

1. GENERAL TECHNICAL SPECIFICATION

1.1. The role of the technical conditions

The role of the technical specifications is to provide the quality execution of works according to technical regulations and standards. Because of that the contractor is obligated to follow them strictly and that all works that are object of this contract execute according to technical conditions.

Beside above mentioned technical conditions regulate the measuring and paying the executed works. Therefore the bidders are obligated to study technical conditions and design documentation before the defining unit prizes, and within the offered unit prizes involve all the expenses that are predicted to be included within unit prizes by technical conditions.

1.2. CONTENT OF THE TECHNICAL CONDITIONS

The technical conditions are applying mainly for all the position of works that are involved in bill of quantities. If the existing technical conditions could not be applied to some unpredicted works, it is necessary to define the annex of technical conditions.

Technical conditions contain specificities that are not involved by basic regulations, as well as law regulations, and have to be fulfilled for providing the necessary quality of the object.

The property-legal relations are not considered in these technical conditions. Contractor will accept the construction site by the day of introduction to property, which means that all the property-legal relations are solved.

1.3 CONDITIONS AT THE SITE

Before preparing the offer the contractor has to do site visit in order to have information about terrain, climate and other conditions, terrain characteristics, construction conditions, and other elements important for forming the real unit prizes.

It is necessary that contractor, before starting of works should be introduced with local conditions, regulations, access roads, possible landfills and other elements that related to smooth execution of works

Investor is obligated that for necessity of building up the temporary facilities as the shacks, storehouse etc., determine the most suitable locations in agreement with contractor.

Investor is obligated to provide to contractor the list of referent geodetic points and show their locations and to deliver in proper time the design documentation for construction.

Investor is not obligated to provide to contractor supply to infrastructure, electricity and water and the installation of the ecologically acceptable WC at the site. All of this is obligation of contractor during the site preparation.

Contractor is obligated to supply construction site with all necessary building material, tools, mechanization and other for works start on time and be finished according to time schedule.

The construction of the access roads, docks for mechanization access, material deposition as well as the temporary building will not be paid separately. It should be involved in the unit prizes in bill of quantities.

1.4. CHANGES OF TECHNICAL CONDITIONS

Technical conditions generally cannot be changed. Only in exceptional and necessary cases, site supervision can change the technical conditions, with agreement of designer and investor.

2. TECHNICAL CONDITIONS FOR WORKS

2.1. MARKING AND MEASURING

2.1.1. Marking during the construction

The marking of the lake, channel and ditches should be on basis design coordinates and elevations. The obligation of contractor is to provide, nearby the lake the permanent stabilized points for horizontal and vertical marking of object. The construction works should not disturb these points.

Before construction works, the marking of the area where all the works should be performed, placing of the necessary mechanization and equipment, depositions of materials. This location will be taken to contractor for temporary usage, and contractor cannot use any other location for construction works.

In special cases, if some other space outside of protected area will be occupied, it has to be marked as well.

Within the location it should be provided and continuously renewed the points that define as building lines or different as defined by supervision engineer. At any moment contractor can provide this points to be established.

Only supervision engineer, in agreement with designer can allow the deviation from the directions from design, and exclusively in order to adopt the technical solution to

field conditions.

The deviation should not make additional pollution or expropriation, and construction out of marked area. Without designer agreement the change of the elevation of lake, Chanel, road or embankment cannot be made.

According to type of works that should be done, the marking will be done in following manner.

- *Marking of the edges and directions of the lake borders, Chanel axis, road axis and embankment axis will be done by polygonal trawl placed along the lake and out of area of works and possible damage. That polygonal trawl should be constantly maintained and have to be controlled with two independent points of state network (trigonometric) and two points of state levelling.*
- Marking of the cross sections will be done on basis recorded cross section, as recalculated elevations and coordinates of excavation borders. The directions are defined by points on distance of maximum 50m and during the excavation should be marked either additional points on every 5 meters. On the last point of working area are noted the elevation of the point and distance of the slope edges from that point.

It is obligatory that during the construction all the points should be maintained. The point's maintenance is obligation of contractor.

