

## **PART 2 – Works Requirements**

**Section VII - Works Requirements**

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## **Specifications**

**SECTION 1– Road Specification**

**PART I-STANDARD TECHNICAL SPECIFICATIONS**

**PART-I STANDARD TECHNICAL SPECIFICATIONS**

The Technical and Standard Specifications shall be the Ethiopian Roads Authority Standard Technical Specifications (2013):

These Standard Specifications are subject to the variations and additions set out in Section - 7 of this Tender Document “Special Provisions.”

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**PART II - SPECIAL PROVISIONS**

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**Series 2000 Site Clearance**

**DIVISION 2100: CLEARING AND GRUBBING**

2103 Execution of work

- (a) Area to be cleared and / or grubbed

From the first sentence of the first paragraph delete the phrase “ as well as certain borrow area”.

2104 Measurement and payment

Item 2.0 Clearing and grubbing..... hectare (ha)

Add the following at the end of this pay item:

Measurement and payment for clearing and grubbing at inlet and outlets of hydraulic structures are included under this pay item. No differentiation shall be made between clearing and grubbing within the roadway prism, and clearing and grubbing at inlets and outlets of hydraulic structures.

Division 2200: Demolition, Removal, Disposal, Storage or Clearing of existing structures and Installations.

2206 Measurement and Payment

Item 22.05 removal of existing road pavement

Add the following at the end of this pay item:

Any expenses in connection with breaking up, processing, loading, hauling, etc the existing pavement are deemed included in the relevant pay items for which proposed pavement material is used and will be deducted from item 22.05.

- If the processed existing pavement material is used for fill layer, all expenses for breaking up, excavating and processing, loading, hauling, damping shall be deemed included under pay item 42.01(a)
- If the processed existing pavement material is used for Subbase layer, all expenses for breaking up, excavating and processing, loading, hauling, damping shall be deemed included under pay item 51.01(a)

**SERIES 3000: DRAINAGE STRUCTURES**

**DIVISION 3200: CULVERTS AND APPURTENANT STRUCTURES**

**3201 Scope**

This Division covers the construction of in-situ and prefabricated drainage culverts for new and extension works, together with inlet and outlet structures, and other appurtenant structures at the locations and to the dimensions shown on the Drawings or as directed by the Engineer. No distinction in payment shall be made between new construction and extension works.

All concrete works for culverts shall be in line with the requirements of Divisions 8200, 8300, 8400 and 81100 of Series 8000 and shall not be repeated as part of this Division.

The specifications for Structures (bridges) for river crossings (including foundation requirements), and slab and box culverts (cast in-situ or prefabricated), are covered in Series 8000.

**3202 Dimensions**

Culverts shall be constructed to the dimensions and levels described in the Contract or as instructed by the Engineer.

Excavations and alignments for culverts and appurtenant structures shall be true to line, gradient and cross section as described in the Contract or as instructed by the Engineer.

**3203 Types of Culverts**

The following types of culverts are covered:

- Prefabricated concrete pipes of circular section, hereinafter called “concrete pipe culverts”.
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- Prefabricated corrugated metal pipes and pipe arches, hereinafter called “metal culverts”. These may be of steel or aluminum construction.

The specifications for other types of culverts (excluding box and slab culverts) not mentioned above, if required, will be shown on the Drawings.

### **3204 Materials**

#### **(a) Concrete Pipes**

In-situ concrete culverts, pre-cast concrete and concrete surrounds to metal culverts shall conform to the requirements of Series 8000.

Pre-cast concrete pipes used for the construction of culverts shall be manufactured in accordance with the requirements of AASHTO M 170M (ASTM C 76 or ASTM C 118) or AASHTO M-242 and shall be of the Class described in the Contract.

Concrete used for the construction of culverts shall be Class C 30/20 in accordance with the requirements of Division 8400.

Reinforcement used for the construction of pre-cast or in-situ concrete culverts shall be steel reinforcement complying with the requirements of Division 8300.

#### **3205 Construction Methods**

Prefabricated culverts shall be installed under the following conditions:

- Trenched conditions: Where the units are laid in a trench excavated below existing ground level or in a trench excavated in previously constructed subgrade and, if necessary, sub-base layers.
- Embankment conditions: Where the units are laid approximately on the existing ground surface and the subgrade is then constructed on either side and over the culvert.

Unless otherwise approved by the Engineer, all pipe culverts shall be constructed under trenched conditions.

Surface water must be controlled to prevent storm water from entering the trench.

The Contractor shall make good with bedding materials, any excavation at or below the bottom of the drainage trenches if the Contractor allows the trench bottom to become soft or otherwise unsuitable for the construction of the culvert.

### **3206 Excavation by Trench Method**

#### **(a) Depth of Excavation**

The Contractor shall first construct the embankment, subgrade and, if necessary, the sub-base to such a level as will provide a minimum cover above the proposed level of the top of the culvert. Thereafter, the Contractor may commence excavation of the trench for the culvert.

Where authorized by the Engineer, and particularly in areas of swampy or marshy conditions, the Contractor may construct the fill to the top of subgrade before commencing excavation for the trench of the culvert.

#### **(b) Width of excavation**

The widths of trenches shall be sufficient to allow for proper laying, bedding and backfilling culverts, but shall not exceed four-thirds of the external diameter of the pipe(s), plus 400 mm on each side for single barrel culverts, plus the allowable gap between each pipe for multiple barrel culverts.

If the width of any trench is increased by slipping or collapsing of the trench, the Contractor shall immediately inform the Engineer and shall not proceed with any further pipe-laying or backfilling until the Engineer has reviewed the circumstances and provided instructions as to the need for alterations to the class of pipe or bedding conditions.

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Where metal culverts consist of two or more units next to each other, the minimum clearance between adjacent culverts shall be as shown on the Drawings.

### **3208 Excavation for Embankment Conditions**

Where culverts are to be constructed under embankment conditions as defined in Clause 3205, the Contractor shall level the existing ground by excavating, filling and compacting as required so that the foundation for the culvert is true to grade and of uniform density over the whole length of the culvert.

The finished level of the ground on which the culvert is to be bedded shall be below the proposed level of the underside of the culvert by the same amounts as specified in Clause 3206 (a), for the various types of culverts.

### **3210 Bedding and Laying of Prefabricated or Cast in-situ Pipe Culverts and Drains**

#### **(a) Concrete Pipe Culverts and Drains**

Concrete pipe culverts and drains shall be laid on Class A, B, C or D bedding as shown on the Drawings and as directed by the Engineer. The pipes shall be laid so as to ensure tight joints between the pipes. Spigot and Socket pipes and Ogee type pipes must be laid with the spigot ends pointing downstream. The inside of the pipes shall be smooth with no displaced joints.

All pipes shall be laid true to line and level. The joints shall be sealed on the outside with two layers of bitumen impregnated hessian. The units shall be butted end to end with butt joints, which shall be covered with two layers of hessian of 340g/m<sup>2</sup>, pre-impregnated with a bituminous emulsion, or a similar approved material. The strip of hessian shall be at least 150mm wide and placed symmetrically over the joint. The units shall first be treated with a primer of 60% bitumen emulsion over the width of the strip of hessian.

#### **(i) Class A Bedding**

The pipe shall be laid with the bottom portion on Class C 20/20 concrete of specified thickness below the lowest part of the pipe and extending upwards on each side of the pipe to a specified proportion of its height. The thickness of concrete below the pipe and the height to which it is extended upwards shall be as indicated on the Drawings. Pipes shall be supported on suitably shaped temporary cradles during concreting. No longitudinal construction joints on the horizontal plane will be permitted.

#### **(ii) Class B and Class C Beddings**

The pipe shall be laid on a bedding cradle of compacted selected granular material with a maximum stone size of 30 mm. The bedding shall extend upwards on both sides of the pipe to a specified portion of its height, as shown on the Drawings. Joint holes shall be formed in the bedding cradle for pipe sockets and couplings to ensure that each pipe is fully supported throughout the length of its barrel on the bedding cradle.

Where unsuitable material beneath the bedding is required to be removed, the voids shall be filled with the same material as the bedding, compacted in layers according to the specifications.

#### **(iii) Class D Bedding**

The pipe shall be laid on the in-situ material in the bottom of the excavation after the excavation has been hand trimmed to support the pipe along the entire length of its barrel in accordance with the details shown on the Drawings. Wherever necessary, the in-situ material shall first be stabilised in accordance with the details shown on the Drawings or as prescribed by the Engineer. Joint holes shall be formed in the trench bottom for pipe sockets and couplings.

#### **(iv) Rock Foundation**

Where rock, shale or other hard material is encountered in the bottom of excavations, construction of pipes on Class A bedding shall be as follows:

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- The material below the pipe shall be excavated and replaced with an equalising bed of sand or approved gravel or soil to a depth as shown on the Drawings or directed by the Engineer;
- The backfill material shall be watered and compacted to provide a firm earth cushion. Class A
- Bedding shall then be prepared as described in sub-clause (a)(i) of this Clause.

