion.

3.9.7.5 Construction works period

The carrying layer with specifications from these technical terms may be installed only when air temperatures are above 5ºC, there is not wind or the air temperature is minimum 10ºC with wind. The asphalt mixture may not be installed if it is raining or foggy. The underground temperature may not be below +5ºC.

3.9.8 Quality control

3.9.8.1 Preliminary tests and analysis of asphalt mixture

Prior to the beginning of the works, the contractor is obligated to order a study on asphalt mixture at an independent and authorized laboratory, which must fully comply with these technical terms. Absolutely no work may begin until the contractor submits this preliminary asphalt mixture for approval by the supervising engineer. Attestations and certificates on the basic material and preliminary asphalt mixture may not be older than 6 months. In case of changes in quality of basic materials, the contractor must immediately propose the supervising engineer a new mixture for approval, but before using such new preliminary mixture.

3.9.9 Tests of physical – mechanical properties of the asphalt mixture and installed layer

These tests will be done by the operational laboratory:

- At the beginning of the works and
- Every 2000 m2.

Asphalt mixture behind the finisher. The compactness control and control of cavities in the asphalt layer is done by sampling core pieces from the finished asphalt layer, at the same point where from the hot, just distributed asphalt behind the finisher already samples were taken.

3.10 CONSTRUCTION OF A LAYER OF ASPHALT CONCRETE (AB 11)

3.10.1 Description

This item contains purchase, preparation and installation with compacting of asphalt concrete in a thickness of 4cm. The base for setting up the technical terms for this item is JUS U.E4.014.

3.10.2 Basic materials

- Crushed, high quality stone in fractions 2/4*mm, 4/8 mm, 8/11 mm;
- Crushed sand 0/2 mm (carbonate);
- Stone powder of a carbonate composition;
- Bitumen Bit 60.

For sand, high quality crushed sand, produced out of rock mass of carbonate composition must be used.
The sand must comply with the following properties:

- Sand equivalent is min. 60%
- The sand must be free of clay clumps
- The sand must be free of organic impurities
- The sand may not clump

For stone powder, carbonate stone powder I. class and in accordance with JUS B.B3.045 must be used. Powder made of crushed dolomite rock is not recommended, because of less biding properties onto bitumen. Prior to the works the contractor must obtain a certificate issued by an authorized laboratory in respect of the quality of the rock powder, which guarantees the quality.

As binding material, bitumen Bit 60 in accordance with JUS-u U.M3.010) to be used or polymer bitumen with a certificate issued by an authorized institution.

3.10.4 Composition of asphalt mass

The quantity of binding material that is necessary for the asphalt mass to accomplish the wanted values is defined by laboratory analysis in form of drafting an overview of the composition and properties of the preliminary asphalt mass mixture.

The optimum quantity of bitumen in this asphalt mixture should not be below 5.0%, to prevent early fatigue of the asphalt concrete.

3.10.5 Physical – mechanical properties of the asphalt mixture

The asphalt mixture compacted into Marshall moulds at 155-160 ºC and the mineral mixture of extracted asphalt mass must comply with designed terms and properties.

3.10.6 Properties of installed wear layer

The installed layer of asphalt concrete must comply with demanded properties. Deviations above the defined requirements are prohibited.

3.10.7 Construction technology

3.10.7.1 Preparation of underground

The asphalt layer can be installed onto an underground that is dry and not frozen. Prior to the start of the works, the underground must be properly washed, cleaned with steel brushes and blown clean with air compressors. After cleaning of this underground, the evenness is measured by the supervising engineer. In parts where the evenness of the underground level

deviates more than 15 mm against the designed, the contractor has to perform remedy works in accordance with the requirements from the project design.

Prior to the making of the asphalt layer, an emulsion must be applied at a quantity of 150 g of bitumen binder per m2. The type of emulsion depends on the type of underground it is applied onto.

3.10.7.2 Making and transport of the asphalt mixture

The asphalt machine must be equipped with a sieve, of eye 16 mm, which will separate unwanted, bigger fractions in the mineral mixture. During production it is prohibited to use the reject stone powder.

The temperature of the bitumen must be 150-160ºC. The temperature of the stone aggregate must not exceed the bitumen temperature, i.e. it must not be above 150ºC.The temperature of the asphalt mixture in the mixing machine must be between 150-170ºC (extraordinarily 175ºC). The asphalt mass must be covered during transport. The basic load of the vehicle must not exceed an axis load of 10 ton.

3.10.7.3 Installation of asphalt mixture

The asphalt layer is installed with a finisher and adequate tools – rollers, based on technology approved at the test surface.,

The temperature of the asphalt mixture at site of installation may not be below 140ºC or above 175ºC. The asphalt layer is rolled until the required compactness is achieved, which is controlled at site with an isotopic probe. When continuing the works after longer breaks or interruptions, the joint area must be cut clean and treated with bitumen emulsion.

3.10.7.4 The period for performance of these works

The wear layer with specifications from these technical terms may be installed only in the period April 15th to October 15th, i.e. when air temperatures are above 5ºC, there is not wind or the air temperature is minimum 10ºC with wind. The asphalt mixture may not be installed if it is raining or foggy. The underground temperature may not be below +5ºC.

3.10.8 Quality control

See description for quality control for bituminized gravel BNS22.

3.10.9 Measurement and payment

Calculation based on m2 of really installed asphalt layer of thickness d=4cm or calculation in tons, if the thickness of the layer varies.

3.11 INSTALLATION OF CURBSTONES

The installation of curbstones is done in a fresh concrete layer, type MB15, with side formwork, all in accordance with the elevations and dimensions from the project design. The concrete underground must be done on top of a previously compacted and tested tampon layer.

The curbstone is industrial type product, in a metal frame, with a concrete core made of aggregate and Portland cement. White curbstones must have visible surfaces made of white concrete in a thickness of 3 cm, and processed with grinding.

The quality of the curbstones and their production must comply with the technical terms for concrete. The concrete curbstones are made of concrete MB 50.

The curbstones are laid with 1 cm wide joints, filled with cement mortar R=1:3, with processing of splint that is pulled in for 1 cm. The mounted curbstones may have a tolerance of 0,5 cm from the designed absolute elevation points.