Measuring by recording (a) temporary and permanent excavation profiles

(b) Elevations of earth filling (c) geometry of specific structures as riverbank, slopes, embankments or fences are valuable only if they are performed from fixed points and according to demand from supervision engineer.

2.2. EARTH WORKS

2.2.1. Types and amount of works

For construction works at lakes, channels and embankments the following works are dominant:

- (a) Excavations at water or half - dry conditions at like bed
- (b) Excavations at dry conditions
- (c) Shipment and transportation of excavated material
- (d) Placement of excavated material into embankment including its stabilization
- (e) Filling of the road embankment with gravel materials with compaction
- (f) Removal of surface humus and its placing over the agriculture surfaces
- (g) Stabilization of slopes of lake and embankments by construction of earth-gravel threshold
- (h) Cleaning from the bushes
- (i) Repair of the fence around the water source

The amount of works in this project is determined on basis of recorded profiles of terrain as well as detected facts obtained by terrain prospection and geotechnical investigation works and review the existing documentation.

Contractor is obligated to provide all the necessary building material, equipment and workers in order works to be executed completely according to these technical conditions and all other additions or changes that were given by supervision engineer during the works.

2.2.2. Clearing of terrain

Before start of the works, complete area with permission should be cleaned from forest, bushes, shrubs, and other vegetables. Stump will be cleaned or removed on another way.

The material obtained by cleaning the terrain will be burned or removed from the construction site, according to decision of supervision engineer.

The cost of the cleaning and all the similar works will be involved in unit prices of excavation offered in bill of quantities.

2.2.3. Protecting of the objects

In cases where the works are executed nearby the existing structures, contractor will make all the necessary protections

All the damages that happened from construction works, occurred from inadequate protecting of nearby structures, will be covered by contractor. All necessary repairs will be paid from contractor.

The prizes of protecting the part of the structures will be involved in unit prizes of excavations and will not be paid separately.

2.2.4.Excavations

2.2.4.1. Basic conditions related to excavations

All the operations that contractor wants to apply during the excavations have to be listed in the site organisation design and that have to be completed before the start of the excavations. The site organization design should be submitted to supervision engineer on confirmation at least 7 days before the planed start of the works. Material, equipment and workers, as well as the technology of the works, temporary and permanent earth fills for listed operation are necessary to be confirmed by supervision engineer. Supervision engineer can widened or deepen the predicted excavations, to modify the slopes of the excavation and to make every modification in purpose of maintaining quality of the excavations or construction materials.

The site organization design should include:

- (a) Locations of temporary depositions with transport plan
- (b) Measures for material classifications
- (c) Design of the temporary docks for transportation

- (d) Dynamical plan for construction with synchronization of works on lakes, channel embankment and road.

Contractor is obligated, before submitting the offer, to be introduced with terrain where the works will be executed, to read investigation works documentation, the degree of the vegetation overgrown.

And to make his own picture about heaviness of works that are offered and to check if necessary, conclusions of the investigation works and with full responsibility make the offer for execution of works.

Contractor is obligated to execute excavation and works after that continually, meaning to synchronize the works in order to avoid weathering, dispersion, chamfering and other degradation of the surfaces where the excavation is finished.

Supervision engineer can order from the contractor removing the damaged parts of surfaces of finished excavation and filling these parts with embankment materials.

Acceptance of the excavation is done after definite preparation of excavation surface with natural moisture, fresh compact conditions, after was removed all loose material. Acceptance of the excavation will be done parallel with geodetic recording of the surfaces of protected excavation, and contractor can't continue the works until he don't get written confirmation that excavations are accepted. Supervision can demand deepening or widening of excavation on locations where the dimensions or quality is not satisfied.

General tolerances for excavations, related to elevations from design and that are obligatory for contractors are ± 5 cm, in case if in design is not defined different value.

2.2.4.2. Classification of the excavation

If differently is not predicted in design by this conditions, excavated material will be measured and classified in the excavation till the borders shown on drawings predicted by this conditions determined from the supervision engineer.

