SERIES 1000: GENERAL

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DIVISION 1100 : TERMS AND DEFINITIONS

1101 DESCRIPTION

In this Specifications the following terms, words or expressions shall have the meanings hereby assigned to them. For clarify and ease of understanding, certain cross-sectional and pavement structure elements are illustrated in figures 1, 2 and 3.

1102 TERMS AND DEFINITIONS

Aggregate

Hard mineral elements of construction material mixtures, for example: sand, gravel (crushed or uncrushed) or crushed rock.

Anchorage

Anchorage is the device comprising all the components and materials required for retaining the force in a tensioned tendon and to transmit this force to the concrete of the structure.

Anchorage reinforcement

Anchorage reinforcement is the spiral and other reinforcement which forms part of the anchorage and is required for strengthening the anchorage and/or assisting in transmitting the tendon force to the concrete.

Angle of Slope

Unless otherwise stated, is given in terms of the ratio of the vertical difference in elevation between any two points and the horizontal distance between them.

This ratio may also be expressed as a percentage.

Arising Tool

A tool used to round off the edge of a concrete slab.

Asphalt

A mixture to predetermined proportions of aggregate, filler and bituminous binder material prepared off the road and usually placed by means of a paving machine.

Asphalt Concrete

A mixture to predetermined proportions of aggregate, filler and bituminous binder material plant mix and usually placed by means of a paving machine.

Asphalt Surfacing

The layer or layers of asphalt concrete constructed on top of the road base.

Back Fill

Excavated material, which is placed and compacted in trenches and around foundations.

Base

A layer of material constructed on top of the sub base, or in the absence thereof, the selected layer. A base may extend to outside the travelled way.

Batter Board

A board of wood fixed to posts at the top of cuttings or the bottom of embankments which indicates the slope at which the cutting or embankment is to be constructed.

Binder

A material such as bitumen, cement or lime, which is added to and mixed into aggregate, granular materials or soils to bind the mixture together.

Bitumen

A class of black or dark-coloured (solid, semisolid, or viscous) cementitious substances, natural or manufactured, composed principally of high molecular weight hydrocarbons, of which asphalts, tars, pitches, and asphaltites are typical.

Bond breaker

Bond breaker is the coating or sheath placed on a tendon to prevent it from bonding to the surrounding concrete.

Bond Stone

A bond stone is an elongated prismoidal stone incorporated with the longest dimension at right angles to the face of a masonry structure to provide structural integrity.

Borrow Area/Borrow Pit

An area, within designated boundaries, outside the Permanent Works, approved for the purpose of obtaining fill or pavement materials. A borrow pit is the excavated pit in a borrow area.

Borrow Material

Borrow material is a general term used to describe material obtained from a borrow pit.

Boulder

A fragment of rock, usually rounded by weathering or abrasion, with a minimum dimension of 200mm or more.

Bridge

A structure erected over a depression, river, watercourse, railway line, road or other obstacle for carrying motor, railway, pedestrian or other traffic or services and having a length, measured between abutment faces along the centreline of the superstructure, of 6 metre or more.

Bursting reinforcement

Bursting reinforcement is the reinforcing steel required in and adjacent to the anchorage zones to resist the tensile stresses induced in the concrete by the anchorage(s).

Cable

Cable is the tendon. together with the anchorage, sheathing and all fittings.

California Bearing Ratio (CBR)

The California Bearing Ratio (CBR) of an untreated soil or gravel as determined by means of Method A8 of TMH1 is the load in Newtons, expressed as a percentage of California standard values, required to allow a circular piston of 1,935 mm^2 to penetrate the surface of a compacted material at a rate of 1.27 mm per minute to depths of 2.54 , 5.08 and 7.62 mm.

The California standard values for these depths are 13.344, 20.016 and 25.354 kN respectively.

Capping Layer

A layer of selected fill material placed on the top of the topmost embankment layer or the bottom of excavation.

Carriageway

That portion of the roadway including the various traffic lanes and auxiliary lanes but excluding shoulders.

Catchwater Drain or Bank

A longitudinal drain or bank outside the road prism for diverting water that would otherwise flow into the road prism.

Cemented Material

Material in an existing pavement which cannot be broken up with the tines of a type 1400 caterpillar or similar road grader.

Cemented crushed stone is cemented material constructed with crushed stone.

An existing stabilized pavement layer will not necessarily be classified as cemented material.

Channel

A natural or artificial water course.

Characteristic strength

Characteristic strength of prestressing steel is the manufacturer's guaranteed tensile strength below which no more than 5 per cent of the test results in a statistical population shall fall.

Characteristic Strength of Concrete

The characteristic strength of concrete is that strength below which only a pre-selected proportion of test results (i.e 1%, 2% or 5%) are expected to fall.

Chippings

Chippings are single sized particles of crushed rock, crushed boulders, crushed cobbles or crushed gravel used for surface dressing.

Coarse Aggregate

Coarse aggregate is material retained on the 4.75mm sieve.

Cobble

A fragment of rock, usually rounded by weathering or abrasion, with a minimum dimension of 60mm and a maximum dimension of 200mm.

Coefficient of Uniformity

The coefficient of uniformity is the ratio of the sieve size through which 60% by mass of the material passes to the sieve size through which 10% by mass passes.

Compliance Testing

Testing of the completed works to ascertain compliance of the requirements of the Specification.

Coupler

Coupler is the device comprising all components required to join up two tendons.

Crushed Particle

A crushed particle is a particle of coarse aggregate, which has at least three fractured faces when obtained by crushing rock and boulders, and at least two fractured faces when obtained by crushing gravel.

Crushed Ratio

The crushed ratio is the percentage of crushed particles of coarse aggregate in the total number of particles of coarse aggregate.