(v) Concrete Casing

Where shown on the Drawings or ordered by the Engineer, pipes shall be fully encased in Class C 20/20 concrete with the dimensions as shown on the Drawings or as ordered by the Engineer. Temporary supports shall be provided near the pipe ends to support the pipes during placing of the concrete. The placing of concrete shall be such that all voids under the pipe are completely filled. Use shall be made of poker vibrators to ensure proper filling of all voids under and around the pipes with concrete. The concrete casing shall be cast in one continuous operation until completed.

**3212 Inlet and Outlet Structures**

Inlet and outlet structures for culverts shall be constructed in accordance with the details shown on the Drawings.

**(a) Excavation and Backfilling**

Excavation and backfilling work shall be carried out in accordance with the provisions of Clauses 8105 and 8108.

**(b) Concrete Work**

Concrete work shall be carried out in accordance with the provisions of Series 8000. Unless otherwise specified, all concrete shall be Class C 20/20.

**DIVISION 3400: STONE PITCHING, MASONRY, PRECAST CONCRETE BLOCK AND RIPRAP**

**3401 Scope**

This Division covers the furnishing of materials and construction of erosion protection in stone pitching (dry and grouted), masonry, precast concrete block paving, or heavier protection in the form of riprap as shown on the Drawings, or as ordered by the Engineer.

**3402 Materials**

**(a) Stone**

(i) Pitching and Masonry

Stone for pitching and masonry shall be sound, tough and durable with no stone less than 200mm in minimum dimension; except that smaller pieces or spalls may be used for filling spaces between the larger stones. Rocks or stone shall be of such a shape as to form a stable protection structure of the required section. Rounded boulders or cobbles shall not be used on slopes steeper than 2:1 grade unless grouted.

All stone intended for use on any particular pitching works shall receive the prior approval of the Engineer.

(ii) Riprap

Stone for riprap shall be hard field or quarry stone not susceptible to disintegration or excessive weathering on exposure to the atmosphere or water. It shall be free from soft material such as sand, clay, shale or organic material and shall not contain an excessive amount of elongated or flakey stone.

The required size of stone shall be determined by the "critical mass" specified. At least 50% by mass of the material comprising the riprap shall consist of stones having a mass heavier than the critical mass and not more than 10% by mass of the material shall consist of stone having a mass of less than 10% of the critical mass or more than 5 times the critical mass.

The grading requirements for riprap are shown in Table 3402/1.

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**(b) Cement**

Cement shall be Ordinary Portland Cement complying with the requirements of BS 12 Part 2 or Type II, AASHTO M 85.

**(c) Sand**

(i) Sand for Cement Mortar

Sand for the cement mortar shall comply with the requirements of BS 882.

(ii) Sand for Bedding

Sand for bedding used for stone pitching shall not contain any deleterious impurities and shall comply with the grading requirements.

(iii) Sand for Joints

Sand used for brushing into joints between pavement blocks shall all pass the 1.18mm sieve; and between 10 and 15% shall pass the 0.075mm sieve.

**3403 Construction Requirements for Stone Pitching**

**(a) Dry Stone Pitching**

The area shall be prepared by excavation, shaping and trimming to accommodate the stone work and shall be thoroughly compacted by hand-ramming to minimize subsequent settlement. A trench shall be excavated along the toe of any slope to be pitched or along the unprotected edge of the pitching in the beds of streams.

**(b) Grouted Stone Pitching**

Grouted stone pitching shall be Class B in accordance with Clause 8903 (b), except that the spaces between the stones shall be filled with cement mortar composed of one (1) part of cement to three (3) parts of sand. Before the mortar is applied, the adjacent surfaces of the stones shall be thoroughly cleaned of adhering dirt and clay, and then moistened.

**3404 Riprap**

**(a) General**

Riprap shall consist of a course(s) of large rock placed on bank slopes and toes; river and streambeds; and other localities where protection of this type may be required. Stone for riprap shall conform to Sub-clause 3402(a)(ii).

Two types of riprap are specified:

- Packed riprap: where the rocks are individually packed;
- Dumped riprap: where the stone is dumped and then spread by machines.

The surface of the areas to receive riprap shall be neatly trimmed to line and level and all loose material compacted. The perimeters of riprap shall be protected by the construction of either rock-filled trenches, walls, or other structures as may be required. Perimeter trenches shall normally be backfilled with rock of the same size and quality as used in the construction of the riprap it adjoins. Any cavities shall be filled with smaller material and the whole backfill shall be well consolidated.

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**SERIES 4000: EARTHWORKS**

4101 General

a) Scope

Add the following at the end of the first paragraph.

- a) “This section also covers the work involved in disposing of spoil materials Shaping and compaction of the roadbed on suitable material

*Delete the phrase “93% or” in the third line of the first paragraph and first line of the second paragraph.*

**4103 Treatment of the Existing Ground and of the Roadbed Materials in Cuttings**

In the Title of Clause 4103, add the phrase “in Fill” next to the word “Ground”

- b) Removal, Disposal and Replacement of unsuitable materials

*Delete second bullet of first paragraph and replaced with following  
Unsuitable material consists of*

A material having Liquid Limit (LL) exceeding 60%; or a Plasticity Index (PI) exceeding 30%; or CBR value less than and 5% at 95% of modified AASHTO compaction (AASHTO method T-180) after 4 days soaking or a swell value of more than 2% (with two surcharge rings) when determined in accordance with AASHTO t-193 at 95% of modified AASHTO compaction.

*Delete first bullet of second paragraph and replaced with following*

Excavated areas shall be backfilled with approved imported materials with the following properties:

*The CBR shall not be less than 5% at 95% of Modified AASHTO (T180) and where no capping or selected layer is specified shall have a minimum soaked California Bearing Ratio (CBR) of 8% at 95% of Modified AASHTO (T180), Liquid Limit (LL) less than 60, a Plasticity Index (PI) less than 30 and swell value of less than 2.0%.*

**4104 CAPPING OR SELECTED LAYERS**

*Delete the first and second paragraphs and replace with following*

Capping shall be provided as showing on the drawing. In cut or fill the material 600mm (minimum) below the subbase layer shall fulfill the minimum 4 days soaked CBR strength from which the pavement layer designed. The capping material shall comply with requirements of clause 4402 except that it shall have minimum 4-days soaked CBR of 15% of modified AASHTO density as shown on the drawings. The capping layer of 600mm thickness shall be constructed in accordance with the requirements of Clause 4403.

**4106 PROBLEM AREAS**

*Amend the material for backfilling as specified in Clause 4103 (a)*

**4107 MEASUREMENT AND PAYMENT**

**DIVISION 4200: ROADWAY AND BORROW EXCAVATION**

**4207 Construction Requirements for the Excavation of Cuttings**

a) Equipment

*Add the following sentences at the end of the Sub-clause:*

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The equipment shall not be less than that designated for that purpose in the Contractor’s program and plant list approved by the Engineer.

c) Dimension of cuttings

*Add the following sentence at the end of the second paragraph*

No separate payment for cutting below specified level.

**4209 MEASUREMENT AND PAYMENT**

(a) General Directions

(ii) Material from commercial sources

*Delete this sub-clause entirely,*

(iii) Work in restricted areas

*Delete the paragraph under this sub-clause and replace with the following:*

No separate measurement and payment shall be made for works in restricted areas. Any additional costs involved in working in restricted areas are deemed to be included in the tendered rates for earthworks items.

Item 42.01 Cut and borrow to fill

*Delete the sub-items 42.01(a) and 42.01(b) and replace with the following:*

42.01(a) Cut and/or borrow to fill compacted to 95% modified AASHTO T180

Density.....cubic meter (m<sup>3</sup>)

42.01(b) Capping layer (or fill) material compacted to 95% modified AASHTO T180

Density.....cubic meter (m<sup>3</sup>)

*Delete pay items 42.01(a) to 42.01 (f) entirely*

Item 42.02 Extra over item 42.01 for excavating and breaking down material

*Delete this pay item entirely*

Item 42.03 Cut to spoil

42.03(a) Common normal excavation to spoil..... cubic meter (m<sup>3</sup>)

42.03(b) Hard excavation to spoil..... cubic meter (m<sup>3</sup>)

*Delete pay item 42.03(a) to (f) entirely*

The unit of measurement shall be the cubic meter of material measured in its original position in cut and computed by the method of average end areas from levelled cross-sections taken along the ground line after clearing and grubbing and the removal of topsoil, if any, but prior to excavating the cut with the final specified or authorized cross-section of the cut superimposed thereon at intervals not exceeding 20 m along the center line of the road.

The tendered rates for cut to spoil shall include full compensation for excavating from the road prism and roadbed in the various classes of excavation, for loading, transporting, off-loading and disposing of the material as specified, including shaping and levelling off any piles of spoil material.

This payment item will also apply to the removal of unsuitable roadbed material as described in Division 4100.

Except where the temporary storage of spoil material is ordered by the engineer, the tendered rates shall also include full compensation for the temporary storage of spoil material, the later loading, transporting, off-loading and grading of the spoil material within the borrow areas, and for reinstating the storage site to its original condition.