Classification of the excavation will be done by mutually the supervision engineer and representative of contractor. It is remarked that any other additional prize will not be accepted because some material is wet. The excavation will be classified according to following:

- Excavation in sandy dusts/loess
- Excavation in sands
- Excavation in gravel materials

Excavation in sandy dusts/loess is classified as excavation in third category in dry conditions. Inclinations of temporary slopes (height till the 3 meters) can be vertical but only till the moment when slopes get wet. This material should be classified such to be used as final layer of the embankment.

Excavation in sands is classified as excavations in material of second category and mainly will be performed in dry conditions. Inclinations of temporary slopes can't be steeper than 1:2. If it happened that surfaces should immediately be seeded with some vegetation (grass) in order to protect the slope chamfering due to rainfall.

Excavation in gravel materials that are the deepest formation in which are works at the bottom of the lake. These excavations are classified as mainly third category, although on some locations where the chemical conjunction of gravel grain occurred, the excavations can be classified into fourth category.

Depending on if the conjunction occurred inclinations of temporary slopes in this materials for depths to 5m can't be steeper from 1:1.5, and immediate recommendation till the designed inclination is recommended.

Measuring and payment of excavation will be done till the excavation limits presented on drawings, limits determined by this conditions or the ones determined by supervision engineer.

If the excavation is going to be made in material that can be precisely excavated till the predicted borders and inclinations, the excavation should be done exactly till this borders and inclinations, that are reference for measurement and payment. Any excavation over predicted limits won't be accepted.

In case of occurrence the muds and muddy gravels, excavations can involve that materials in order to put on their places gravel materials (change of materials).

Measurement for payment will be done till the predicted borders and inclinations, and in cases of additional excavation due to unfavourable structure of the earth material, the amounts will be decided by supervision engineer and the measurement for payment will be done till the line of excavation parallel to determine borders and inclinations.

Payment of excavation will be done according to unit prizes on cubic meter offered by excavation for ordinary excavation. Unit prizes will involve the work of mechanization and workers, transport of the excavated material into embankment or deposition to location 500 m from the location of excavation, dewatering and drainage and all the other works necessary for maintaining excavation in good conditions during construction.

Equipment for this works are: all the types of the dredgers, graders and bulldozers for moving and shaping of the excavated masses.

2.2.5 Transport

All the contaminated material from the excavation, during the excavation should be sorted and transported on specially formed earthfill that will be determined by supervision engineer in the site organization design. The earthfill will be at distance less than 500m.

City of Trstenik has done in cooperation with Military of Serbia decontamination of water source

The method of destroying contaminated organic material that is removing and depositing is not objective of this project. Earthfill from contaminated material during the work has to be temporary covered with clayey compacted material- humus thickness of 20 cm with inclinations of 2% and grass.

Works on material transport include:

- Works on moving the earth mass into embankments, that can be done with dozers
- Works on moving the earth mass from excavation that need loading, transport, unloading and planning of the materials.
- Works on moving the earth mass to earthfills that beside the loading, transport, unloading, and planning of materials include the works on opening and closing the earthfill
- Works on procurement of rock material for stabilization thresholds, if necessary
- Works on maintaining the access roads and platforms from which the mechanization is operating and over which the transport machines are moving

Transport equipment for this work is all the track-kippers, lift- tracks, jammers, and dozer for moving and shaping the deposited masses.

Kilometre / cubic meter of transport is defined as cubic meter of excavated material transported on 1 km out of borders into which the transport is not paid, because it is included into unit prices.

That limit is 500m.

Measuring and payment of the transport will be done on basis of amounts and transport lengths no matter on method and equipment used for transport.

No matter on really passed length of the transport., the upper length of the transport will be distance measured along the main axis between normal projection on axis of the centre of the mass material into excavation, and normal projection on centre axis of the deposited material.

Material for installation into lake filters will be driven to construction site before start of the works. The construction site deposition areas have to be placed inside the water source, on location less than 500m from the installation location.

Transport of the material for forming of filters to the construction site is not paid separately. It is involved into offered unit price for installed material.

If the material is taken later on from the borrow places that are at distance bigger than 500m from the axis of the regulation, the length of the transport will be measured over the shortest possible path that will be determined by supervision engineer- from the centre of the mass of excavated material to the centre of the mass of filled material.