Culvert

A drainage structure which provides an opening under the carriageway or median for the passage of water.

Curing Compound

A liquid which is applied as a surface coating to (newly placed) concrete and hardens to form a membrane that inhibits the evaporation of moisture from the concrete.

Cut

Cut shall mean all excavated material from the road prism including side drains.

Cutting

That portion of the road prism from where material is excavated to sub-grade or road bed level.

Deflector

Deflector is the device used to deflect a tendon alignment within a structural element.

Duct

Duct is the void formed to house the tendon (s) and may be formed by coring, or by using sheaths or by way of extractable cores.

Earthworks

The excavation of material from cuttings and/or the construction of embankments.

Embankment

That portion of the road prism composed of approved fill material, which lies above the original ground and is bounded by the side slopes, described in the Contract, extending downwards and outwards from the outer shoulder breakpoints and on which the pavement is constructed.

Equipment

All machinery, together with the necessary supplies for upkeep and maintenance, and also all tools and apparatus necessary for the proper construction and acceptable completion of the work.

Excess Overburden

Overburden within a borrow area which is not required or is unsuitable for use in construction.

False work

Support for concrete formwork.

Fill

Material which is used for the construction of embankments.

Filler

Processed or naturally occurring material passing the 75 micron sieve which is principally used to improve the combined aggregate grading and thus reduce the air voids content of bituminous mixtures.

Fine Aggregate

Fine aggregate is crushed or naturally occurring material passing the 4.75mm sieve.

Footway

An area normally adjacent to the carriageway provided for the use by pedestrians.

Formwork

Temporary boarding or sheeting erected to contain concrete during placing, compacting and initial hardening.

Furrow Ditch

A longitudinal drain or bank outside the road prism for diverting water that would otherwise flow onto the road prism.

Gabions

Gabions consist of woven steel mesh boxes or mattresses filled with stone.

Grade line

The grade line is a reference line in the drawings of the longitudinal sections of the road indicating at regular intervals the elevations according to which the road is to be constructed. The grade line may refer to the level of the completed road, base or any other layer and may indicate the elevations either along the carriageway center line or along any designated position on the road cross-section.

Grading Modulus(GM)

The cumulative percentages by mass of material in a representative sample of aggregate, gravel or soil retained on the 2.00mm, 0.425mm and 0.075mm sieves, divided by 100.

Gravel

Gravel is naturally occurring, rounded, granular material with a particle size of from 2mm to 60mm. (It does not apply to Gravel Wearing Courses).

Grout Check

A recess formed at concrete construction joints, which may be filled with grout; to mask, and ensure a straight line to, the joint.

Highway

A general term denoting a public way for purposes of vehicular travel, including the entire area within the right -of - way.

Inlet and Outlet Drainage Channels

Channels leading into or discharging from culverts, storm-water drains and minor bridges.

Inspector

The authorized representative of the Engineer assigned to make detailed inspections of materials or contract performance.

Kicker

A concrete plinth at least 70mm high above the concrete floor, forming the start of a concrete wall or column.

Lane

Part of a travelled way intended for a single stream of traffic in one direction, which has normally been demarcated as such by road markings.

Leveling Course(s)

One or more layers of asphalt or granular material, of varying thickness, which are applied to improve the regularity of an existing road surface.

Lot

A sizable portion of work or quantity of material which is assessed as a unit for the purpose of quality control and selected to represent material or work produced by essentially the same process and materials.

Masonry

Stonework constructed with interlocking stones more than one stone thick.

Median

The area between the two carriageways of a dual carriageway road.

Median Drain

A longitudinal drain situated in the median of a dual carriageway road.

Milling

Excavating and removing a layer of material exceeding 10 mm in thickness from an existing pavement by means of an approved milling machine. Milling is normally used only in asphalt and cemented layers.

Mitre Drain/Mitre Bank

A Mitre Drain is a drain constructed at an angle to the centreline of the road to divert water from the side drains. Mitre drains will include mitre banks placed across side drains.

Mortar

A mixture of fine aggregate, cement and/or hydrated lime usually in predetermined proportions, with water, to create a fine grained cementious material suitable for the bedding of bricks and masonry etc.

Optimum Moisture Content for Compaction

The moisture content of a soil calculated on the basis of dry weight of soil at which the soil can be compacted to the approximate maximum density under a specified standard method of compaction.

Overburden

Overburden is unsuitable material which overlies suitable material within a borrow pit or quarry.

Overlay

An additional pavement layer applied on top of an existing road for strengthening the pavement and/or for improving the riding quality.

Parking Lane

An auxiliary lane adjoining the travelled way for the purpose of vehicular parking.

Pavement

A multi-layered horizontal structure which is constructed for the purpose of carrying traffic.

Pavement Layers

The layers of different materials, which comprise the pavement structure.

Pavement Planning

Planning of an existing road surface by the removal of a layer of material by means of a milling machine or other equipment.

Pioneer Layer

An initial layer constructed over a weak roadbed where selected material is used to provide a stable platform for the construction of subsequent layers.

Prestress

Prestress is the stress induced in concrete by tensioned tendons.

Prestressed concrete

Prestressed concrete is structural concrete in which effective internal stresses are induced by means of tensioned tendons.

Pre-stressing

Pre-stressing is the inducement of compressive stress into a structural concrete element either by pre-tensioning or post-tensioning tendons comprising of cables, wires or bars incorporated into the element.

Pre-tensioned concrete

Pre-tensioned concrete is prestressed concrete where the tendon is tensioned before the concrete has been cast.

Post-tensioned concrete

Post-tensioned concrete is prestressed concrete where the tendon is tensioned after the concrete has hardened.