The measurement shall base on the volume of cut minus the volume used in fill for the entire project length without any adjustment for expansion or shrinkage of cut or fill section respectively. The mass balance shall be undertaken the whole road section. Disposal of surplus or unsuitable material shall be made at approved spoil pit. Side waste is prohibited and is not allowed (refer the environmental regulations).

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Coarse rock encountered in cuts shall be utilized for the construction of the lower layers of fills high enough to accommodate thick layers, or, where so required, shall be conserved and used as directed by the Engineer for crushing or for constructing the sides of embankments or for serving as protection against embankment or channel erosion.

The Contractor shall not spoil any material without the Engineer's approval and without satisfying the Engineer that this is necessary and the most economical method of constructing the Works (See Sub Clause 4207(d) of Division 4200).

Moreover, the Contractor shall take note that 95% of the payment that are related to cut and borrow to fill and cut to spoil shall be incorporated in the payment certificate before the application of retention money, when the contractor fulfills all the required works that are stipulated under the relevant Clauses/ Specification/Quantities/Drawings of the contract. Whereas, the remaining 5% of the withhold amount that are related to the above mentioned pay items will be released, when the contractor executes all the necessary environmental reinstatement, and impact management plan as per the relevant provisions of the contract document.

In cases where the contractor maintains his negligence of undertaking the necessary reinstatement and environmental protection works, after two instances of warning, the Employer is at liberty to utilize the withhold amount for any activities related to the reinstatement works either by assigning another Contractor to execute the work and/ or to remedy any damage emanated as a result of the Contractor's timely rectification that are not covered by the surety and/ or to execute the work by other means. Nevertheless, the implementation of the abovementioned mechanism does not jeopardize the Employer's remedial rights that are stipulated under different sections of the Contract, in cases where the Contractor becomes in default of the reinstatement works. Furthermore, the Contractor shall submit his reinstatement methodology for the specifically requested site while he submits possession of site requests for quarries and borrow sites. Accordingly, possession of site requests that are not accompanied with such methodologies or methods that are deficient, in the opinion of the Engineer will automatically be rejected. In addition, the Contractor shall make the reinstatement works in strict adherence to the captioned methodology and based on the applicable clauses of the Contract document."

No separate payment will be made to the Contractor for stock piling of material, widening in cut sections and screening and crushing of material.

Items 42.04 to 42.06

*Delete pay item 42.04 to 42.06 entirely:*

No extra payment shall be made for stock piling, widening of cuts and crushing/screening.

## **DIVISION 4300: BORROW MATERIALS**

### **4301 SCOPE**

*Add the following at the end of the paragraph:*

Performance of work prescribed in this division is not payable directly. All costs involved in obtaining up, exploiting and reinstating borrow pits is deemed to be included in the tendered rates for earthworks and pavement items.

### **4302 OBTAINING OF BORROW MATERIALS**

(a) Borrow area locations

*Add the following after the end of the last paragraph Clause 4302(a)*

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The Employer's Representative should satisfy himself, prior to approval of borrow pits that all reasonable precautions have been or will be taken to minimize adverse environmental impacts.

And

The borrow pit sites and access roads shall be considered as part of the site and as such the powers and authority of the Employer's Representative shall extend to them in the same way as to other areas where works are being undertaken.

(b) Use of borrow materials

*Delete the existing paragraph and replace with:*

The Engineer shall not approve the use of any material from borrow areas unless the contractor has made full use of all available suitable materials coming from roadway excavation in the vicinity of the fill.

And

It would be the sole responsibility of the contractor to ensure that stagnant pools of water do not form any time during operation of the borrow pits and also that adequate precautions are taken towards safety of people and livestock.

If the Contractor uses borrow materials regardless of the availability of suitable materials won from the cut operations, the quantity of spoil material from the road reserve shall be less by the quantity of borrowed material.

*Add the following new Sub-clause*

*(c) Acquisition of land for borrow areas*

If it so happens, at any time during construction, that there are existing settlements on areas to be used for construction purposes outside the road reserve, and the Contractor requires the use of such areas, he shall give the Engineer notice of this required entry and use of the areas. The Employer needs up to 3 and 4 months for acquisition of land in rural and urban areas respectively.

The Contractor shall not enter the designated area until he obtained the Engineer's approval. If compensation for materials or loss of crops and/or habitation is required by the property owners, the Employer negotiate with them and effect the required compensations. The Contractor will therefore not be liable for such costs as the Employer will deal with all negotiations and compensation to the property owners regarding land related issues.

If the land acquired is not used for the intended purposes due to the fault of the Contractor, the amount paid for compensation will be reimbursed to the Employer.

### **4303 OPENING AND WORKING OF BORROW AREAS**

(b) Clearing and Grubbing

*Delete the entire description of the standard technical specification of this Sub-clause and replace with:*

Clearing and grubbing shall be executed prior to the commencement of excavation of borrow areas. No direct payment will be made for clearing and grubbing in borrow sites. The cost shall be deemed to be distributed in rates set for item 42.01 under division 4200 of the specification.

(c) Overburden

*Delete entire description of the standard technical specification of the Sub-clause and replace with:*

Overburden shall be removed as instructed by the Engineer, to the outer limits of the proposed borrow areas. Where possible at that stage the overburden shall be used as backfill to exploited borrow areas as part of the borrow area reinstatement as described in Clause 4304. No direct payment will be made for removal of overburden shall be deemed to be included in rates tendered and paid for work items provided in the BoQ for the use of the borrow material, irrespective of any other statements to the contrary elsewhere.

### **4304 REINSTATEMENTS OF BORROW AREAS**

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*Add the following new paragraph to the Clause*

The Contractor shall submit for approval, a reinstatement plan for borrow areas to the Engineer not later than forty (40) days prior to the planned commencement of exploitation.

#### **4307 MEASUREMENT AND PAYMENT**

*Delete all the paragraphs under this Clause as there is no payment for reinstatement of borrows areas/pits that will be paid to the Contractor. The costs for these works are to be included in the Contractor's other rates.*

### **DIVISION 4400: EMBANKMENT CONSTRUCTION**

#### **4401 GENERALS**

(b) Source of Materials

*Add the following,*

The distance along and at right angle to the main road between any two consecutive borrow sites excluding the access road shall not be less than 5 km in which the contractor shall not open any new borrow site for the same purpose unless the available borrow material is substantially consumed. Notwithstanding this, the Engineer may give consent for opening of additional borrow pits when substantiated with proper justification if the site condition and nature of project dictates for it.

#### **4402 MATERIAL REQUIREMENTS FOR THE CONSTRUCTION OF**

##### **EMBANKMENTS**

(b) California Bearing Ratio (CBR)

*Delete the paragraph in its entirety and replace with the following:*

The fill material shall have a minimum soaked CBR OF 8% and a swell value of not more than 2% (with two surcharge rings) when determined in accordance with AASHTO T-193 at a modified AASHTO density of 95% of the maximum dry density determined in accordance with the requirements of AASHTO t-180 method D.

(c) Liquid Limit (LL) and Plasticity Index (PI)

The fill material shall have a liquid limit not exceeding 60% and a plasticity index not exceeding 30% when determined in accordance with the requirements of AASHTO T-89 and T-90.

(d) Compaction

*Delete the paragraph in its entirety and replace with the following:*

The layer of the embankment fill that constitutes the sub-grade layer including capping and selected layers shall be compacted to a minimum of 95% of modified AASHTO density as shown on the Drawings.

#### **4403 CONSTRUCTION REQUIREMENTS FOR GENERAL EMBANKMENT FILLS**

(a) Layer Thickness

*Delete the paragraph in its entirety and replace with the following:*

The thickness of each compacted layer of the fill, other than rock fill, shall be deposited in layers not exceeding 200mm after compaction. Each layer shall extend over the full width of the embankment and shall be placed in successive layers approximately parallel to the final road surface. The construction of tapered layers shall be restricted to the bottom layers of embankments where this may be unavoidable due to cross-fall, tapering out of fills or super elevation of the final road surface.

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When new layer is constructed on an existing or already constructed fill, and the new layer will be less than 100mm in compacted thickness the existing fill shall be scarified to such a depth as will a layer thickness after compaction of not less than 100mm of the new, plus the scarified material together. No additional payment will be made for this operation.

#### **4406 MEASUREMENT AND PAYMENT**

Add the following after fourth paragraph,

Placing and compaction of side fill as per Clause 4405 shall be paid for under item 42.01.

Widening and compaction of fills as specified in Clause 4405 is not payable as this shall be considered as covered under pay item 42.01.

Spoiling of unsuitable material from benching is not payable as this shall be considered as covered under pay item 41.01.

Items 44.01 to 44.04

*Delete pay items 44.01, 44.02, 44.03, and 44.04 entirely.*

#### **DIVISION 4500: MATERIAL STABILISATION**

##### **4501 Scope**

Delete the paragraph in its entirety and replace with the following

This section covers the stabilization of materials used in the construction of the subgrade and sub-base (covered in Series 5000); by the chemical stabilization of the borrow material (subgrade stabilization) and mechanical modification of the natural gravel material by mixing with crushed aggregate for subbase stabilization. It includes the furnishing, spreading and mixing-in.