4. TECHNICAL TERMS FOR SETTING UP TRAFFIC SIGNALIZATION

4.1. VERTICAL SIGNALIZATION

1. The technical terms apply to the elements of vertical traffic signalization for traffic signs on roads.

2. The setting up, usage of signs on roads is defined by various regulations and laws: The Law on basic safety for traffic on roads, the Law on roads and the Regulation on traffic signs along roads.

3. The technical terms for the making and testing of traffic signs on roads are defined by Yugoslav standard YUS.Z.S2.300 to 308. The standards relate to traffic signs made of ordinary material (color) or retro-reflecting materials and signs with interior or exterior illumination.

4. Elements and their dimensions for graphic presentation of traffic signs on roads or direction signs are defined by Yugoslav standards YUS.Z.S2.301 to 322.

5. The basic geometrical shapes of signs on roads are: triangles, circles, rectangles, squares with arrow-shaped ends and octagonal.

6. Deviations from the defined dimensions is allowed up to 2%. The overall symbol or inscription impression may not be changed in case of allowed deviations. Numbers and letters used on such signs – instruction or direction signs must fully comply with standard YUS.U.S4.201 to 204.

7. The colorimetric and photometric properties of the material for the traffic signs on roads are also defined by standard YUS.Z.S2.330.

8. Traffic signs and boards/panels may be of the following materials: steel sheets, aluminum sheet or plastic, with or without glass fibers, under the condition that the required strength of the sign is met, and its durability under various atmospheric impacts.

9. Traffic signs and other panels and boards are made to withstand all weather impacts and temperature ranges -40 do +50 C as well as relative moisture up to 95%.

10. The background colors of these signs and panels/boards and all elements of fixation of such signs are grey, without gloss.

11. Set up signs must be secured against turning or movement.

12. Traffic signs are set in such a way that their plane surface deviates from the horizontal for a maximum 3 to 5% in the field of the normal line towards the road – path axis.

13. Traffic signs may not show any visible elements used to fixate them onto supports or show any visible signs of damage.

14. The support elements of traffic signs onto posts must form one body with the sign or the connection onto the support is established with screws, rivets or by welding.

15. The durability of a sign must be at least 5 years from the date of setting up, i.e. seven years from the date of production.

16. Works on setting up signs of all types contains purchase and transport of these signs, excavation of foundation holes, concrete pouring into such fo0undations, setting up the posts into the foundations and painting of posts with final set up of the signs.

17. Signs must be set up in such a way, that their lower edge is at a height of minimum 2 meters, when these are placed into the pavement, i.e. 1,10 meters on other underground (lawn) and at a minimum distance of 0,20 meters from the driving lane edge and the nearest sign edge.

18. Payment will be done per piece of set up sign, at the previously agreed individual unit price depending on dimensions and methods of setting up the signs.

4.2 HORIZONTAL SIGNALIZATION

1. These technical term for the elements of horizontal signalization mainly refers to setting up adequate marks signalization onto the ground surface.

2. The technical terms for materials used for marking asphalt and concrete surfaces and the traffic – technical properties of such signals on traffic surfaces are defined by Yugoslav standard YUS.Z.S2.240.

3. Only those materials may be used, that can evidence traffic – technical properties and quality ensuring good visibility both during the day and night, while operating vehicles and that have the required roughness of surface and durability under all conditions and during the defined time. The properties and quality must comply with the traffic load on the marked surfaces.

4. Composition of the materials and the setting up of these signals on the driving surface must ensure the reflecting nature and properties of such signs and markings.

5. The type, shape, dimensions, colors and positions of signalization on driving surfaces and their meaning are all defined by standards YUS.U.S4.221 to 234 and the Regulation on traffic signs on roads.

6. Changes of defined forms and shapes of such signs on the driving surfaces based on Yugoslav standards – like deformations of signs, improper marking procedures or usage of other elements is prohibited.

7. Marks that do not comply with the defined shapes and forms must be removed permanently.

8. After application of the signs and markings onto the driving surfaces, the period of time until traffic may pass over the freshly set signs and markings is maximum 45 minutes.

9. Works are done during dry weather, at air temperatures of +10°C to +30°C, relative moisture of air of max. 85%, and a temperature of the driving surfaces +5°C to+45°C.

10. Prior to application of the paints, the surface on which the paint is applied must be dry, clean, without dust, salt, oil or other grease stains, which must be all removed.

11. On newly asphalted roads only temporary signs/markings are applied, which are replaced with permanent ones after stabilization of the top asphalt layers.

12. Preparation of the driving surfaces that are very rough is done with brushes, air cleaning or washing. Very smooth surfaces, worn surfaces of concrete or asphalt must be previously stabilized by surface grinding or impregnated.

13. The minimum thickness of the dry layer of the slim-layered signs/markings is for longitudinal lines 0.200 mm (to 4000 vehicles/day) and 0.250 mm (above 4000 vehicles/day) and for across going markings and signs (lines) 0.250 mm (to 4000 vehicles /day) and 0.300 mm (above 4000 vehicles/day).

14. In case that more than 10% of the surface under the signs/markings – traffic lines has a layer below the minim defined thickness, these layers of paint must be repaired, i.e. redone.

15. Equipment must enable application of reflecting balls by spraying, which contributes the visibility of the lines and signs at night, but also contributes their life span. If paint mixed with glass balls is used, a surface application of balls onto the just applied layer must be done.

16. The signs and lines on the driving surfaces must be done in accordance with the project design and in compliance with vertical traffic signalization.

17. Works on setting up the horizontal traffic lines and signs consists of: purchase and transport of adequate paint and other material, preparation of the underground for application of the paint, application of paint and insurances of the drying period.

18. Payment is done based on unit of paint (markings) applied in accordance with the standards and project design, as per contract price for these items.

5. LAYING HUMUS ONTO THE EMBANKMENT, SLOPES AND THE PATH DIVISION STRIP

5.1 Description

On the slopes of the cuts and the embankment and in the strip dividing the pedestrian from the cycling path preparation works for brining in of the humus layer have to be done. The layer under the shoulders must be brought to the required elevation and then the humus layer installed in a thickness defined by the project design, after which it is leveled and compacted at site.