Prime Coat

A bituminous treatment applied to the surface of a newly constructed unbound road base prior to the construction of a bituminous layer or surface treatment.

Project Specifications

The specifications relating to a specific project, which form part of the contract documents for such project, and which contain supplementary and/or amending specifications to the standard specifications.

Pull-in

Pull-in is the elastic shortening of the tendon caused by relative movement between the anchorage or coupler components on account of seating and gripping action during or immediately after transfer.

Quality Control

Procedures, and/or testing, carried out prior to, or during, the construction of the Works for the purpose of ensuring compliance with the requirements of the Specification.

Quarry

An area within designated boundaries, approved for the purpose of obtaining rock.

Recycling

The processing of salvaged material in a plant for re-use.

Rehabilitation

Work undertaken to significantly extend service life and improve the condition or riding comfort of an existing road.

Reinforcement for Asphalt

A cloth or grid of synthetic material placed underneath or between asphalt layers for strengthening the asphalt.

Release

Release is the specified elastic shortening of the tendon at the anchorage achieved before or during transfer.

Retexturing

Treatment of an existing road surface to restore the texture to a specified depth of texture or skid resistance.

Right-of - Way

The land secured and reserved by the Department for the construction and maintenance of highway.

Rip-rap

Unbonded stone provided to protect the surfaces of slopes and the beds of watercourses from erosion and scour.

Road Base

A layer of material of defined thickness and width constructed on top of the sub-base, or in the absence thereof, the sub-grade. A road base may extend beyond the carriageway.

Road Bed

The natural in-situ material on which the embankment or capping layers are to be constructed.

Road Bed Material

The material below the road bed extending to such depth as affects the support of the embankment structure or capping layer.

Road Prism

The cross sectional area bounded by the original ground level and the sides of slopes in cuttings and embankments excluding the pavement.

Roadside

The portion of the highway outside the roadway.

Road Reserve

The entire area (Carriageways, median, side drains and catch water drains) included by the boundaries of a road as proclaimed.

Roadway

The roadway comprises the carriageway, shoulders and median.

Rock

A mass of hard mineral material which, when excavated, requires the use of explosives, sawing or splitting by mechanical means.

Roller Passes

Unless otherwise specified in the specifications or the project specifications, an area will be taken to have received one roller pass when a roller has passed over such area once. Additional passes made only as a result of nominal overlapping so as to ensure full coverage shall not be taken into account.

Scabbing

The use of a hand-held or self supporting percussion machine to remove the surface of hardened concrete without damaging the structure.

Scarify

Loosen and break-up soil or existing pavement layers by means of a machine fitted with tines.

Screed

A layer of fine-graded asphalt or slurry placed to fill in slacks in existing seals and to improve the riding quality of the road.

Seal

The application of one or more layers of bituminous binder with or without layers of crushed stone, sand or slurry in successive layers on the carriageway, shoulders or on any other compacted layer on which movement of traffic takes place.

Selected Layer

The lower layer or layers of the pavement, which is constructed, direct onto the fill, or in some cases the roadbed. It may include roadbed material compacted in- situ.

Services

Cables, pipes or other structures to provide, inter alia, conduits for electricity, telephone and telegraph connections, water, sewage, etc.

Sheath

Sheath is the tube or casing enclosing the tendon and which temporarily or permanently allows a relative movement between the tendon and the surrounding concrete

Shoulder

(a) When referring to this as a surface: The area between the outside edge of the travelled way and the shoulder breakpoint.

(b) When referring to this as a pavement layer: The upper pavement layer lying between the outside edge of the base and the shoulder breakpoint.

Shoulder Breakpoint

The point on a cross section at which the extended flat planes of the surface of the shoulder and the outside slope of the fill and pavement intersect.

Side Drain

A longitudinal drain offset from, and parallel to, the carriageway.

Side Fill

Side fill is either surplus or additional fill which is used to extend and flatten the slope of an embankment and which is often compacted to a lower standard than the former.

Sidewalk

The portion of the roadway primarily constructed for the use of pedestrians.

Skew or Skew Angle

The acute angle formed by the intersection of a line normal to the centerline of the roadway with a line parallel to the centerline of bents, piers or abutments of a bridge, or in the case of a culvert, with the centerline of the culvert barrels.

Slope

Unless otherwise stated, slope is given in terms of the ratio of the vertical difference in elevation between any two points and the horizontal distance between them. The ratio may also be expressed as a percentage.

Spalls

Chipped or splintered fragments of stone.

Specifications

The general term comprising all the direction, provisions and requirements contained herein, entitled "ERA Standard Technical Specification for Road Works -2001", together with such as may be added or adopted as supplemental specifications or as special provisions, and all documents of any description, including notes on plans, pertaining to the method and manner of performing the work or to the quantities and qualities of materials to be furnished under the contract.

Spoil (Material)

Surplus material originating from construction operations.

Stabilization

The treatment of pavement materials by the addition of lime or Portland cement.

Stone Pitching

A single course of stones placed on edge with spalls rammed into the spaces between the stones.

Structures

Bridges, culverts, catch basins, drop inlets, manholes, retaining walls, cribbing, end walls, buildings, sewers, service pipes, underdrains, foundation drains, and other miscellaneous items, which may be encountered in the work, and which are not classified herein.

Sub-base

The pavement layer of material of specified dimensions on top of the sub-grade and below the road base.

Subcontractor

Any individual, firm or corporation to whom the Contractor sublets any part of the contract.

Sub-grade

The surface upon which the pavement structure and shoulders are constructed.

Substructure

All of that part of the structure below the bridge seats or bellow the spring lines of concrete arches. Back walls and wing walls of abutments shall be considered as parts of the substructure.

Sub-surface Drain (Sub-soil Drains)

A covered drain constructed to intercept and remove sub-soil water. It includes all pipes and filter material in the drain.