##### **4502 Materials**

(a) Material to be stabilized

*Delete the paragraph in its entirety and replace with the following*

Material to be stabilized shall be naturally gravel material of Plastic Index (PI) more than 30% or Liquid Limit (LL) more than 60% and California Bearing Ratio (CBR) less than 15, the properties of which can be permanently improved by the process of chemical stabilization to comply with the requirements of this Specification for the relevant materials for improved subgrade/ capping layer material.

*(ii) Stabilized Sub-base Material*

*Delete the paragraph in its entirety and replace with the following*

The stabilization of materials for use as sub-base shall provide a permanent improvement to the utilized materials to meet the requirements of Series 5000 of these Specifications.

(b) Stabilizing Agents

*Delete the paragraph in its entirety and replace with the following*

The stabilizing agent is:

(I) Ordinary Portland Cement

Portland cement shall comply with the requirements of AASHTO M-85, Type II or the equivalent ISO standard class.

##### **4503 Chemical Stabilization**

*Comply with Division 4503 of the standard specification.*

##### **4504 Mechanical Modification**

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*Delete the paragraph in its entirety and replace with the following*

Mechanical modification shall consist of mixing of material originating from various sources as described hereafter.

(a) Modifying Soil and Gravel by the Addition of a Soil Binder

*Delete the paragraph in its entirety*

(b) Mixing Materials from Various Sources

The mixing of materials from various sources requires the material from the first source (natural gravel material) to be dumped onto the road, prepared, broken down and spread in a layer of uniform thickness, after which it is lightly rolled with a steel –wheeled roller.

The material from the second source (crushed aggregate) shall then be dumped onto the road, prepared, broken down and evenly spread across the first layer, following which, the two materials shall be thoroughly mixed.

**4505 Bituminous Stabilization**

*Delete the paragraph in its entirety*

**4506 Construction Tolerances**

*Delete the paragraph in its entirety*

**4508 Stabilization Work in Restricted Areas**

*Delete the paragraph in its entirety*

**4511 MEASUREMENT AND PAYMENT**

Items 45.01 to 45.12

*Delete pay items 45.01 to 45.12 entirely.*

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**SERIES 5000: SUB-BASE, ROAD BASE**

**DIVISION 5100: SUB-BASES**

**5102 MATERIALS**

*Delete the text under this clause entirely and replace with the following:*

The sub-base material shall be obtained from the sources previously located by the designer and new sources located by the Contractor and approved by the Engineer or by blending of natural gravel material with base course material from existing pavement or with crushed aggregate. The Contractor is required to obtain suitable sources, which are closest to the area where sub-base is being placed.

**5104 MATERIAL REQUIREMENTS SUB-BASE**

*(a) General*

*Delete the first paragraph entirely and replace with the following*

Gravel material to be used for sub-base shall be obtained from approved sources in borrow areas or by blending of natural gravel material with base course material from existing pavement or with crushed aggregate and shall conform to requirements specified herein.

*Add the following new sentences at the end of the first paragraph:*

All oversized materials shall be removed by using screens at the borrow area or other suitable method proposed by the Contractor and approved by the Engineer. Manual removal of oversize material anywhere may not meet with the approval of the Engineer.

*(b) Particle Size Distribution and Shape*

*Delete the paragraph in its entirety and replace with the following*

The sub-base material shall comply with grading “A” shown in Table 5104/1. It shall be well graded with a smooth continuous grading within the limits shown.

The minimum Grading Modulus shall be 1.5, except where a material, having a lower Grading Modulus (but not less than 1.2) is approved for use by the Engineer.

*Add the following at the end of the Sub-clause:*

If natural material available does not meet the specified grading requirements, it shall be screened; crushed and screened; or blended as required to meet the grading requirements.

*(c) Plasticity*

*Delete the paragraph in its entirety and replace with the following:*

The natural gravel sub-base material shall have a maximum Plasticity Index, when determined in accordance with AASHTO T-90, depending on the climate as shown in Table 5104/2, or as shown on the Drawings.

*(d) Density and Strength*

The minimum dry density to which the material shall be compacted shall be 97% of the MDD obtained in the AASHTO T-180 method D unless specified otherwise, shown on the Drawings or ordered by the Engineer. Field dry densities shall be determined by the sand replacement method as specified in AASHTO T 191 or any other method approved by the Engineer and calibrated with the sand replacement.

The minimum soaked Californian Bearing Ratio (CBR) shall be 30% when determined in accordance with the requirements of AASHTO T-193. The Californian Bearing Ratio (CBR) shall be determined at a density of 95% of the maximum dry density when determined in accordance with the requirements of AASHTO T-180 method D.

*(e) Use of Laterite as Sub-base*

*Delete the paragraph in its entirety*

*(f) Sub-base Materials for Low Volume Roads*

*Delete the paragraph in its entirety*

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**5105 CONSTRUCTION REQUIRMENTS**

(a) General

*In paragraph three, change the phrase “95 or 97%” to “97%”*

(b) Stabilization

*Delete the paragraph in its entirety and replace with the following:*

When specified in the Contract or required by the Engineer, sub-base layers shall be stabilized as specified in Division 4500

The entire thickness of the mechanical stabilized layer shall be thoroughly and uniformly compacted to a minimum 97 percent or the modified AASHTO maximum density; or as required on the Drawings; or as instructed by the Engineer.

(c) Trial Areas

*Add the following at the end of the paragraph:*

Only when such a trial section has been satisfactorily laid and finished and complies with the specified requirements, will the Contractor be allowed to commence with construction of the permanent work.

If the Contractor should make any alterations in the methods, processes, equipment or material used, or if he is unable to comply consistently with the specifications, the Engineer may require that further trial sections be laid before allowing the Contractor to continue with the permanent work.

**5106 CONSTRUCTION REQUIRMENTS FOR SUB-BASES USING RECYLED (IN-SITU)**

**PAVEMENT MATERIAL**

*Delete the paragraph in its entirety*

**5107 PROTECTION AND MAINTENANCE**

*Add the following at the end of the paragraph:*

The Contractor shall protect and maintain the completed sub-base at his own expense. Maintenance shall include immediate repairs of any damage or defects, which may occur and shall be repeated as often as is necessary to keep the sub-base continuously intact. Repairs shall be made in a manner that will ensure restoration to an even and uniform surface.

Following the construction of the sub-base, the compacted sub-base shall be maintained by the Contractor at his expense. The Contractor shall blade, broom and otherwise maintains the sub-base, keeping it free from raveling and other defects until such time as the base course is applied.

The Contractor may allow traffic to pass on the finished sub-base, however, when the sub-base finished layer is open to traffic, there will be loss of fine materials due to traffic and wind actions. Hence, the Contractor should reinstate the original conditions and repair any damage at his own cost.

Sub-base course which become damaged by traffic or for any other reason and which does not comply with the specification requirements, including compliance with required surface regularity, shall be scarified up to the bottom surface of the last sub-base layer without contaminating it with other objectionable materials that can undermine properties, reshaped and re-compacted as required in the specifications.

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The Engineer shall determine when the surface of sub-base course is in proper condition to permit base course to be applied. If the Contractor chooses not to apply base course at that time he must continue to maintain surface of sub-base course, including re-work at his own expense, until such time as base course is applied. Any additional expense incurred by the Contractor for maintain or re-work the sub-base course will not be considered as the basis for a claim for additional compensation.

No material for construction of bituminous base course shall be placed until the sub-base has been approved by the Engineer.

**5111 MEASURMENT AND PAYMENT**

*Delete the second paragraph as no separate payment shall be made to work that has to be executed in a restricted area.*

Item 51.01 Sub-base layer constructed from gravel or crushed stone:

*Delete pay items 51.01 (a), 51.01(b) and 51.01 (c) entirely and replace them with the following:*

51.01(a)(ii) Sub-base layer(s) from approved sources in borrow areas or by blending of natural gravel material with base course material from existing pavement or with crushed aggregate, compacted to 97% of AASHTO T180 density..... cubic meter (m<sup>3</sup>)

In item 51.01 the layer thickness shall be as per typical section.

The unit of measurement shall be the cubic meter of compacted pavement layer, and the quantity shall be calculated from the authorized dimensions of the completed layer.

The tendered rates shall include full compensation for procuring, any haul, crushing, screening and blending (if any), placing, mixing (if deemed necessary) and compacting the material to the desired finished property, and for the removal, transporting and disposal of oversize material.

The tendered rates shall further include for the protection and maintenance of the layer and the conducting of control testing, all as specified.

Additional payment will not be made for any additional costs involved in taking material from classes harder than soft excavation or for any additional costs for processing such material in the pavement layers.

Additional payment will not be made for work in areas inaccessible to mechanical equipment, any restricted areas or any other areas.