5.2 Construction works

The humus layer to be installed immediately after completion of the embankment of the cut through. Prior to the installation of the humus layer, for achievement of stability, the following basic requirements must be met:

- Surface water from the intake hinterland must be accepted in a controlled way and properly managed/directed away
- Slopes of the embankments, especially the cut through must be roughly leveled so that connection to the vegetative protection is insured
- After completed installation and processing of the humus layer, grass must be seeded.

Deviations of completed elevations in respect of the final surface of the embankment top are ±1cm in regard to the designed surface from the project designs.

For filling in and installing of the humus layer, material from a borrowing site to be used. Humus must be used that guarantees stability and durability of plant life. Seeding of a lawn in humus to be done in accordance with the Landscaping project design.

5.3 Approval of works

Acceptance of completed works will be done by the supervising engineer based on the defined quality terms and these regulations. Quantities for calculation of works are defined based on m2 of really performed works within the project design for this item.

II. HYDRO-TECHNICAL WORKS IN THE EMBANKMENT CORRIDOR

1. INTRODUCTION

Here we speak of the hydro-technical installations (water and fecal sewerage) within the promenade object with the cycling and pedestrian path and all other accompanying facilities and river bank reinforcements, i.e. the water protection area along the right river bank of Tara, section Strelički krš to the bridge over river Tara.
Of existing installations near the construction site, lies the city water pipeline PEHD DN110, at the existing Sports hall.

1.1. PROTECTION OF EMBANKMENT AGAINST RIVER FLOODS OF THE TARA

1.1.1 Protection of the right river bank at Strelički krš

The protection of the river bank must be done sufficiently, by placing anchoring trees with bigger treetops along the right river bank and forming a proper slope of this bank. The current river bank is very steep and consists of lose material, so that wetting of this area is sufficient to break away particles and the bank simply falls off.

The excavated soil from shaping of the slopes is to be filled onto the set trees.
The trees to be planted from down-flow towards upper–flow side, turning the branches downstream. Up stream, the next tree covers the branches of the tree down-stream. The trees are connected with each other with steel ropes.

The anchoring of trees is done with reinforced concrete anchoring blocks, dimensions 60x60x60cm, onto which the trees are attached with ropes.

The length of river bank to be temporarily protected in such a way is approx. 50 meters.

1.1.2 Protection of the slopes of embankment towards the water flows

The solution that gives a good protection of the embankment slope is the setting up of a row of gabions – wired cages along the bottom of the slope towards the water flow.

Gabions of dimensions 100x100x300 cm. The cages will be sufficiently reinforced on the edges, so that a proper structure can be established. The gabions will be filled with crushed stone, whereas this stone is nicely laid on the visible sides to create the impression of a constructed stone wall.

Behind the gabions – cages is a humus layer that will be planted accordingly.

1.2. WATER PIPES

For the supply of the designed objects, toilet and public fountain, a pipeline of diameter Ø100mm, with a length of 1416.0m is planned, laid on the left side, towards the Tara river, immediately at the cycling path.

The connection between the newly designed and the existing PEHD DN110 pipeline will be done through a joint/connection C8. Also, in connection point C7-I1 another connection to the existing pipeline PEHD DN63 is planned.

Speaking of objects along the water pipes, connection points are planned for these – the toilet and public fountain- through secondary pipelines of diameter O20 and O50. Water meters will be installed at these connection points type R 1“ for measuring the water consumption in the future catering objects. In the connection points C2, C3, C4 and C5 fitting pieces will be installed for future development and expansion of the water pipe grid.

Two air valves are planned in this pipe section and one outlet at the horizontal breaking point of the plane elevation levels.

It is planned to install five above ground hydrants for firefighting vehicles and firefighting actions.

The material of the planned pipes is polyethylene of high density, class 100 for operational pressures of 10 bar (PEHD PE100 Pn 10bar).

1.3. FECAL SEWERAGE

Fort sewage of waste water from the planned objects, a fecal sewerage is planned, of a diameter Ø200, which is laid in the green division strip between the cycling and pedestrian paths.

The material of the sewage pipes and collector of waste waters is PVC, class Sn4.

The basic properties of this main waste water collector DN200 are:

- a length of approx. 888,0 m;
- pipe profile PVC DN 200 mm, load bearing Sn4
- longitudinal inclination of pipeline i=5.0‰.

Along this waste water collector a total of 33 revision shafts are planned, the pattern of which is conditioned with technical criteria of maintenance and connection of individual objects onto this network.

For each revision shaft the inlet elevation is defined and the elevation of the bottom of the connecting pipe.

Circular revision shafts will be constructed along the sewerage, their body made of reinforced concrete pipes of a diameter O1000. Circular lids will close these shafts, with a joint connection between the lid and the frame.

2. TECHNICAL TERMS FOR CONSTRUCTION WORKS

2.1 Preliminary, preparation and final works

The contractor must organize the site in such a way that access is enabled to the location, but at the time traffic may not be obstructed if possible.

Prior to the beginning of the works, the wider area must be marked, then cleaned of all obstructing elements. All material from the subject route corridor, shrubs and other small plants to be removed and disposed at a designated landfill. When the area is cleaned and prepared, the contractor will mark the profiles of the designed route corridor in presence of the supervising engineer with wooden pegs or paint on asphalt and concrete surfaces. On this a protocol will be drafted. After this and if defined by bill of quantities, manual excavation works on narrow trenches will start across towards the axis of the pipeline, to define the exact location of existing installations.

2.2 Excavation works

After marking of the designed route corridor, the asphalt and concrete surfaces must first be cut mechanically and then broken off. En to be done mechanically or manually, depending on possibilities, type of ground and surface and the vicinity of other installations. All excavation works must be done to elevation points defined by project design and the elevations will be checked and approved in writing in the construction works log book by the supervising engineer.