Surface Dressing

The sealing or resealing of the surface of the carriageway or shoulders by means of one or more successive applications of bituminous binder and chippings.

Tack Coat

A bituminous treatment applied to the surface of an existing bituminous layer prior to the construction of a new bituminous layer.

Tendon

Tendon is the prestressing steel consisting of the bar, wire or strand individually placed, or of bars, wires or strands placed in a duct, all of which are tensioned to impart prestress to a concrete member.

Tensioning

Tensioning is the action of inducing and regulating the force in a tendon by means of tensioning and measuring equipment.

Texture Treatment

Treatment of an existing road surface to obtain a uniform texture.

Topsoil

A surface layer of soil, which contains organic matter and is capable of supporting the growth of vegetation.

Traffic

Vehicles, pedestrians and animals travelling along a route.

Traffic Lane

Part of a carriageway intended for a single stream of traffic in one direction, which has normally been demarcated as such by road markings.

Transfer

Transfer in the case of post-tensioned concrete is the action of transferring the tensioning force from the tensioning equipment (jack) to the anchorage.

Transfer in the case of pre-tensioned concrete is the action of transferring the force in the tensioned tendon(s) to the concrete.

Transmission length

Transmission length is the tendon length required to transmit via bond stresses the full force in the tendon to the concrete.

Travelled Way

That portion of the carriageway, which includes the various, traffic lanes and auxiliary lanes but exclude the shoulders.

Unbound Material

Naturally occurring or processed material, which is not bound together by the addition of a binder such as cement, lime or bitumen.

Verge

The area between the outer edge of the road prism and the boundary of the road reserve.

Wheel Track

The path followed by the wheel of a vehicle during normal riding movements. The wheel tracks cover approximately the outer meter width on both sides of a traffic lane.

Working Drawings

Stress sheets, shop drawings, erection plans, false work plans, cofferdam plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data which the contractor is required to submit to the Engineer for approval.

Work in restricted areas

No additional or extra over payment will be made for work in restricted areas, unless the items of work to which it will apply and the pay items under which payment will be effected, are explicitly specified in these standard specifications or in the project specifications and listed in the schedule of quantities.