Items 51.02 to 51.12:

*Delete pay items 51.02 to 51.07 entirely.*

**DIVISION 5200: ROAD BASES (EXCLUDING BITUMINOUS BASES)**

**5201 SCOPE**

*Delete the paragraphs under this Clause entirely and replace with:*

This division covers the specifications of materials for, and the construction of, crushed aggregate base course layer from approved base materials.

**5203 MATERIALS**

(b) Road base material types

*Delete the contents of this Sub-clause and replace with:*

The materials used for the construction or road base layers shall consist of crushed fresh quarried rock extracted from good and sound parent rock formation and meet the requirements to GB1 material.

**5204 MATERIAL REQUIRMENT FOR CRUSHED STONE**

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(a) General

Graded crushed stone (GB1) (as defined ERA Flexible Pavement Design Manual) shall be produced by crushing fresh, quarried rock and may be an all-in product, usually termed as “crusher-run”, or alternatively the material may be separated by screening and recombining to produce a desired particle size distribution of Nominal maximum particle size 37.5mm as per the specifications. The material shall be of such a nature that it can be readily transported and compacted without segregation.

(b) Particle Size Distribution and Shape

The combined grading of the material shall be a smooth continuous curve falling within the grading limits of Nominal maximum particle size 37.5mm shown in Table 5204/1 when determined in accordance with the requirements of AASHTO T-27.

The mass material passing the 0.075 mm sieve shall be determined in accordance with the requirements of AASHTO T-11.

The flakiness index determined in accordance with BS 812, Part 105 or ASTM D 3398 shall not exceed 30 per cent.

(c) Plasticity Index

The fine fraction of a GB1 material shall be non-plastic when determined in accordance with AASHTO T-90

(d) Density, Strength and Durability

**5209 CONSTRUCTION REQUIRMENTS FOR DENSE BITUMEN MACADAM ROAD BASE**

Delete Clause 5210 in its entirety.

**5210 CONSTRUCTION TOLERANCES**

Add the following new Sub-clauses at the end of the Clause:

(f) Gradation Tolerances

The combined, gradation including tolerances shall be as specified in Table 5200/1, i.e. the specified gradations are including application of tolerances.

(g) Compaction Tolerances

The in-situ compaction degree specified in Sub-clause 5208 (b) is a minimum value to be respected by all process control tests.

**5212 MEASURMENT AND PAYMENT**

*Delete the second paragraph as no separate payment shall be made to work that has to be executed in a restricted area.*

Item 52.01 Base layer construction

Delete pay items 52.01 (a), 52.01 (b) and 52.01 (c) entirely and replace them with the following:

52.01 (c )(ii) Crushed aggregate base course (GB1) compacted to 100% of AASHTO T180 density (including shoulder, carriageway, widening area, town section parking, town merging to rural and junctions).....cubic meter (m<sup>3</sup>)

In item 52.01 the layer thickness shall be as per typical section.

The unit of measurement shall be the cubic meter of compacted crushed aggregate base course, and the quantity shall be calculated from the authorized dimensions of the completed layer as shown in the drawings or directed by the Engineer.

---

The tendered rates shall include full compensation for procuring, crushing, screening, transporting to any haul distance, placing and compacting the material to the desired finished lines, grades and levels, and for the removal, transporting and disposal of oversize material. The tendered rates shall further include for the protection and maintenance of the layer and the conducting of control testing, all as specified.

The tendered rates shall further include for the protection and maintenance of the layer and the conducting of control testing, all as specified.

Additional payment will not be made for work in areas inaccessible to mechanical equipment, any restricted areas or any other areas.

Construction of trial section as specified shall be deemed to be included in this item and shall not entitle separate and extra payment to the Contractor.

Items 52.02 to 52.12:

*Delete pay items 52.02 to 52.12 entirely.*

DIVISION 5300: BREAKING UP EXISTING PAVEMENT LAYERS

*Delete Division 5300 entirely.*

DIVISION 5400: GRAVEL WEARING COURSE AND GRAVEL SHOULDERS

5401 SCOPE

*Delete the paragraphs under this Clause entirely and replace with:*

This division covers the specifications of materials for, and the construction of, Gravel Wearing course layer from approved base materials.

**5402 MATERIALS**

*Delete the contents of this Sub-clause and replace with:*

The material used for the Construction of Gravel Wearing Course shall consist of hard durable angular particles produced by crushing rock, crushing gravel or from natural sources and shall be clean and free from organic matter, lumps of clay or other deleterious substances and the material shall be with a quality of natural sub-base materials.

5408 MEASUREMENT AND PAYMENT

*Delete the Clause entirely.*

DIVISION 5500: HAND-PACKED STONE PAVING AND MORTARED HAND-PACKED STONE PAVING

*Delete Division 5500 entirely.*

DIVISION 5600: STONE SETTS AND COBBLESTONE PAVING

*Delete Division 5600 entirely.*

DIVISION 5700: FIRED CLAY BRICK PAVEMENT

5706 MEASUREMENT AND PAYMENT

Item 57.01 Base layer construction

*Delete pay item 57.01 entirely.*

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**SERIES 6000: BITUMINOUS SURFACING AND ROAD BASE**

**DIVISION 6100: BITUMINOUS PRIME COAT**

6102 MATERIALS

(b) Priming material

*Delete the contents of this Sub-clause and replace with:*

Priming material shall be MC-30 cutback bitumen complying with AASHTO M82 or as directed by the Engineer.

6106 STORAGE PRIME COAT MATERIAL

Replace Table 6106/1 with the following:

Table 6106/1: Recommended storage and application temperatures

Type of Prime	*Maximum storage temperatures (°C)		Spraying temperatures range (°C)
	Up to 24 hrs.ʹ	More than 24 hrs.	
MC-30 Cutback	50	30	45 - 60

*\*Temperatures may be above the flash point of some materials. Care must be taken to prevent fire and explosion.*

**6108 APPLICATIONS OF THE PRIME COAT**

*Delete the first paragraph of this Sub-clause and replace with:*

The spray rate for the prime coat is selected so that the prime binds at least the top 4 mm of the base if possible. Prime coat shall be applied with a spray rate of 0.8 liter/m<sup>2</sup> – 1.2 liter/m<sup>2</sup> with MC-30 medium curing cut-back bitumen. For tender purpose a spray rate of 1.0 liter/m<sup>2</sup> has been assumed. The exact rate of application, which may be varied to suit field condition, will be determined by the Engineer following trials to be carried out by the Contractor. Those trials shall be performed to the full satisfaction of the Engineer and shall not be less than 50 m length and the full width of one lane. Recommended spraying temperatures are given in Table 6106/1.

Add the following sentence at the end of the last paragraph of this Clause:

Before the Contractor commences with the construction of any Prime Coat work, he shall demonstrate, by laying a trial section of not less than 500m<sup>2</sup> in area, that the equipment and processes that he proposed to use, will enable him to construct the Prime Coat in accordance with the specified requirements. The total section shall be laid where indicated by the Engineer.

Only when such a trial section has been satisfactorily done and finished, and complies with the specified requirements, will the Contractor be allowed to commence with construction of the permanent work.

If the Contractor should make any alterations in the methods, process, equipment or materials used, or if he is unable to comply consistent with the specifications, the Engineer may require further trial sections be laid before allowing the Contractor to continue with the permanent work.

**6112 MEASUREMENT AND PAYMENT**

*Item 61.01 Prime Coat*

*Delete sub-item 61.01(a) and replace with:*

61.01 (a) MC-30 cutback bitumen (1.0lt/m<sup>2</sup>).....liter (Lt.)

*Delete pay item 61.01 (c) and 61.02 entirely.*

**DIVISION 6200: TACK COAT**

6201 SCOPE

This division covers the specification of materials for, and application of, bituminous tack coats that are applied on newly constructed primed base course or to existing bituminous tack coats that are applied to existing bituminous surface to promote adhesion between the existing bituminous surface and the new asphalt pavement layer.

6202 MATERIALS

#### Tack (a) coat material

The material used for tack coats shall be the following as specified or as directed by the Engineer:

- Stable Grade 30% bitumen emulsion complying with AASHTO M-140 OR M-208; or SANS 4001-BT3 and – BT4 (previously SANS 309 and 548).

#### **6207 APPLICATIONS OF THE TACK COAT**

The rate of application of shall be as directed by the Engineer. The Engineer may direct that trial application be conducted on short test sections to determine the optimum application rate for the various layer materials to which the tack coat shall be applied. In general, for a stable grade emulsion diluted to have 30% bitumen content, the rate of application of tack coat for new Hot Mix Asphalt shall be 0.25 liter/m<sup>2</sup>.

The application of bituminous material shall not exceed the required amount. Any excess which is applied, shall be removed by application of blotting material approved by the Engineer. Recommended spraying temperatures are given in Table 6206/1 of Standard Technical Specification and Method of Measurement.

The tack coat shall not be applied more than 24hrs before the paving is carried out.

#### **6211 Measurement and Payment**

The tendered rate for the specific pay items shall include the general requirements of SERIES 6200.