All data that won't be available at a later point in time must be presented in sketches, profiles and sufficient elevation points entered into the log book and land survey situation of the area, all to be verified by the supervising engineer in the "as built" project design. The sides of the excavated zones must be cut in a straight line, either vertical or in a lope; the bottom must be leveled at designed elevations with an accuracy of + 3 cm. All potential supports, subsequent supports, pumping of ground or surface waters, heavy working conditions (obstructions by ground or above ground installations, roots and similar) are all included in the unit price of this item. Performed work and used material on insurance of adjacent buildings is not charged separately but is already contained in the unit price of excavation works.

Excavated material to be disposed at a designated landfill or deposited along the trench, at sufficient distance so that communication is enabled through all phases of installation and testing of the pipeline. Calculation based on m3 of excavated material includes: all work, material, machinery, transport, potential support structures, marking of objects, survey for calculation of quantities, pumping of precipitation or ground waters, proper cutting of the side walls of trench, leveling of the bottom at an accuracy of +-3cm, loading, transport, eventually basic leveling of the surrounding area and tidying of the landfill and other works from this description and works necessary to complete this item of excavation works.

2.2.1 Procedure of making the bedding layer and filling up of the trench

On the leveled trench surface a bedding of fine sand, fractions 0-4mm is applied at a minimum thickness of 10 cm, so that the pipes can be laid on top of it. After the pipes are mounted, fine sand is filled in around and on top of the pipes (fraction 0-4 mm). Even the trench is filled with this fine sand; the pipes should not be covered by sand in their overall

length until they are tested onto operational pressure. This means that initially 2/3 of the laid pipes are covered with this sand, all connecting points/joints must remain freely accessible.

After successful pressure test and after land survey measurements for the cadastre map of underground installations, the joints are covered with a protective layer of sand, with mandatory compacting. If not differently defined by design, the thickness of this protective layer is minimum 10 cm.

Further filling of the trench is then done with material that was originally excavated or a tampon in layers of up to 30 cm thickness. After installation of each individual layer, the trench is compacted with a vibrating plate up to the demanded density/compactness level.

2.2.2 Quality control

Each layer installed into the trench must be compacted to designed value. The compactness is defined by the density module Ms, as presented in JUS M.B1.046. The place and number of control tests is defined by project design. When constructing underground installations on existing roads and surfaces, where no reconstruction of the top layer is planned, the following conditions must be met at leveled elevation point of the lower layers:

I under traffic surfaces
a) minimum required compactness 95% (see JUS U.B1.038) or
b) minimum required module of density Ms=350N/mm2 (see JUS U.B1.046)

II under pedestrian paths and green areas:
a) minimum required compactness 92% or
b) minimum required module of density Ms=250N/mm2

2.3 Concrete blocks

Basic contents (aggregate, water and cement) must comply with JUS standard for composition of concretes type MB 10 to MB 30. The concrete must comply with the basic requirements of this norm. A special requirement is compactness and frost resistance. In principle, all concrete must be poured mechanically, based on previously established, good work organization. Nourishment and maintenance of concrete to be done at least 7 days from the date of pouring based on adequate provisions.

The chosen type of cement will not be changed without previous approval of the supervising engineer. Copies of the cement plant certificates must be submitted in time for each batch and delivery of cement.

The aggregate must be hard, strong, stable and clean – washed gravel or crushed stone containing a maximum of 0,5% weight of flat, elongated and crushed particles. All fractions have to be presented in defined proportions. Water used must be of drinking quality, clean, free of oil and grease, acids or damaging quantities of organic substances. Basically, only water from the city water line may be used. Storage of cement, aggregate (fine, especially bigger fractions) must be done in accordance with regulations on protection of stone aggregates against humidity, dust, mud and organic materials. The quality test of poured in concrete is done successively, during the installation of the concrete. The analysis of the test samples must be done by a verified institution that is selected based on approval and consent by the supervising engineer. Three sample cubes for testing the concrete quality will be taken from each 20m3 of installed concrete, for each type of concrete. The cubes must be marked with the date of production, a number and mark of the sample and the place of installation. The strength test and pressure tests on such sample cubes to be done after 7 and 28 days of the date of installation.

When installing the concrete, special care must be given to the prevention of segregation of concrete and also prevention that the free fall of concrete when poured is less than 2 meters. The speed of concrete pouring must be adjusted in such a way that at any given moment the concrete remains plastic. Concrete that is only partially bound or contains unwanted substances may not be installed. The pouring of concrete must be done with usage of mechanical vibrating machines. The measure tolerance in production of concrete elements may be a maximum of +/-1 cm.

Concrete objects during the construction of water distribution pipelines and pipeline networks are the foundations of revision shafts, mud outlets, blocks for support of pipes and similar elements.

Calculation and payment will be done based on 1m3 poured in concrete of a certain type into a certain objects – element of the water supply network, all based on descriptions from the bill of quantities. Unit price includes the making, setting up and removal of necessary formworks and all other works and costs that are usual for the construction of such objects – elements and which may not have been specified in the bill of quantities.

2.4 Installation of pipeline

The construction and installation of all parts of this item must be completely done in accordance with the project design. Any deviation from the design is allowed only after previous, written approval by the designer. All changes must be properly evidenced.

The used and installed materials, equipment, fittings etc. must comply with valid technical regulations and terms from the Contract, so that the contractor carries all costs caused by non-compliance with these terms and provisions.

2.4.1 High density, polyethylene pipes PEHD

2.4.1.1 Production of pipes

The pipes are made of polyethylene, in a quality complying with JUS-G.C1.300. The pipe quality is controlled in accordance with requirements contained in JUS G.C6.601, JUS G.C6.602, JUS G.C6.500, JUS G.S3.502. and JUS G.S3.501.

2.4.1.2 Transport

Polyethylene is a very elastic and tough material. Despite this, the pipes must be handled very carefully, since they are softer than metal and damages are possible.

2.4.1.3 Storage

Pipes are stored in the open. For storage over one year, the pipes must be protected against sun. All pipe ends must be closed to prevent penetration of impurities and the pipes must not be stored near sources of heat or fuel, or near heated spaces. Any contact with acids, paint or similar substances must be prevented.

2.4.1.4 Installation of pipes

Polyethylene pipes may be laid into, onto and above the ground, as well as under water (se details in JUS G.C6.605.).