If the material is driven later on to the earth fill that is at distance bigger than 500m from the regulation axis, the length of the transportation will be measured along the shortest possible path that will be determined by supervision engineer- from the centre of the mass of excavated material to the centre of the mass of deposited

material.

During the measurement of the amounts of materials for the purposes of transport payment, the volume of material for transport will be measured into excavation. The length of the transport will be measured in units of 100m. The started unit is counted as completed. The payment of transport will be done according to offered unit prize for 1km/m³

2.2.6 Filling

2.2.6.1. General conditions

Supervision Engineer can make all necessary adjustment of fill, in order to make work suitable to real site conditions.

Tolerance for this work is +5cm from design geometry of fill.

If Contractor make deviation from designed geometry, more than proscribed above, he will correct all deviation at his own expense.

Contractor's obligation is to maintain geometry of all fills executed as designed, during construction works, until the handover of all works to the Investor. Contractor must rectify and bring to the designed state all changes or damages to the filling that might occur prior to the handover, at his own expense.

On demand of Supervision, Contractor must assist with his simple labor in "in site" testing and sampling of the soil. Contractor must not otherwise interfere with this tests.

Supervision can take samples for control testing of building materials at any time and from any place on site. Results of these tests are authoritative for Contractor. Decision on quality of works can be made by Supervision considering only these results.

2.2.6.2. Specification of fill works

This tender documentation will cover earth filling works as follows:

- Filling of filters in lakes with non-coherent material
- Filling of local Depos (landfills) with waste material
- Filling of the base of service roads with building material from excavation, site and base

2.2.6.3. Material from excavation for slopes and the embankment

For slopes and the embankment, all excavated materials can be used, according to the following conditions:

Body of embankment can be made from coarse gravel and sands, fill layer after static compaction is 25-50cm. If clay is mixed with gravel and sand, vibro compaction of

soil is necessary.

Edges and slopes of embankment, have to be done by smaller grain material, in fill layers no greater than 30cm with moisturizing of material until reaching of optimal moisture. Optimal moisture of fill material is necessary for maximum compaction results. Compaction must reach 90% of Proctor dry density.

Humus peat clean surface cover material from excavation will be used for grass base cover of slopes and embankment top. Manual compaction of this layer is recommended. After leveling top and slopes surfaces, plant grass on it. Watering of grass is to be done, until the first mowing.

Material from excavation for base of internal site roads

For base of roads, only gravel material must be used. Clay can be added up to 10% to gravel. Base is compacted above prepared sub-base soil.

Sub-base surface can be level with grader, extracting top humus layer. Road have to be tilted for 3-5% toward surrounding ground. $M_v \geq 15000 \text{ kN/m}^2$ is Modulus of compressibility at sub-base top. After preparation of sub-base, gravel in at least two layers will be statically compacted. First layer can be clay-gravel $D=30\text{cm}$, and second-final layer will be made from pure gravel, $D=20\text{cm}$. $M_v \geq 25000 \text{ kN/m}^2$ is Modulus of compressibility at top of road surface.

Price of works must include expenses for internal road maintain during works on site (included in lump sum of preparatory works).

2.2.7. Fill and embankment from aluvial materials (MA)

This is instruction for construction of compacted filter fill in lakes, made from alluvial material (M.A) as define on fig 1-3.

Origin

Alluvial material (M.A) can be extracted from river banks Z. Morava near Trstenik.

M.A for filters and drain construction, can be made from intact, pure and stabile to weathering river rock grains. No peat, clay or significant amount of splash or needle grains or debris is allowed.

Deposit of alluvial gravel and sand river banks can be use for borrow of alluvial materials.

Contractor must propose location for extraction of gravel and sand and must have a right of exploitation for it.

Detail investigation of borrow/open mine/ location

Contractor will perform soil investigation to classify M.A materials, and proof enough volume on propose borrow location.

Soil investigation will be conducted in borrow wells, at least 2 per 1ha area, as preparatory works, before any transport of material onto site. Places of borrow wells will propose Contractor, and be approved by Supervision.

Contractor will classify materials according to par. 2.6.8, based on granulometric/sedimentology tests, and determination of Atterberg limits of consistency, gain on soil samples taken at every 1m depth of each layer at borrow location.

To conduct that tests, Contractor will employ experience staff and necessary equipment.