*Item 62.02 Tack Coat*

*Delete pay item 62.01 entirely.*

#### **DIVISION 6300: SURFACE SEALS**

#### **6303 MATERIALS**

##### a) Bituminous Binders

*Amend the first paragraph to read as follows:*

The bitumen for surface treatment shall be MC-3000 cut back Bitumen with Nominal rate of Application 1.3 lit m<sup>2</sup> for first seal and 1 liter /m<sup>2</sup> for the second seal for tendering purpose. The Nominal Spray rate of Bitumen in case of Single seal shall be 1.5 Liter/m<sup>2</sup> for tendering purpose. The actual application rate shall be determined on site jointly with the Engineer.

#### **6321 MEASUREMENT AND PAYMENT**

*Delete pay item 63.11 - Addition of wetting agent and replace with the following:*

No extra payment will be made for this item. The costs for any wetting agent shall be deemed to be covered by rates tendered for other billed items.

Delete pay items '63.13- Extra over item for surface treatment in areas inaccessible to mechanical equipment.' and add the following:

No separate payment will be made for this item and the rate tendered will be deemed to be fully inclusive of compensation for surfacing all areas, including areas inaccessible to mechanical equipment.

#### **DIVISION 6400: ASPHALT ROAD BASE AND SURFACING**

#### **6401 Scope**

*Delete this Clause entirely and replace with:*

This section covers all works in connection with continuously graded asphalt wearing course. It includes the procuring and furnishing of aggregate and bituminous binder, mixing at a central mixing plant, spreading and compaction of the mixture for the construction of continuously graded asphalt wearing course.

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The widening of asphalt surfacing and placing of asphalt in restricted areas, and the construction of asphalt surfacing on bridge decks were shown on the Drawings or ordered by the Engineer are also included.

**6402 MATERIALS**

(b) Bituminous binders

(i) Penetration Grade Bitumen

Amend the Sub-clause as follows:

*(i) The penetration grade bitumen with grade 60/70 shall be used for the project. The design requirements of 60/70 penetration grade bitumen for the hot mix asphalt as per AASHTO M 20/ ASTM D 946 are:*

- Penetration at 25°C (100 g needle for 5 seconds) ----- 60<P<70
- Flash point, Cleveland Open Cup °C ----- > 232°C
- Ductility at 25°C 5 cm per min. ----- > 100 cm
- Solubility in trichloroethylene ----- > 99%
- Loss on heating ----- < 0.8%
- Penetration of residue-----> 54% of original
- Ductility of residue at 25°C 5 cm per min.--- ----- > 50 cm

**6403 Mix Design**

(a) Mix Proportions

The Asphalt Concrete wearing course shall be continuously graded Asphalt Concrete wearing course as shown in Table 6403/3 for 19mm Nominal size Aggregate.

*Amend the Sub-clause as follows*

*(i) Continuously graded Asphalt Concrete wearing courses*

*The Contractor proposes to use a nominal maximum size of 19 mm for continuously graded asphalt concrete (AC) wearing course, whichever is appropriate to be decided on site based on ‘job mix’ formula; and the particle size distributions, as per ERA STS – 2013, Table 6403/3 shall be used.*

(b) Mix Design Specifications for Conventional Asphalts and Macadam’s

*The AC wearing course mix design shall be designed to the Asphalt Institute (MS-2, 1994) Marshall criteria as shown in the table below:*

Table 6403/14: AC Wearing Course Specification

Category and design (million ESA)	No. of blows of Marshall Hammer	Min. Stability (N)	Flow (mm)	VFB (%)	VIM at optimum bitumen content (%)
T4 (1.5 – 3.0)	75	8000	2-3.5	65-75	4

6416 Measurement and Payment

Bill Item No.	Description	Unit
Item 64.02	Asphaltic surfacing	
a)	Continuously graded asphalt concrete, Pen. Grade 60/70, 50 mm thick	m <sup>2</sup>

*The tendered rates shall include full compensation for procuring, furnishing, transporting, heating, mixing, placing and compaction of all materials as specified as well as process control testing, protecting and maintaining the work. No differentiation in unit rate between the works carried out on relaxed or restricted areas or on bridge decks.*

Bill Item No.	Description	Unit
Item 64.05	Binder variations	ton

*The unit of measurement in respect of increases or decreases in the bituminous binder from that specified in the nominal mix shall be the ton.*

Bill Item No.	Description	Unit
Item 64.07	Trial sections	m <sup>2</sup>

*The tendered rate shall include full compensation for the construction of the trial section of asphaltic Layer.*

*Delete Item 64.09 Asphaltic surfacing on bridge decks*

*(a) Continuously graded (60/70 penetration grade)..... Square meter (m<sup>2</sup>)*

*It is deemed that payment for item 64.09 is included in Item 64.02.*

6416 Measurement and Payment

*Add the following below the last paragraph:*

*No additional direct payment shall be made for restricted area.*

**SERIES 8000 STRUCTURES**

**DIVISION 8100: FOUNDATIONS FOR STRUCTURES**

**8102 MATERIALS**

**(a) General**

Materials used in the permanent foundation work shall comply with the requirements specified for the particular material in series 8000 of the Specifications.

**(b) Rock (for rock fill)**

Stones shall be hard, angular, field or quarry stones of such quality that they will not disintegrate on exposure to water or weathering. The stones shall be free from overburden, shale, and organic material. Neither the breadth nor thickness of a single stone shall be less than one-third its length.

Not more than 10% of the total volume of rock fill shall consist of stones having a mass of less than 0.5 of the mass specified and not more than 10% of the total volume of rock fill shall consist of stones having a mass more than 5 times the mass specified. Not less than 50% of the total volume of rock fill shall consist of stones larger than the specified mass.

**8105 EXCAVATION**

**(a) General**

This work shall include excavations required for the foundation of structures as well as for the excavations required for existing bridges and culverts where these have to be demolished, extended or modified; and are not provided for elsewhere in these Specifications,

The Engineer may require additional excavation to that described in the Contract to remove any pockets of soft soil or loose rock. The resulting voids and any natural voids shall be filled with Class 20/20 concrete complying with the requirements of Clause 8404 of these specifications; or other material as instructed by the Engineer.

No trimming of the sides of the excavation shall be carried out within 24 hours of the placing of any blinding concrete.

Any additional excavation below the bottom of foundations, including that resulting from removal of material which the Contractor has allowed to deteriorate, shall be replaced with Class 20/20 concrete complying with the requirements of Division 8400 of these specifications; or other material as instructed by the Engineer.

The sides of the excavation for foundations for structures shall either be vertical or sloped at a safe angle for the material to be excavated. Except in rock, vertical sides shall be adequately supported at all times to the satisfaction of the Engineer.

All practical measures shall be taken to prevent the ingress of surface water into the excavated foundations. Any water collecting in the excavated foundation shall be removed as soon as possible thereafter.

**(b) Ground surface for excavation**

Prior to commencement of any excavation, the Contractor shall notify the Engineer in good time to ensure that measurements, cross sections and levels of the undisturbed ground can be taken in order that an average ground surface level from which the excavation is to be measured can be established and agreed upon between the Engineer and the Contractor.

**(c) Excavation**

Where, in the opinion of the Engineer, the casting of concrete against the excavated earth faces is not permissible, or where formwork has to be provided, the extremities of the excavation, for purposes of measurement and payment, shall be deemed to be the vertical planes parallel to, and 0.6m outside, the perimeter of the member for which formwork is to be provided.

Where suitable stable material is encountered during excavation, that part of the trench or foundation pit shall be excavated to the neat dimensions of the base unless directed otherwise by the Engineer.

Over excavation (over-break) in hard material shall be backfilled with the same class of concrete as that in the base or with mass concrete fill as specified or as directed by the Engineer.

Where blasting is required, the Contractor shall complete the entire foundation excavation before the commencement of the construction of any permanent concrete work, unless otherwise approved by the Engineer.

The Contractor's attention is drawn to the general requirements for blasting as specified in Clause 1210.

Boulders, logs, or any other unsuitable material excavated shall be spoiled.

When hard material suitable for foundation is encountered at the foundation level, it shall be cut and trimmed to a firm surface, either level, stepped or serrated, as required.

Where the material at the foundation level is soft material or hard material that deteriorates rapidly on exposure, excavation to final grade and elevation shall not be made until just before the blinding layer is placed.

Where, in the opinion of the Engineer, unsuitable material is encountered at foundation level, such material shall be removed and replaced with foundation fill in accordance with Clause 8109 and as directed by the Engineer.

**(d) Classification of excavated material**

Distinction shall be made for payment purposes between excavation in hard and soft material. All excavation for the foundations of structures shall be classified in accordance with the following classifications:

(i) Hard material

Material, which cannot be excavated except by drilling and blasting, or the use of pneumatic tools or mechanical breakers shall be classified as hard material.

(ii) Soft material

All material not classified as hard material shall be classified as soft material.