Figure 1 Terms and Definitions for Road Cross Section Elements

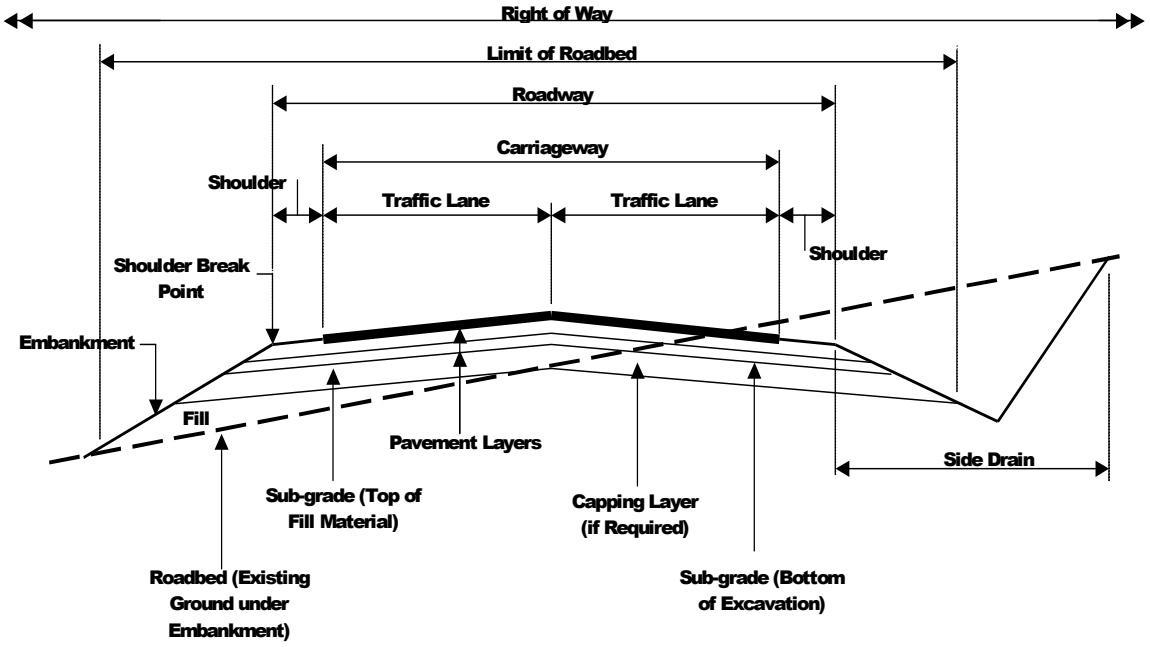


Figure 2 Terms and Definitions for Flexible Pavement Structure

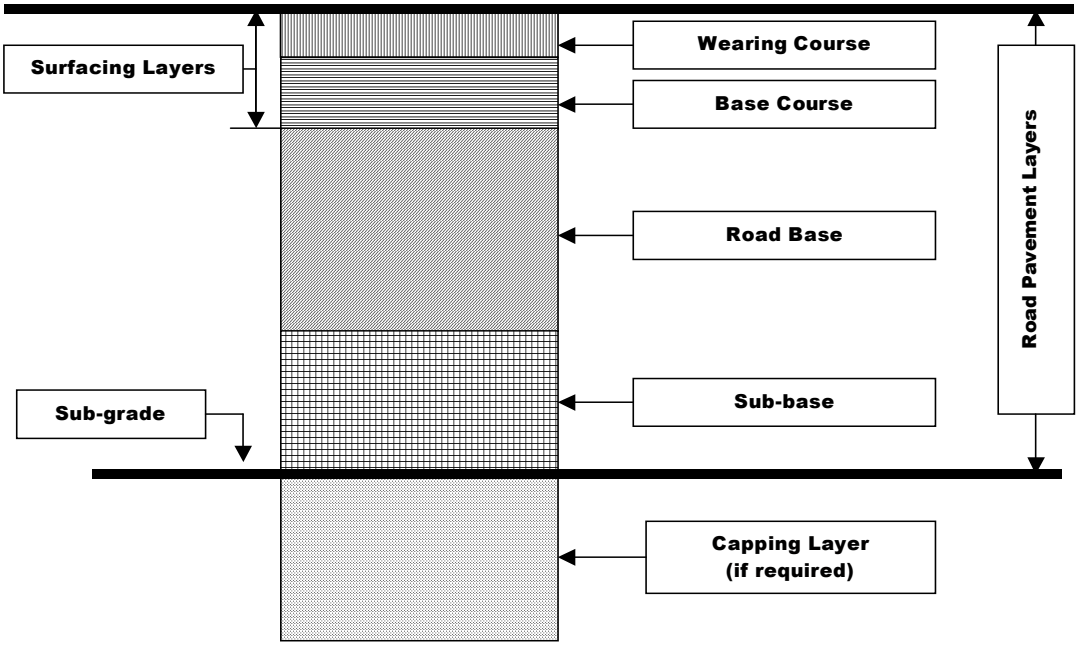
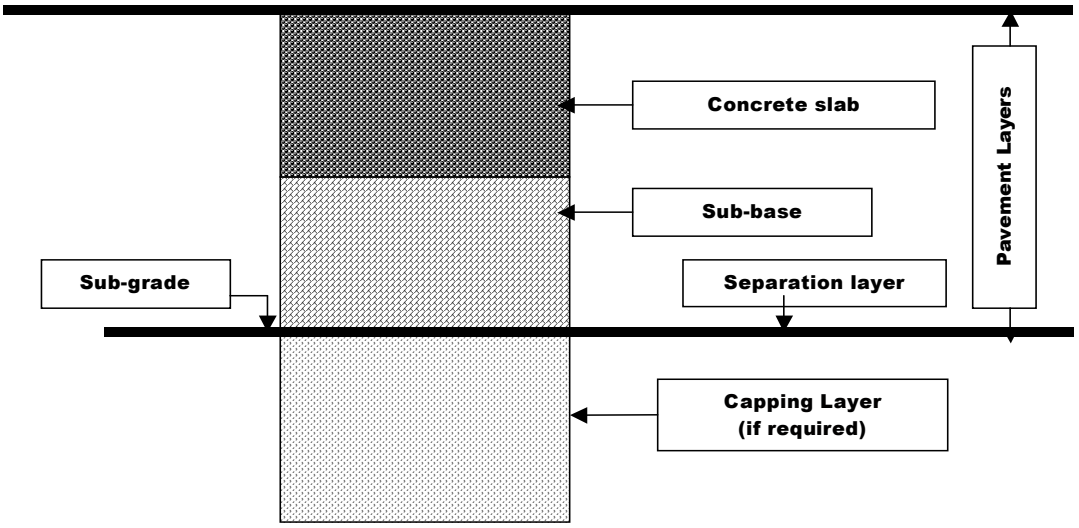


Figure 3 Terms and Definitions for Rigid Pavement Structure



DIVISION 1200: GENERAL REQUIREMENTS AND PROVISIONS

1201 SCOPE

This Division covers matters, which relate to the construction work as a whole. Definitions, phrases or wording, which would otherwise require repetition in other Divisions of the Specifications, are also covered by clauses in this Division.

1202 WORKMANSHIP AND QUALITY CONTROL

It is the Contractor's responsibility to produce work, which conforms in quality and accuracy of dimensions to the requirements of the Specification and Drawings. The Contractor must implement his own quality control system with experienced staff, together with all necessary facilities, to ensure adequate supervision and positive control of the Works at all times.

If the Engineer has any doubt concerning the quality of any material to be used in the Works, he shall instruct the Contractor to carry out tests to prove the quality of material before it is used in the Works. The results of tests, which are carried out by the Contractor, shall be submitted to the Engineer on request.

1203 APPROVAL OF COMPLETED WORKS

Unless otherwise instructed by the Engineer, the Contractor shall submit a request and obtain approval for each completed element of the Works and shall not proceed with subsequent elements until approval is granted. The Contractor shall give a minimum of 24 hours notice in writing to the Engineer to allow any inspection and testing to be carried out. Any approval given by the Engineer shall not relieve the Contractor of any of his obligations under the Contract.

The Contractor shall submit to the Engineer the results of all relevant tests, measurements, and levels indicating compliance with the Specification on completion of every part of the work.

1204 SETTING OUT OF WORK AND PROTECTION OF SURVEY MONUMENTS

The Contractor's attention is drawn to the requirements of Clause 17, Parts I and II of the Conditions of Contract regarding setting out of the Works.

The Contractor shall check the condition of all reference and level survey monuments and satisfy himself that they have not been disturbed and are true in regard to position and level. If survey monuments have been destroyed, disturbed or damaged before the Site is handed over to the Contractor, the Engineer will arrange to have new survey monuments installed. A survey monument, which has been disturbed, shall not be used unless its true position and level has been re-established and the new values have been verified by the Engineer.

Where a survey monument is likely to be disturbed during construction operations, the Contractor shall establish suitable reference survey monuments at locations where they will not be disturbed during construction. Survey monuments shall be established on steel pin set in concrete or another less permanent manner approved by the Engineer. No survey monument shall be covered over, disturbed or destroyed before accurate reference survey monuments have been established and details of the position and levels of such survey monuments have been submitted to the Engineer and approved by him. The Contractor's

reference survey monuments shall be of at least the same quality and durability as the existing survey monuments.