Supervision have authority to conduct additional soil test, at any places on borrow location. Result of this test will be used to make decisions.

Site investigation of soil on borrow location, must finish at least 7 days before works on main site. On borrow location confirm reserves of quantity of all row material must be $>+20\%$ of total quantity for all works.

Investigation wells diameter must be sufficient to take representative specimen of soil. Protection column/wall will be used if necessary to maintain stability and safety during examination and sampling.

All precaution and safety measures for humans and animals, must be taken during investigation.

Investigation of borrow location with well or boreholes, have to be done according to previous condition, including water underground pumping.

Pickling the borrow location

At start, borrow location have to be clean from vegetation, humus and cover peat (coluvial materials). No mixing with alluvial material beneath is allowed.

Depth of exploitation of pickling coluvial materials will determine by Supervision.

Optimum moisture content for compaction works

The standard moisture values are given in paragraph 2.6.8.

Extraction of sand and gravel on borrow location

Method and equipment to use for exploitation of alluvial material from borrow location, have to allowed uniform mixture of alluvial deposits. It is necessary to gain continual granulometric composition, without grains bigger than 25cm. If necessary, screening may be used. Local pads and nests of organic material, will be removed before taking materials.

Filter materials (gravel and sand) is made from taken row material from borrow location, by washing and screening, and if necessary crunching boulder gravel grains.

Equipment for producing filter material, have to be inspected and approved by Supervision. Production capacity have to be adequate too.

Each fraction of material have to be put on separate landfill, no mixing materials on landfills is allowed. On landfill, layers of row material must not exceed 1m, to avoid segregation of grains.

Reserve of materials on landfill, must be sufficient for one month work on site.

This operations on landfill is part of price for building materials will be included in price for building filters on site.

Classification

Material for cover the slopes and bottom of infiltration lakes on site, must fit criteria prescribe in Design filter curves and this technical specifications.

Compacting alluvial materials

Dry mass weight of compacted materials of bottom lake filters, must be greater than 1.95 t/m³

Supervision can change up this criteria, if results of laboratory tests materials from landfills is different than expected.

2.2.8 Method of making the embankment/ filters

Building in alluvial materials, have to be done in such manner to achieve stabile and homogeneous layer, without local pads and nests of debris and peat.

To define Method of building in embankment, systematically observation, record and tests will be made at start of works.

Method of statement for building in filters, have to be accepted after compacting first few layers of filters. Contractor will not use for works different method or equipment then listed in statement.

Preparation of contact of layers for compacting (building in) next layer

Before material of next layer is dumped for next layer, previous layer must be dry/wet to optimal water content of water and ripped 5cm depth. Approval from Supervision have to be sealed into Log Diary before compacting next layer.

No extra price will be paid to Contractor for works specificities in this chapter.

Spreading and compacting

Material will spread in horizontal layers, thickness 30cm, by bulldozer or similar, all boulder grains bigger than 25cm, remove by hand from spread layer.

All spreading and compacting will be done in axes parallel with longer axis of lakes.

Segregation of material have to be avoided. Special care should be apply to contact zone between layers, so no mix of materials between of layers will happened during compaction.

Contaminated materials will be extracted from layers, on Supervision demand.

Spreading will be done in a manner to gain more homogeneous materials. Grains greater than 2/3 of layer thickness, will be removed and can be used for fixing bottom of slopes.

Thickness of layers and moisture of materials have to be chosen, to gain dry density mass greater than 1.95 tons/m³

Thickness of layers must not be greater than 30cm, unless Supervision approval other.

Compaction will be done by:

Vibratory roller with next features:

- Max. width of roller B=3m
- Min. Static load per 1cm of roller axle 35 kg/cm Weight on one roller 7 to 10 tons
- Frequency of vibration for roller 29 to 35 Hz
- Additional dynamic load roller on ground greater than 6 tons per m¹ of roller width

Number of pass over will be determined in Method of statement, in a way as predicted in next paragraph

Compaction will continue until compaction of layer will give dry mass density weight of 1.95 tons per m³

Number of passes over layer is calculated in unit prices for building the layers is 6 times for vibro hedgehog and 4 times for vibratory roller

If more or less number of passes over layer will be demanded from Supervision, increase or decrease of unit price will be applied.