**8108 BACKFILL AND FILL NEAR STRUCTURES**

**(a) General**

In placing backfill and fill, the following precautions shall be taken:

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- The material shall be placed simultaneously, in so far as is possible, to the same elevation on both sides of an abutment, pier, or wall where appropriate.
- If conditions require placing backfill or fill appreciably higher on one side than the other, the additional material on the higher side shall not be placed until authorised by the Engineer and preferably not until the concrete has been in place 14 days; or until tests show that the concrete has attained sufficient strength to safely withstand any pressure created by the backfill or fill or the method of construction.
- The material behind abutments restrained at the top by the superstructure (eg portal type structures) shall be placed as stated on the Drawings or as directed by the Engineer.
- The material behind the walls of concrete culverts shall not be placed until the top slab is placed and cured, unless otherwise authorised by the Engineer.

**(b) Backfill**

Excavated areas around structures shall be backfilled with approved material in horizontal layers, not exceeding 150 mm in depth after compaction, to the level of the original ground surfaces. Each layer shall be moistened or dried to optimum moisture content for the material and compacted to a density of not less than 93% modified AASHTO.

**(c) Fill**

To prevent wedge action against the structure and bounding slopes, the slopes shall be benched or serrated. In no case shall the toe of the bounding fill be closer to the concrete face than the height of the exposed face of the abutment or wall.

**(d) Select Granular Backfill**

Select granular backfill shall be sound, durable, granular material free from organic matter or other deleterious material (such as shale or other soft particles with poor durability

**DIVISION 8200: FALSE WORK, FORMWORK AND CONCRETE FINISHES**

**8204 DESIGN AND CONSTRUCTION REQUIREMENTS**

**(b) Design**

i. General

*Insert an additional paragraph as follows:*

“In the design the Contractor shall include for all personnel and workmanship related safety requirements of local and national statutes etc. and for any safety related requirements of the Engineer.”

**(c) Construction**

iii. Formwork

Add the following at the end

- “Formwork to faces of structures with a gradient equal to or greater than ten vertical to one horizontal shall be classified as vertical formwork.
- Formwork to faces of structures with a gradient of less than ten vertical to one horizontal, or equal to or greater than one vertical to ten horizontal, shall be classified as inclined formwork.
- Formwork to faces of structures with a gradient of less than one vertical to ten horizontal shall be classified as horizontal formwork.”

**8205 FORMED SURFACES: CLASSES OF FINISH**

**(d) Class F3 surface finish**

---

Add the following at the end

- The use of steel forms shall be permitted to form surfaces for which Class F3 surface finish has been specified, provided that only undamaged forms shall be used for such work and that the forms shall be subject to the approval of the Engineer.

#### **8207 UNFORMED SURFACES: CLASSES OF FINISH**

Add new Sub-Clause (d):

##### **(d) Surface finish to bridge decks**

- The surface shall initially be finished as Class U2 and shall then be textured by drawing a stiff broom lightly across the surface with adjacent strokes slightly overlapping all to the approval of the Engineer. The lines so formed shall be perpendicular to the road center line.
- Brooming shall be carried out after the initial concrete set but while it is still soft enough to take an impression and shall be executed so that the corrugations formed on the surface are uniform and not more than 1.5 mm in depth.
- Brooming shall be completed before the concrete is in such condition that the surface will be torn or unduly roughened by the operation. If the Contractor fails to finish the brooming in sufficient, time to avoid such damage to the surface they shall stop brooming and (a) propose another method of texturing the surface and (b) rectify any damage to the concrete surface which has occurred.
- The surface thus finished shall be free from rough and porous areas, irregularities and depression

#### **DIVISION 8300: STEEL REINFORCEMENT FOR STRUCTURES**

##### **8302 MATERIALS REQUIREMENT**

###### **(a) Steel Reinforcement**

Deformed and plain carbon steel reinforcing bars shall conform to the requirements of AASHTO M-31 and ASTM A615.

Low alloy steel, deformed and plain billet steel bars, for concrete reinforcement shall be Grade 60 to ASTM A 706. The nominal area of the bar, as given in Table 1 of AASHTO M-31 or ASTM A 706, shall be used for computation. Steel fabric reinforcement shall comply with AASHTO M-225, M-221 or M-54 as appropriate.

Hard drawn mild steel wire reinforcement shall comply with AASHTO M-55, welded steel wire fabric for concrete reinforcement.

Deformed steel wire for concrete reinforcement shall comply with AASHTO M-225 and cold drawn steel wire for concrete reinforcement shall comply with AASHTO M-32.

###### **(f) Laps and Joints**

*Add the following at the end:*

No separate payment shall be made for laps and wastage in cutting.

#### **DIVISION 8400: CONCRETE FOR STRUCTURES**

##### **8402 MATERIALS**

###### **(a) Cement**

Cement used for structures shall be either ordinary Portland or sulphate resisting cement complying with the requirements of AASHTO M-85 or blended hydraulic cement complying with the requirements of AASHTO M-240 or Pozzolana cement manufactured within Ethiopia.

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**(d) Water**

Delete the third paragraph in its entirety and replace the following:

Table 1: Water quality requirement for concrete construction:

Chloride (as Cl <sub>2</sub> ) (ASTM D512)	400 max.
Sulfates (as SO <sub>3</sub> ) (ASTM D 516)	500 max
Alkali Carbonates and Bicarbonates	750 max
Total dissolved solid (ASTM D 1888)	2000 max
PH	7-9

**8403 STORAGE OF MATERIALS****(a) Cement**

Add the following after the last Paragraph of this sub-clause:

- “Provisions for storage shall be ample, and that each batch of cement received shall be stored separately in such a manner as to provide easy access for the identification and inspection of each shipment.

**8404 CONCRETE FOR STRUCTURES****(a) Concrete Grade and Class**

The Grade and/or Class of concrete used for structures shall be as described in the Contract. For each Grade of concrete the specified minimum 28-day cube and cylinder compressive strength in MPa shall be as given in Table 8404/1. The Class of concrete shall be defined by its Grade followed by the maximum size of aggregate.

NB: In table 8404/1, C15 is added in the first row:

Table 2: Concrete grade

Grade	Minimum 28 days Cube Strength (Mpa)	
	Cube	Cylinder
C15	15	12
C25	25	20
C30	30	24
C40	40	32
C50	50	40
C60	60	48

**8405 CONSTRUCTION REQUIREMENTS****(i) Consistency and Workability**

Add the following after the 4th paragraph

“The control on slump shall be as per the following guidelines.”

Table 3: Concrete slump

No.	Type	SLUMP (mm)
1	(a) Structures with exposed inclined surface requiring low slump concrete to allow proper compaction	25
	(b) Plain cement concrete	25
2	RCC structures with widely spaced reinforcements; e.g. solid columns, piers, abutments, footings, well staining	40 – 50

No.	Type	SLUMP (mm)
3	RCC structures with fair degree of congestion of reinforcement; e.g. pier and abutment caps, box culverts well curb, well cap, walls with thickness greater than 300 mm	50 – 75
4	RCC and PSC structures with highly congested reinforcements e.g. deck slab girders, box girders, walls with thickness less than 300 mm	75 – 125
5*	Underwater concreting e.g. bottom plug, cast-in-situ piling	100 – 200

\* Concreting underwater should include use of admixture to improve workability and no vibratory compaction is allowed.

#### 8406 HANDLING, PLACING AND COMPACTION OF CONCRETE

##### (a) General

*Add the following paragraphs at the end*

Bridge decks shall be cast in sections as indicated on the Drawings or as approved by the Engineer.

Balustrades and sidewalks on bridge decks shall only be cast/placed after completion of the deck and removal of the staging.

#### 8409 FINISHING PLASTIC CONCRETE

##### (b) Striking of form work

*Delete Table 8409/1 and replace with the following.*

Table 4: Minimum period for striking form works

No.	Type of formwork	Minimum period of striking
1	Vertical formwork to column walls and large beams	24 hrs
2	Soffit form work to slab	14 days
3	Props to slab	21 days
4	Soffit formwork to beams	21 days
5	Props to beams	28 days

#### 8410 CURING CONCRETE

*Add the following new paragraphs to the end of the clause:*

- Where curing by retention of formwork is used as the only method of curing the concrete, it must be left in place for the minimum period specified in Table 8204-1 but in no instance shall it be less than 7 days.
- The materials used for formwork shall take into account properties such as thermal insulation and moisture absorption when assessing the suitability of the material, to the approval of the Engineer.
- If impermeable curing membranes are to be used as a curing method, they shall be installed at the same time as formwork is removed and no portion of a concrete surface may be left unprotected for a period in excess of 2 hours.
- If the surface is an unformed finish e.g. top of deck slab, then the surface must be protected immediately by appropriate methods approved by the Engineer after it is finished, without damage to that surface, since it is vulnerable to plastic shrinkage cracking due to high rates of evaporation while the concrete is still in a plastic state.

- Plastic shrinkage and settlement shall not be permitted on any of the structural elements since it compromises the durability of the concrete.