The Contractor shall submit to the Engineer the method of setting out he proposes to employ. The Engineer may at any time request the contractor to submit proof that his setting out has been satisfactorily checked.

If any trigonometry survey monuments, benchmarks or other land survey marks are disturbed or destroyed during construction they shall be replaced by the Contractor so as not to disrupt the Contractor's Programme.

Accurate control of line and level shall be provided by the Contractor at all stages of construction. In respect of the road itself control shall be at 20 m intervals, or such closer intervals as may be directed on horizontal and vertical curves. Wherever necessary, but particularly on completion of the subgrade and the base, the Contractor shall reestablish stake line pegs at sufficiently close intervals to determine accurately the edges of the base, surfacing and other road elements permanently exposed to the eye.

Setting out will not be measured and paid for directly and compensation for the work involved in setting out will be deemed to be covered by the prices tendered and paid for the various items of work included under this Contract.

1205 STANDARDS

American, British and Ethiopian standards are used in this Specification. In case of differences in requirements or applicability, American standards (AASHTO, ASTM etc.) shall take precedence with the exception of sieve sizes.

ISO sieves shall be used for all tests. In various standard test procedures quoted in this Specification, American or British sieves shall be replaced by the nearest ISO sieves. The standard sieve series, based on ISO 565, shall be as shown in Table 1200.

Table 1200-1 Standard Sieve Sizes

Aperture size	Superceded Designation	Aperture size	Superceded Designation
125 mm	5 in	2.80 mm	No.7
106 mm	4.24 in	2.36 mm	No.8
100 mm	4 in	2.00 mm	No.10
90.0 mm	3 1/2 in	1.70 mm	No.12
75.0 mm	3 in	1.40 mm	No.14
63.0 mm	2 in	1.18 mm	No.16
53.0 mm	2.12 in	1.00 mm	No.18
50.0 mm	2 in	850 μm	No.20
45.0 mm	1 3/4 in	710 μm	No.25
37.5 mm	1 1/2 in	600 μm	No.30
31.5 mm	1 1/4 in	500 μm	No.35
26.5 mm	1.06 in	425 μm	No.40
25.0 mm	1 in	355 μm	No.45
22.4 mm	7/8 in	300 μm	No.50
19.0 mm	3/4 in	250 μm	No.60
16.0 mm	5/8 in	212 μm	No.70
13.2 mm	0.530 in	180 μm	No.80
12.5 mm	1/2 in	150 μm	No.100
11.2 mm	7/16 in	125 μm	No.120
9.50 mm	3/8 in	106 μm	No.140
8.00 mm	5/16 in	90 μm	No.170
6.70 mm	0.265 in	75 μm	No.200
6.30 mm	1/4 in	63 μm	No.230
5.60 mm	No.3 1/2	53 μm	No.270
4.75 mm	No.4	45 μm	No.325
4.00 mm	No.5	38 μm	No.400
3.35 mm	No.6		

1206 PROTECTION OF THE WORKS AND REQUIREMENTS TO BE MET BEFORE CONSTRUCTION OF NEW WORK ON TOP OF COMPLETED WORK IS COMMENCED

The General Obligation of the Contractor in terms of the General Conditions of the Contract shall inter alia include the following:

(a) The provision of temporary drainage works such as drains, open channels, banks, etc. and the furnishing and operating of temporary pumps and such other equipment as may be necessary to adequately protect, drain and dewater the works and temporary works. This will be in addition to any permanent drainage works specifically paid for separately.

(b) Care shall be exercised not to allow material in borrow pits to become excessively wet, to keep all completed layers properly drained, not to cause dumps of material on completed layer work to inhibit surface drainage or to form wet spots under and around dumps, and to protect all parts of the work against erosion by floods and rain.

Material shall not be spread on a layer that is so wet as to result in the danger of damage being caused to the layer during compaction of a subsequent layer or when opened to traffic.

When material is spread out on the road, it shall, during wet periods, be given a good cross-fall, and a light compaction on the surface with a steel tired roller, in order to facilitate run- off during rainy weather.

(c) Fill and cut slopes shall be promptly repaired whenever damaged by surface water. Where erosion occurs on high fill, the slopes shall be repaired by cutting back to form benches and compacting the back fill mechanically to the specified controlled densities, using suitable small equipment.

(d) Excavations for pipe drains, culverts, sewer drains, water mains, manholes, service ducts, and similar structures shall be adequately protected against the possible ingress of water during rainstorms.

(e) All completed layer work shall be protected and maintained until the following layer is applied. Maintenance shall include immediate repairs to any damage or defects, which may occur and shall be repeated as often as is necessary to keep the layer continuously intact and in a good condition.

(f) Before any completed layer is primed or a succeeding layer constructed thereon, any damage to the existing layer shall be repaired so that after repair or reconstruction if necessary, it will conform in all respects to the requirements specified for that layer. All repair work other than minor surface damage repairs shall be submitted to the Engineer for inspection before covering up.

The previously constructed layer shall also be thoroughly cleaned of all foreign material before construction of a succeeding layer or application of a prime coat, surfacing or surface treatment. In the case of all bituminous work in particular, the existing layer shall be thoroughly broomed and all dung, clay, mud, and other deleterious material completely removed. Where necessary, the surface shall be sprayed with water before, during, and after brooming to remove all foreign material.

Work performed as part of the above obligations shall not be measured and paid for separately and the cost thereof is to be included in the prices tendered for the various items of work requiring protection and for the Contractor's establishment on Site as specified in Division 1300.