For installation of these pipes into the ground, the trench depth must be 0,8 to 1,0 meters, depending on the ground properties. When crossing over traffic surfaces or water flows, the depth of the pipe trench must be adjusted accordingly and additional, protective pipes casings must be used.

The pipes should not be installed at temperatures of around 0ºC.

If the outside temperatures are near to 0ºC, pipes are straightened from their transportation rolls by heating with air up to 100ºC.

The pipe trench must be 50-60 cm wider than the pipes diameter. Pipes are never laid onto a layer of stones; they must always be placed onto a sand bedding of 10-15 cm thickness.

The linear heat expansion coefficient of polyethylene must be taken into consideration (2 x10-4/K). This is why the pipes are loosely installed into the trench.

IN case of changes in routes directions, the minimum permitted diameters for bending of such pipes must be taken into account for various temperature ranges.

Pipes laid into a trench are covered by sand or fine material without any rocks, to a height of 30 – 40 cm above the upper pipe ridge. The filled in material must be properly compacted to fill all hollows and cavities around the pipes.

The pipe joints to be covered with material only after successful pressure test of the pipes are completed.

2.4.1.5 Connecting polyethylene pipes

Polyethylene pipes can be connected in accordance with JUS-G.C6.605.

2.5 Testing the installed pipes on pressure

The pressure test of installed pipes is limited in time and based on it the accuracy of the installation of the pipes is tested, whereas the test enables to detect any faults or damages during transport and installation of pipes.

2.5.1 Test preparation

2.5.1.1 Definition of test section length

The maximum length of the tested pipe section should not exceed 500 meters. IN case of significant inclined sections, such portions must be used that at least in the highest point the operational pressure is accomplished. At the lowest pipeline point the test pressure must be at least 1,5 x the operational pressure.

2.5.1.2 Supports and anchoring

At the ends of each section the pipes must be supported, i.e. the pipeline must be properly supported before it is filled with water. Sharp bends, ends, joints and fittings must be supported with concrete anchors already during the installation of the pipes.

Supports at the ends of sections are removed only after complete depressurization of the pipeline.

2.5.1.3 Filling the pipes with water

The pipes must be filled with clean water in order to remove possible remaining air completely from the pipes. This is very important for pipelines laid onto a configured ground, where the pipeline goes up and down – hill, since the air in the pipe during pressure test with water, negatively impacts the flow and results of the test.

2.5.1.4 Pressure measurement

For pressure measurement previously checked manometers must be used with a pressure scale enabling measurement accuracy of 0,1 kp/cm2.

At the lowest point of the tested pipes section, i.e. pipeline, a control manometer will be mounted, while the main manometer is to be placed near the testing pump.

During the pressure test, the contractor must have an available team of installation experts at site and the test must be attended by all authorized persons who will sign the test protocol.

During the test all other works in the tested section trench are prohibited, i.e. any works on the subject pipeline due to safety reasons.

2.5.1.5 Preliminary test

After the pipeline is completely or only a section of it, filled with water, it needs to be placed under operating pressure, at the air valves, and air must be released if any remained in the pipeline. The decreased pressure due to air release must be increased again onto operating pressure of the pipeline. All joints must be checked and possible damages or faults remedied, whereas the preliminary test must be repeated. The duration of the preliminary pressure test is 12 hours. Every 2 hours the preliminary pressure is increased onto the operating pressure.

Maximum allowed temperature for pressure testing is 20oC.

Since the volume of the pipes under pressure expands during the first 12 hours of pressurized pipeline, water needs to be added accordingly.

2.5.2 Testing

2.5.2.1 Test pressures

Depending on what we use to test the pipeline, i.e. what test method is applied, we also have required test pressures:

If testing with air or air under water the test pressure is pi = 0,6p

At water tests the test pressure is pi = 1,5p

Here p = operating pressure

At air tests it is considered that the pipeline seals if the test pressure remains constant at least for 1 minute.

At tests with air, under water the pipeline seals if the test pressure remains constant at least for 2 minutes and that no air bubbles emerge in the water.

2.6 Cleaning, disinfecting and flushing the pipeline

All objects of the water pipes system must be disinfected prior to usage. During the constriction works the contractor must maintain clean insides of the pipes and equipment.

Prior to the disinfection and flushing of parts of the water pipe system, the authorized person of the city sanitary department must be informed about the time of these works.

In order to simplify the flushing and disinfection of the water pipes and still to maintain efficiency, it is necessary that all parts built into the system are clean as possible (from pipes, joints, fittings…) and that during the installation of these elements all measures are taken to prevent impurities entering into the pipes system and subsequently the water.

The concentration, quantity and time of keeping the chloride solution in the pipes, tanks and similar is defined by the authorized representative of the city sanitary department.

2.6.1 Flushing

The flushing of the water supply pipes is done after completed pressure test. Exclusively drinking water may be used for this flushing. Efficient flushing of the pipes may be achieved only if the water flow speed is min. 1,5 m/sec. The method of flushing depends on number of outlets from the pipe. If the pipes are laid downhill, the flushing starts always from the higher positioned point.

Flushing is done until clean water is flowing through the outlet. If clean water appears at the outlet within 20 minutes from the beginning of the flushing, then the flushing must continue so long that the water flushed through the pipes reaches the defined volume of water for flushing operations.

2.6.2 Disinfection

To successfully perform pipeline disinfection, the water with defined content of chloride must remain for a certain time in the pipes, chambers, tanks etc., i.e. 24 hours.

Flushing and disinfection of the water pipeline system is done exclusively in accordance with the valid sanitary regulations and under mandatory presence of a qualified and authorized representative of the city sanitary department.

The doses of chloride should be within the limits of allowed concentration. In each individual case this doses of chloride is legally defined.

The minimum duration of the disinfection procedure is 30-60 minutes. Parts of the network that are not disinfected must be separated from the network.

A protocol is kept on adding chloride into the water and this protocol is to be verified by the authorized person that controlled the disinfection procedure.

2.6.3 Flushing

After expiration of the time defined for successful disinfection, the pipes and system is flushed with drinking water, treated with chloride, coming from the water supply network of the city. Flushing to be done so long until the chloride content in the water doesn't drop below 1 mg/lit. After completed disinfection and flushing the water pipes are ready for usage.