#### **DIVISION 8900: STONE MASONRY STRUCTURES**

##### **8901 SCOPE**

This work shall consist of stone masonry structures and the stone masonry portions of concrete, steel, timber, and composite structures, constructed in conformity with the lines, grades, dimensions, and design shown on the Drawings; and in accordance with this Specification.

##### **8902 STONE MASONRY WALLS**

###### **(a) Plain Packed Stone Walls**

*Delete the existing Sub-Clauses and insert the following in their place:*

- “The foundation trench for the wall shall be excavated to a depth of not less than 300mm or to a depth to the approval of the Engineer to rock, or to another approved founding stratum with an adequate bearing capacity.
  - The foundation stratum shall be trimmed to form a clean, level and sufficiently hard bearing surface on which to hand lay the stone material, which shall consist of large selected stones of not less than 10kg, such that the stone blocks shall be stable when set on it. The stones shall be laid up on the bed to the lines and levels defined on the drawings or directed by the Engineer.
  - Flat stratified stones shall be laid individually in courses, with the largest dimension in the horizontal plane. The stones shall be firmly set against adjacent stones and shall be packed so as to stagger the joints.
  - No vertical joints shall extend through more than the course in which it is laid. Each stone shall be laid so that it is stable and well wedged into the rock fill mass.
  - Spalls shall be used to fill voids and stabilize both the stones and the whole mass but stones shall not bear upon any spalls.
  - Spaces between the hand-laid rock fill and a structure etc. shall be filled with hand tamped or rammed fill or filter material as directed by the Engineer. The top and ends of the walls shall be neatly finished with selected capping stones.
  - The whole shall form a neat and pleasing appearance with a tight, even surface
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**Series 9000: Ancillary Works**

**Division 9500: Road Traffic Markings, Rod Studs and Traffic Calming**

9502 Material

(c) Thermoplastic road marking material

Delete the paragraph under this Sub-clause entirely and replace it with the following:

The thermoplastic road marking material shall comply with the requirements of AASHTO M249 specification.

955 Measurement and payment

Item 95.01 Paint (Specify Road marking, retro- reflective road marking and/or Thermoplastic)

Amend pay item 95.01 as follows:

Item 95.0 Thermoplastic Road marking

95.01 (a) 100 mm wide white continuous and broken lines for centreline ..... Km

95.01 (b) 100 mm wide yellow continuous line for edge marking..... Km

95.01 (c) Lettering, symbols, traverse lines, painted islands and arrested markings (white or yellow color as directed by the Engineer) ..... m2

## **Environmental, Social, Health and Safety Requirements**

### **I. Scope**

The clause addresses issues pertaining to the safety, social, and environmental regulations that the Contractor must take into account for all employees and the community within the Tog-Wajaale River approach road corridor.

In order to accomplish this, the contractor will designate a specialized subcontractor who is capable of performing the aforementioned services and who has at least three years of experience working in a community in conjunction with local groups on environmental, social, and safety matters within the last five years. The Engineer/Employer must first approve the subcontractor's experience and qualifications before allocating him or her to the assignment.

### **II. General**

In general, the subcontractor shall prepare and implement the environmental, social, and safety compliances, which shall include but not be limited to those listed below in each category, in accordance with the national and international ratified environmental and social safeguard policy and regulatory considerations for its construction projects, with road projects attracting the highest priority.

1. Environmental Regulatory and Policy Considerations: The subcontractor shall undertake and execute the following:
    - Regulations pertaining to Environmental Impact Assessments (EIAs): Complete an extensive EIA and secure the required permits.
    - Air quality standards: Adhere to worldwide and national air quality regulations for pollutants such as NO<sub>x</sub>, PM, and others.
    - Vibration and noise limits: During construction, abide by the highest levels of vibration and noise that are permitted.
    - Water quality regulations: Comply with groundwater and surface water effluent discharge guidelines.
    - Waste management best practices: Make sure that hazardous and non-hazardous wastes are handled, stored, and disposed of properly.
    - Laws protecting wildlife and biodiversity: Reduce effects on vulnerable areas and endangered species.
    - Requirements for environmental reporting and monitoring: Put in place a reliable system for environmental reporting and monitoring.
  2. Social Regulation and Policy Considerations: The subcontractor in collaboration and coordination with the respective key stakeholders and local government shall undertake and execute the following:
    - Policies for land acquisition and resettlement: Adhere to national and international norms for equitable and just compensation.
    - Guidelines for community participation and consultation: Make sure that impacted communities are meaningfully consulted.
    - Rules governing labor and working conditions: Comply with both worldwide best practices and domestic labor legislation.
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- Requirements for occupational health and safety: Put in place extensive protocols for worker health and safety.
  - Policies promoting social inclusion and gender equality: Encourage accessibility and equitable opportunity.
  - Guidelines for the preservation of cultural heritage: safeguard and manage all archaeological and cultural treasures.
  - Requirements for the grievance resolution procedure: Provide impacted stakeholders with an efficient grievance redress mechanism.
3. National and/or Global Safeguard Regulations: The subcontractor shall undertake and execute the following where relevant:
- National environmental and social safeguard policies/regulations
  - World Bank Environmental and Social Framework (ESF)

The expenses of adhering to these environmental and social policies as well as legal requirements should be fairly reflected in the bill of quantities. This could involve: conducting surveys, studies, and evaluations; putting mitigation and management measures into place; setting up monitoring and reporting systems; interacting with stakeholders and impacted communities; and making sure project staff members receive the necessary training and capacity building.

The Tog Wajaale River Approach Road Project with one-stop border posts requires close interaction with environmental and social specialists as well as relevant regulatory agencies to ensure thorough coverage of all applicable laws and regulations and an accurate cost estimate.

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**Key Personnel**

## Contractor's Representative and Key Personnel

No.	Position/specification	No.	Relevant academic qualifications	Total Work Similar Experience (years)	Experience in Similar Works (years)
1	Project Manager /Construction Manager	1	Minimum Bachelors Science Degree in Civil Engineering/ equivalent, Registered Engineer by equivalent with a minimum of 15 years of total experience and at least 10 years in road construction project management.	10	7
2	Assistant Project Manager	1	Minimum Bachelors Science Degree in Computer science/ equivalent, Registered IT professional by equivalent with a minimum of 7 years of total experience and at least 5 years in road construction project management.	7	5
		1	Minimum Bachelors Science Degree in Civil Engineering/ or equivalent, Registered Engineer/ equivalent with expertise in road construction with at least 7 years experience.	7	5
3	Material Engineer	1	Minimum Bachelors Science Degree in Civil Engineering/equivalent, Registered Engineer by ERB/equivalent with at least 5 years experience.	7	5
4	Plant/Equipment Manger	1	Higher Diploma in Mechanical Engineering	7	3
5	Land Surveyor	1	Bachelors Degree in Surveying/ Geodesy, Registered Surveyor/equivalent with at least 3 years of experience in engineering survey.	7	3
6	Quantity Surveyor/Measurement Engineer	1	Bachelors Degree in Quantity Surveying/Building Economics or Civil Engineering or equivalent qualification with at least 5 years in engineering works.	8	5

Section VII – Works Requirements

No.	Position/specialization	No.	Relevant academic qualifications	Total Work Similar Experience (years)	Experience in Similar Works (years)
7	Quality Control and Assurance Officer	1	Bachelor Degree/Higher National Diploma in Civil Engineering or equivalent qualification with at least 3 years of experience in road construction.	5	3
8	Social, Health & Safety Officer	1	Bachelor Degree/ Higher National Diploma in Civil Engineering, Public Health Science or equivalent qualification with additional specialized training in Occupational Safety and Health	5	3
9	Site Forman	2	Roads: Ordinary Diploma/Higher Diploma in Civil Engineering	7	5
		2	Building Infrastructure: Ordinary Diploma/Higher Diploma in Civil Engineering		

**Key Equipment**

No.	Equipment Type and Characteristics	Minimum Number required
1	Bulldozer of at least 140 hp	2
2	Wheel Loader at least 120 hp	2
3	Excavator - 2.0 m3	2
4	Motor Grader at least 140 hp	1
5	14 m3 capacity Dump Truck	4
6	Concrete Mixer (750 Lt)	2
7	Concrete Mixer (500 Lt)	2
8	Concrete Vibrators	2
9	Plate Compactor	1
10	Vibro Rollers of 10tonnes capacity	2
11	Pneumatic Roller - 8 tonnes	2
12	Pedestrian Roller	1
13	Asphalt Plant - 70m3 per day or Portable Asphalt Plant	1
14	Asphalt Paver	1
15	Stone Crusher - 50 tonne/hr with drilling and Blasting Equipment	1
16	Mobile Materials Testing Laboratory	1
17	Mechanical Broom	1
18	Portable dewatering pump	1
19	Safety Equipment (gloves, gum boots, helmets, eye protection goggles, reflective jackets, fire extinguishers, etc)	As required
20	5000 lts water tanker	2
21	Water bowser of more than 8,000 lit	2
22	Generators	2
23	Low bed	1

Drawings

*[Drawings are attached in separate Volume i.e., Volume II].*