1207 EXISTING PUBLIC UTILITIES

The Contractor shall carry out the necessary investigations to identify the location of all existing public utilities within the right-of-way and provide accurate records of such to the Engineer prior to commencement of the Works.

The Contractor shall notify the Engineer, and provide accurate records, of any public utilities encountered during the execution of the Works. He shall take all necessary steps to prevent damage to and safeguard any such services.

The Contractor shall co-operate with the public utility authorities in the removal and relocation of any underground or overhead services or facilities so as to safeguard and minimize disruption to the services. In the event of a utility service being interrupted as a result of damage caused by the Contractor, the Contractor shall promptly notify the authority concerned and be responsible for the cost of any repairs that are required to restore the services.

1208 REMEDIAL WORK

Remedial measures shall ensure full compliance with specifications of the final product, shall not endanger or damage any other part of the Works and shall be carefully controlled.

For the guidance of the Contractor an indication is given below of what would normally be required in the more common cases of defects or damage, but the Engineer will in no way be bound to approve of or adhere to the measures given below as the actual remedial measures will be dictated by the circumstances of each particular case.

(a) Earthworks

Where a cut slope has been over-excavated or undercut, backfilling will not normally be allowed and the entire slope may have to be retrimmed to obtain a uniform slope.

Where the floor of a cut has been taken too deep, it will normally require backfilling and recompaction with selected gravel in the case of soil or gravel excavation and with crushed stone material or suitably sized rock in the case of hard excavations. All necessary measures shall be taken to drain away ground water that may accumulate in backfilled sections.

Excess width of fills will have to be trimmed down.

Where erosion has damaged the surface of cuts or fills the damage shall be made good by backfilling with suitable material and retrimming. In more serious cases the slopes may have to be cut back and backfilled by benching and compaction to the required standard of compaction with suitable small equipment and then retrimmed.

Where excavated material has been allowed to spill over the edge of existing slopes, this surplus material shall be removed and the vegetation of the slope reinstated.

(b) Stabilizing

Any sections failing to meet the requirements specified or damaged to the extent that they require breaking up and recompaction will have to be restabilized with the type and quantity of stabilizing agent ordered by the Engineer. The Engineer may also order that the layer be removed entirely and replaced with fresh material to be stabilized.

(c) Local defects in pavement layers

Where remedial measures are taken to make good local defects, the length and width of the area to be repaired by machines shall be such as will be necessary to accommodate the full width of the machines used and a reasonable length to ensure effective operation.

The depth to which material will have to be removed will depend on the type of material. Gravel will require breaking up to a depth of at least twice the maximum particle size and crushed stone will usually require breaking up over its full depth. Asphalt material will normally require removal for its full depth.

(d) Concrete

Concrete work will normally require the cutting back and complete removal of any weak or honeycombed sections and making good using special epoxy adhesives to bind fresh concrete to old concrete. Cracks, when permitted to remain shall be injected suitable epoxy compounds and test cores drilled to test the efficiency of the injection process.

1209 WATER

The Contractor himself shall make arrangements for procuring, transporting, storing, distributing and applying the water needed for construction and other purposes, except where otherwise specified. No direct payment will be made for providing water, the cost of which shall be included in the rates tendered for the various items of work for which water is needed. Only clean water, free from undesirable concentrations of deleterious salts and other materials shall be used in the construction of the works. The Engineer must approve all sources of water used.

1210 USE OF EXPLOSIVES AND DEMOLITION

Generally the Contractor will be permitted to use explosives for breaking up rock and hard material during excavations, for demolishing existing structures and for such other purposes where it may normally be required, subject to the following conditions:

The Engineer shall have the power to prohibit the use of explosives in cases where, in his opinion, the risk of injury or damage to persons, property or adjoining structures is too high. Such action by the Engineer shall not entitle the Contractor to any additional payment for having to resort to other less economical methods of construction unless otherwise provided for in the Bill of Quantities.

The provisions of Division 1600 must be complied with.

Before any blasting is undertaken the Contractor, together with the Engineer, shall examine and measure up any buildings, houses or structures in the vicinity of the proposed blasting and establish and record together with the owner thereof the extent of any cracking or damage that may exist before commencement of blasting operations. It shall be the responsibility of the Contractor to make good at his own expense further damage to such houses, buildings or structures which is a result of the blasting.

Where there is reasonable danger of damage to power and telephone lines or any other property the Contractor shall suitably adapt his method of blasting, the size of charges and use adequate protective measures such as cover blasting in order to limit the risk of damage as far as possible.

Authorized personnel will carry out all charging and detonation of explosives.

The Engineer shall be advised, in writing, twenty four hours before each blasting operation is carried out, unless otherwise agreed with the Engineer.

The Contractor shall make arrangements at his own cost for the supply, transport, storage and use of explosives.

Legal provisions in regard to the storage, transportation and use of explosives and the requirements of the relevant authorities shall be strictly complied with.

1211 PHOTOGRAPHIC RECORDS

The Contractor shall make photographs and other records to be agreed by the Engineer of the condition of the surfaces of the Site immediately before entering upon them for the purpose of constructing the Works. He shall provide the Engineer with 3 prints each of any 36 photographs each month. No separate payment will be made for photographs and the cost shall be deemed to be included in other unit rates.

Each photograph provided shall comply with the following requirements:

(i) Prints shall be 125 mm x 100 mm.

(ii) The date of exposure shall be incorporated on the negative using a data-back system.

(iii) The back of each print shall be marked with an identification reference number, and the job title.

(iv) A list of titles indicating reference number, brief description, chainage, and direction of view shall be provided with each set of prints.

(v) Albums, approved by the Engineer, shall be provided for 2 sets of prints every month.