2.7 Delivery and installation of PVC sewage pipes

2.7.1 Production of pipes

The pipes are made of PVC, the quality of which is defined by JUS-G.C6.502. The quality of the pipes in respect of stability and durability is controlled based on JUS - G.C6.503.

2.7.2 Transport of pipes

PVC is a tough, sturdy material. Along with this they need to be transported and handled carefully, since damages are possible.

2.7.3 Installation of pipes

The trench bottom is to be excavated in the designed line and elevation. The pipes must firmly lean against the 10 cm filled in fine sand bedding. The pipe must be over the entire width of the trench with layers of fine sand. The pipe is covered with fine material from the excavations in a layer of 30 cm thickness above the upper pipe ridge.

Compacting of layers is done manually. Mechanical compacting is allowed if layers are thicker than 30 cm. The minim thickness of the layer above the upper pipe ridge is 100 cm.

In case of changes in the route of the pipes, the minimum bending radius of the pipes must be taken into consideration. This radius is equal to the 300x nominal diameter of the pipes.

2.7.4 Connecting the pipes

The pipes are connected with an insertion pocket system and rubber sealing ring.
Pipes of diameter DN110 to DN200 use rings made of synthetic natural rubber marked GP.

Before the usage, i.e. installation of the pipes and the outside parts, the inner surface of the insertion pockets must be cleaned, as well as the sealing ring. The ends of the pipe are coated with a lubricant and then inserted with slow turning to the end of the pocket. Some pipes have prefabricated depths of insertion.

2.7.5 Processing of pipes

The pipes may be cut with a fine saw blade, in order to get a clean cut.
After removal of the cut off part, the edges of the cut must be ground. The angle of grinding the edges is some 15º.

2.7.6 Connections onto shafts

Since PVC pipes are not connected onto concrete and mortar, in order to establish a water tight connection between the pipe and the concrete, i.e. the shaft, an insert must be made.

The groove of the insert is given a rubber seal that creates the water tight connection. The end of the pipe inserted into the connect ion insert is lubricated for easier mounting.

2.8 Hydraulic testing of the sewerage system

After construction a sewerage network, the network must be tested to check the quality of the works.

The testing of the pipeline of the sewerage is done prior covering of the pipes in the trench. In ground with high ground water levels, the test is done by measuring the quantity of water penetrating the pipes at the overflow that is set into the trench at the downstream shaft.

When the ground is dry, the test measurement can be done in two ways. First method is to test two neighboring sections for three revision shafts. At the end shafts the network is closed and through the medium shaft the pipes are filled with water at defined level. Now the joints are checked for water tightness and maintaining a constant water level in the shaft over a period of 30 minutes.

3. INSTALLATION OF GABIONS

The mounting of gabions and Reno mattresses must be done in accordance with these Technical terms and instructions of the manufacturer.

3.1 Procedure

3.1.1 Gabions filled at site

- The gabions are opened and laid onto a hard surface
- The front, back and side walls and the diaphragm are lifted into upright position to form a basket
- The upper edges are secured with thick wire. The edges to be connected with metal rings or strong wire, starting from the top downwards. Rings are placed at distances of 20 cm, manually or with pneumatic stapler SC-50.
- The gabions are placed in a row, onto an even surface and all baskets are now connected before being filled with material (same way as above). The principle is that at least one gabion is empty in front of the one being filled with rocks.
- The gabions are filled with rocks, 50 – 75 mm above the top cage level to allow settling based on own weight.

- If necessary for aesthetic or other reasons, the gabions may be filled under tension. The gabions are tensed with loads distributed over the entire upper panel of the gabion, connected to the first cell that is anchored in position.
- Gabions with exposed fronts are filled 2/3 of the height, where at every third a cross reinforcement with wire is applied
- After filling, the cover is closed and fixated along all edges with the diaphragm, rings or wire.
- It is mandatory to connect every gabion basket to the adjacent one at all contact surfaces.

3.1.2 Pre-filled gabions

- Gabions are made in the above described way, but with a double loop. It is recommended to make another, little bigger frame in which the empty element can expand.
- After filling, the horizontal ends of the net at the top are cut off and reinforced with steel bars of 20 mm diameter if demanded, to maintain the shape when lifting a full element. After positioning the steel bars to be removed.
- Lifting of elements of a weight up to 3,6 t/m3 is done with a special frame and lifting ropes

3.1.3 Filling of mattress at site

- The mattresses are laid and set up on a hard underground
- The side walls and diaphragms are lifted into upright position and connected
- The mattresses are placed into final position and connected to the adjacent elements at all contact surfaces
- Each compartment is filled with stone, starting from the bottom of the slope upwards, until all are completely full
- After filling, the cover is placed into position, then connected to the side walls of the diaphragm at the contact edges.

III. ILLUMINATION OF THE PROMENADE

1. TECHNICAL DESCRIPTION

1.1 selection of equipment and adequate input parameters

For the promenade along the right river bank of Tara it was found that lamp-posts with pre-connecting devices , positioned on 4,5 meters high posts and a distance between the lampposts as given in the drawings completely satisfies the needs. Because of the location of this object and the promenade length, an average distance of 20 met between the lampposts has been defined.

The lamps and posts are marked with numbers on the drawings.

1.1.1 Technical specifications of lamps

The technical specifications of the lamps are given in the project designs, with a photometric calculation.

1.1.2 Post – support of lamp

For the post, a post has been chosen that is similar to one attached to project design. The post has a height of 4,5 meters, without the lira.

The concrete post foundation is dimensions 0.6 x 0.6 x 0.6 m, made of concrete type MB20. Together with the posts the anchors with screws must be ordered. Plastic pipes are installed into the posts foundation of a diameter Ø 63 mm, for the power supply cables.

At 1,2 m from the post bottom a latch is installed for installation of the connecting/wiring plate with fuses. This space is closed by a lid, preventing access by non-authorized persons and also protects the electric installation against dust, weather and rain.

A winding lies at the bottom of the post, as connection to the potential equalization (earthing) strip.