One pass of equipment over layer is movement with compaction from one end to other end of layer, and come back to beginning spot.

Direction of moving over layers, have to be planned, so as compaction of whole layer is uniform, Speed of equipment have to be smaller than 5 km/h for vibro hedgehog and 4 km/h for vibratory roller

In edge zones of layer, where equipment cannot reach, layer thickness is reduced to 20cm, and compacted with hand rammer or vibro plate

Compaction will be applied, minimum to achieved compaction of natural layers, that surround lakes. Contractor will conduct all a priori soil investigation to determine optimum work condition

Granulometric composition

Granulometric compositions of filters must be in next Designed boundary:

Sand filter from washed and sieved grains diameter from 0.2mm to 4mm

Gravel filters for bottom of lakes and side drains from washed and sieved grains diameter from 2mm to 32mm

Installing the filters and drains have to be done to avoid segregation of grains, pads and inclusion of debris. Denivelation of filter layers must not be greater than one level. Passing of equipment across compacted filter is allowed only on one place in one lake, at location determine by Supervision.

Quality control of building materials

Tendered-Contractor must have Certificated Soil Testing Laboratory, or Sub-Contract for permanent technical control of earth works with Laboratory certificated according by Governmental certification body in Serbia (JUAT).

Laboratory is responsible for laboratory testing procedures, sampling and Reports.

Sampling procedures and classification of samples:

- For determination of nature moisture and rate of compaction, small undisturbed samples (NPU) will be taken according to SRPS U.B1.01.
- For classification tests, small and big disturbed samples will be taken (PU)

Report of soil sampling will be sealed by Supervision engineer. Example of Sampling record is in addition of this chapter.

Quantity and time for Testing:

- Moisture of soil, will be tested more often at start of works, minimum on every 5 000 to 10 000m³ of one kind of soil (if Design do not proscribe often testing).
- Clasiffication of soil will be tested more often at start of works, minimum on every 5000 m³, and later on every 25 0000m³ of one kind of soil (if Design do not proscribe often testing).

Laboratory testing for Classification of soil is:

	• Moisture/Prirodne vlažnosti	SRPS U.B1.012
	• Man made moisture/ Pripremljene vlažnosti	SRPS U.B1.012
	• Granulometric composition/ Granulometrijskog sastava	SRPS U.B1.018
	• Optimum moisture and max. mass density acc.Proctor Zbijenosti po Proctor-u	SRPS U.B1.038
Content of organic mater/	Sadržaja organskih-sagorljivih materija	SRPS U.B1.024
	• Content of carbonate/ Sadržaja CaCO ₃	SRPS U.B1.026
Special testing:	• In sity seepage koeficient/ Vodopropustljivost u zadatim uslovima	SRPS U.B1.034

Report

Report Content:

- Daily testing reports, delivered to Supervision Engineer at the end of the every day, and with written Note into the Diary Log
- Final Report for all Soil Tested during construction works, with professional conclusion for all material build in.

2.6.9. Other embankments

Embankments surrounding lakes

Here the condition for constructing other embankments, surrounding lakes. This embankments will be repair with clay alluvial materials.

Rules for this embankment is according to SRPS C5.020-Tehnickal rules for design of hydro-embankments. Equipment for this works, should be adopted to site conditions. Minimum dry density mass of compacted hydro-embankment is 90% of Proctor test max. Dry density mass.

Road, landfill and other embankments

Access to platphorms and site roads are made of cut material. Required compaction is 95% modified Proctor

Remaining materials

Remaining materials is put on site Depoe / landfill. Extra price per m3 can be charge if remaining materials is transported out of site.

For remaining materials Depoe plan with optimum use of space have to be prepare during preparation works.

Condition for embankment on landfill storage is:(a) layers will not exceed 50cm high (b) temporary slope inclination is from 1:1.5 for gravel layers up to 1:20 for clay cover (v) compaction of layer up to min. 80% of Proctor dry mass density (g) classification of materials in landfill according to this specifications

Measuring the geometry for Invoice calculation will be done by make map and profiles of landfill, before start and after end of all works.