The cable inlet into the post is done through plastic pipes Ø 63 mm, installed into the foundation of the post, before the foundation is poured. Plastic pipes are installed in such a way that their straight, even parts is parallel to the traffic road and the pipes are at an angle of 45 degrees towards the vertical. On each post up to two pipes and in posts in which the cable is manifolded, three pipes Ø 63 mm to be installed.

Before the post foundations are made, the locations of the posts must be precisely marked based on drawings attached to the project design and if there are no justified reasons for any relocation. Any change in the distribution pattern of the posts must be previously approved by the supervising engineer and investor. All posts are vertical.

The verticality of the posts must be checked from two normal straights. The post must be protected against corrosion and after two basic paint layers; two coatings of finish paint must be applied (aluminum bronze).

The measurement sketch of the post with foundation is part of the project design.

1.3 Installations in the posts

In the lower part of the posts a so called connecting plate is installed, which is made of epoxy resin, for connecting the supply cables, at the “incoming – outgoing” principle and the insulated conductors for the wiring with the lamp.

The plates have input connectors on side for the supply cable, above them input opening for fuses, i.e. connection with the lamp. The connection between these inputs is brazed on all connection points.

Technical specification of the connecting plate:
- nominal voltage 0,6 kV
- test voltage 50 Hz 3,0 kV
- thermal class of insulation E
- maximum fuse current FRA - 16 A

The connection plate will be equipped with one fuse FRA 16/4A (for the bulb). A conducting cable type PP00 3x2,5 mm2 is used for connecting the plate with the lamp. The location of the posts and the range of designed illumination are presented on the drawing and make some 36 meters.

1.4 Illumination and power supply systems

The project design defines a three-phase system of power supply for the designed illumination equipment (every third lamp). In such a system the lamps are equally and inter-changeably distributed on all three phases.

It is designed that the existing MBTS 10/0,4 kV “Sportski centar” is expanded with a new field of outdoor illumination that will contain the equipment that is necessary for supply and measurement of electricity for this system of outdoor illumination.

1.5 Supply cable network

As supply cable for the connecting plates in the posts, a cable type PP 00A 4x35 0,6/1kV is used, based on in/out principle.

The power cable PP 00A 4x35 0,6/1 kV has a soft aluminum conductor, with a seamless PVC insulation. The core of the cable consists of wires and a layer of non vulcanized rubber, while the cable casing is a seamless PVC pipe in black color.

The supply cable will be laid freely in a trench, except in sections where it crosses beneath the road, where the cable will. Be pulled through a PVC cable protector ∅ 110 mm.

The dimensions of the cable trench are 0,45 x 0,80 m. The bottom of the trench must be even. At this free cable laying, first a layer of sand is distributed over the trench bottom, in a thickness of 10 cm, then the cable is laid atop of it. The cable is laid freely, without any tension, with mild curving (amplitude of curves some 10 cm) for compensation of temperature impact and slight settling of the underground.

Prior to laying of the cable, the posts foundations must be poured and then the cable pulled through the pipes in the foundations, leaving sufficient cable length for connection onto the plate in the post. The cable may never, without proper preparation measures, be laid at temperatures below + 5 °C. When bending the cable the minimum permitted radius must be taken into account. The supply cables to be laid without any cable connectors.

At sections where the cable passes below the street/road, the cable must be laid in protective cable pipes, made of PVC, ∅ 110 mm. For this purpose, along the entire cable trench a sand layer of 10 cm thickness is installed (for pipe connections rubber rings must be used). At all crossing points four cable pipes must be laid (reserve) with distancers at every 1,50 meters.

Now another layer of sand is laid onto the pipes and must cover theses for 10 cm. Now remaining layers are filled into the trench, with compacting.

After laying the cable and before it is covered in the trench, the exact location of the cable must be recorded, including the position of the lampposts for the draft of the cadastre map of installations, which is legally mandatory.

The filling of the trench in which the cable is loosely installed is first done with a layer of sand of some 10 cm thickness, then Gal- protectors are installed (l = 1,0 m) or a similar protection for the cable.

The protectors are placed along the entire length of the cable (except parts where the cable is laid in the cable canalization), so that the protectors overlap in length some 10 cm, covering the cable completely.

The remaining material for filling of the trench is the material from the excavation works , which is installed in layers of 20 cm, manually compacted (a compactness of over 92% must be achieved), while bigger pieces must be removed from the material.

After laying a first layer, a galvanized steel strip is laid Fe/Zn 25x4 mm and connected to the strips Fe/Zn 25x4 mm that are already pulled through the post foundations and connected to the earthing of the supplying TS (transformer station). This connection is done with pieces of this strip “strip on strip” (JUS N.B4.936). Connection between the posts and the strip - strip Fe/Zn 25x4 mm in the trench must be done properly, over full strip surface. The strip is laid flat in the trench.

When filling the trench care must be taken that the material filled around the strip has bigger humus content, for decrease of specific ground resistance. After the second layer of excavated material is placed into the trench, along the entire length of the cable, a tape is laid

with a warning that beneath a power line (low voltage cable) is positioned. The tape should be plastic (same lifespan as the cable), red color and adequate inscription.

After the trench is filled up completely, the site must be cleaned and excess material disposed at a landfill (the bill item contains a disposal to a landfill of up to 3,0 km distance), a mark indicating the cable route is to be mounted and all damaged or disturbed surfaces must be brought into their original status. The mark is to be a brass plate, mounted onto a concrete, irregular tube. It contains data on voltage and position of cable, places of direction changes or crossings of the supply cable with other cables and other underground installations and all other positions the supervisory engineer deems necessary.

Since there is not cadastre map of existing underground installations and not knowing the depth in which these cables are laid along the route of the supply cables, the project design doesn't show any possible crossings or parallel cable or other installation routes, but only rules are given the contractor must comply with if such installations are found:

- parallel laying of two or more low-voltage cables in same trench, their minimum distance must be 7 cm;

- parallel lasing of a low and high voltage cable in same trench – a minimum distance of 20 cm must be established plus a division with bricks (set upright) or another insulation material must be insured;

-it is prohibited to lay parallel low voltage cables and telecommunication cables, except if these have a horizontal distance of at least 0,50 met. In case of crossing of these cables, it must be under a right angle, but not less than 45 degrees. At the crossing of cables, the power cable is always under the telecommunication cable, at a distance of 0,50 met.

- it is not permitted to lay the low voltage cable under or above a water or sewage pipeline, except if the established distance is at least 0,50 met. When crossing, the cable must be adjusted in position to the position of the water (sewage) pipe, with a distance of at least 0,3 met.

The route of the supply cable and the distribution of the lampposts is presented in the installation plans of illumination.

1.6 Protection

Protection against high voltage contact is established through a system of mutual earthing (potential equalization). This system is established by direct connecting of the protective earthing of the lampposts (strip Fe/Zn 25 x 4 mm) with operating earthing of the transformer station.

The resistance of operating earthing of the TS is below 2 ohm. The real resistance will be significantly lower, when taking into consideration the earthing of the lampposts that is connected with the strip to the TS.

At the outlet in the cabinet of the public illumination fuses of 25A to be used.
At the connection plate PP-3 in the post, one or two melting fuses type FRA 16/4A to be mounted.

2. TECHNICAL CONDITIONS

2.1 Introduction

2.1.1 List of applicable standards and technical regulations

- Regulation on technical norms for electric LV installations (National Gazette SFRY No.53/88)
-Yugoslav standards – Electric installations in buildings – safety requirements JUS N.B2.741/1989
- International recommendations for illumination of traffic roads (CIE 115)

- Regulation on technical norms for protection of LV grids and transformer stations (National Gazette SFRY No.13/78) an d supplement to the Regulation (NG SFRY 37/95).
- Law on fire prevention ("NG Montenegro 47/92) ,
- Law on spatial development and construction (NG Montenegro 51/08)
- General conditions for power distribution (NG Montenegro 1/90) and other technical regulations and recommendations for standardization of distributive network elements

2.2 Defined protection measures

For exact definition of location and the way the existing underground installations are laid, the contractor will in presence of a representative of the department in charge for the individual subject – existing installation first undertake some test excavations of trenches. At such locations these trenches must be excavated manually, with all safety measures applied. Especially the existence of 10KV cables at the site are emphasized, which must be taken into consideration.

After completion of the works, the laid installation must be checked and tested and professional opinions obtained by an authorized body.

By linking and connecting all lampposts in the illumination installation with the galvanized steel strip Fe/Zn 25x4 mm, the installation is protected against atmospheric discharge.

The supplier of the posts must deliver evidence that the posts (with lamps) can withstand a wind speed of 90 daN/m2.

2.3 Technical conditions for the realization of the project

The illumination installation is to be constructed based on Law on construction (NG Montenegro 51/08), as well as in accordance with the technical regulations, standards and provisions.

Supply cables must be laid without any cable connectors – in one piece. The installation of individual elements of the designed installation for public illumination must be done in accordance with the technical description and the preliminary measurements of the works from the Bill, attached drawings and instructions of manufacturers.

All equipment and materials that are used and mounted must comply with standards (JUS) valid for the type of equipment, i.e. material.

When performing the works, the contractor must take care not to cause damages to existing underground installations or other objects. The contractor must, after completion of the works, to bring all disturbed, changed or damaged objects into their original condition (concrete surfaces due to excavation works for cable trench and cable canalization).

The contractor is obligated to organize the testing of the installation he installed and its commissioning into operation. For this purpose labor and adequate tools must be secured.

After completion of the construction works, the investor must demand from the authorized body a technical inspection of the completed works – installations in order to get the usage and operation permission. Without such operation permission the object may not be introduced into operation and putting the installation under voltage is allowed only during the test and the technical inspection.

IV. LANDSCAPING

1. GENERAL

1.1 Climate characteristics

Based on data published from the meteo-station Kolašin it can be said that in Tara river valley, where the city Kolasin is located has a moderate continental climate.

Snowfall is frequent in the region of Kolašin. The average annual is 77 days with snow, from October to the end of May.

In January and February the snow remains in Kolašin longer than 21 days and very often all the days of these months are with snow. Almost half of March has snow (14,8 days) and almost as many days in December (11,4). The maximum number of days with snow is 120 days and a minimum is 37 days per year. Besides that the snow can be as thick as 150 cm.

1.3 Geological characteristics

In the central and southern parts of the area, there is mainly brown soil on flysch, eruptive and limestone. These soils are of different depth and different plant life, which also counts for rendzines.

Along the Tara river flow there is mainly alluvial and alluvial – coluvial or coluvial layers rich in humus.

2. TECHNICAL SOLUTION DESCRIPTION

The landscaping of the area in the complex of this project demands especially elevated green surfaces. At certain positions it is planned to set up benches and rest areas, with shades or out in the open for any time of year.

The spatial and functional design of free spaces fits with the conditions of the region, the ground and micro-climate.

The pedestrian and cycling paths are processed in the architectural design.

2.1 Description of planting

Application of the humus layer is the final step on landscaping the green areas within the designed complex. After leveling of the green surfaces, fertile, humus should be distributed. The material for the final completion of the free surfaces must be active humus, while 10 cm thick layers are planned to be distributed with a mixture of humus and 30% of fertilizer.

The plants must come from a tree nursery – properly developed, without damaged roots and top parts, without diseases. The plants to be taken from the tree nursery and transported just before planting to the site. If planting is not immediately possible, the material from the nursery must be properly stored. For all planting works only professional labor to be used.

2.2 Maintenance of the plants

After the green areas were planted, these surfaces need proper care and maintenance to help the plants to develop and adjust to the new environment.

During the warranty period the contractor is responsible for replacing plants that were improperly planted. On the other hand the investor is obligated for proper maintenance of the plants.

The warranty term for the landscaping works is one (1) year (one vegetative period), counting from the date of approval and handing over of the works and covers all damages and deficiencies emerging during this period.

2.3 Park furniture

The design defines porches, benches and waste baskets. Detailed processing and set up, as well as dimensions are contained in the architectural design.

2.4 Overview of plants for landscaping

Chrysanthemum sp.

Calla indica

Tulipa