The Employer shall hold the copyright of all photographs and the negatives and prints shall be delivered to the Engineer within 28 days of exposure. The photographs will not be used for any other purpose whatsoever without the Engineer's approval.

1212 MEASUREMENT: GENERAL

The cost of all supervision and process control, including testing so carried out by the Contractor, shall be deemed to be included in the rates rendered for the related items of work except that the cost of certain tests and the provision of certain items of testing and sampling equipment will be paid for separately as provided for in those Divisions of the Technical Specifications where this applies.

(a) Units of measurements

All work shall be measured in accordance with the S.I. System of metric units.

(b) Bill of Quantities

The quantities set out in the Bill of Quantities are estimated quantities and are used for the comparison of Tenders and awarding the Contract. It must be clearly understood that only the actual quantities of work done or materials supplied will be measured for payment, and that the quantities may be increased or decreased as provided in the General Conditions of Contract.

(c) Measurement of completed work

(i) All distances along the center line of the roads as shown on the Drawings are horizontal distances which will be used in calculating the quantities of earthworks, pavement layers and surfacing and paving for payment purposes. All cross sections shall be taken in a vertical plane.

(ii) All materials, which are specified to be measured in the vehicle, shall be hauled in vehicles of such type and size that the actual contents may be readily and accurately determined. Unless all vehicles are of uniform capacity, each vehicle shall bear a plainly legible identification mark indicating its specific approved capacity.

(iii) Where the quantity of bituminous and similar materials is to be paid by volume, it shall be measured at the specified temperature.

(iv) Structures shall be measured to the neat lines shown on the drawings including any changes ordered in writing by the Engineer and shall include any reinforcing steel and minor ducts up to 150 mm in diameter.

1213 PAYMENT

(a) Contract Rates

In computing the final contract amount, payments shall be based on actual quantities only of authorized work done in accordance with the Specifications and Drawings. The tendered rates shall apply, subject to the provisions of the General Conditions of Contract, irrespective of whether the actual quantities are more or less than the billed quantities.

Where no rate or price has been entered against a pay item in the bill of quantities by a tenderer, it shall be understood that he does not require any compensation for such work.

(b) Rates to be inclusive

The Contractor shall accept the payment provided in the Contract and represented by the prices tendered by him in the Bill of Quantities, as payment in full for executing and completing the work as specified, for procuring and furnishing all materials, labour, supervision, plant, tools and equipment, for wastage, transport, loading and offloading, handling, maintenance, temporary work, testing, quality control including process control, overheads, profit, risk and other obligations and for all other incidentals necessary for the completion of the work and maintenance during the Period of Maintenance.

This Clause shall be applicable in full to all pay items except as these requirements may be specifically amended in each case.

(c) Meanings of certain phrases in payment clauses

“Procuring and furnishing.(pay item mentioned) material”

Where any of the words "supply", "procure" or "furnish (pay item mentioned) material” are used in the description of a pay item it shall mean the supply and delivery to the point of use of all materials of any kind required for the work covered by the particular pay items, including all tax, purchase costs, claims, damages, royalties and transport costs involved. In the case of borrow materials, stone and sand, it shall also include all negotiations with owners concerned, royalties, excavating, producing, preparing, processing, testing, hauling and delivering the material to the point of use; the construction, repair, maintenance and making good after completion of all access roads, and all work required in opening, using and finishing off borrow pits which is not covered by other pay items in the Bill of Quantities.

"Placing material"

The phrase "placing material" shall mean the offloading, spreading, blending, processing, watering, mixing, shaping and compacting (where specified) the material in the road prism, subbase, base, shoulders, banks and bypasses as well as procuring, furnishing, applying and admixing of water; breaking down oversize material, removing oversize material which cannot be broken down, correcting irregular or uneven surfaces or deficient thickness, finishing off to within the specified tolerances, refilling test holes and maintaining the completed work. In the case of asphalt courses and bituminous treatments it shall also mean the heating and spraying of binder, spreading of aggregate or asphalt mixtures, rolling, compacting, finishing off to within the specified tolerances and maintaining the completed work.

The phrase **"procuring, furnishing and placing" shall mean "**procuring and furnishing" in addition to "placing" all as defined hereinbefore.

(d) Pay items

The descriptions under the pay items in the various Divisions of the Specifications, indicating the work to be allowed for in the tendered prices for such pay items, are for the guidance of the Contractor and do not necessarily repeat all the details of work and materials required by and described in the Specifications.

These descriptions shall be read in conjunction with the relevant Specifications and Drawings and the Contractor shall, when tendering, allow for his prices to be inclusive as specified in Sub-clause (b) above.

(e) Provisional Sums and Prime Cost Items

(i) Provisional Sums

The Bill of Quantities may contain certain Provisional Sums so designated and entered as a preliminary allowance to cover the cost of work, materials, goods or services to be provided by the Contractor and which have not been fully specified or measured or to cover the cost of unforeseen items of work or contingent expenditure for which no rates are applicable but for which the Contractor is to be paid according to the applicable provisions of the Contract.

(ii) Provisional Items

Work done under a Provisional Item shall only be executed upon a written order by the Engineer which order shall also specify the method of payment. The expenditure in respect of a Provisional Item for work ordered by the Engineer shall be entirely at his discretion and any final expenditure in respect of a Provisional Item may be more, less or equal to the amount provided in the Bill of Quantities. Such an item may be an alternative to another item of similar or greater quantity.

Payment as specified in the order given by the Engineer shall be either at contract rates, where such are applicable, or where none are applicable, payment shall be in accordance with the provisions of Clause 52 "Extra Work" of the General Conditions of Contract. Where the method of payment is not according to any rates but contingent upon the provisions of the Contract, it shall be determined as specified and will not require an order in writing from the Engineer.

(iii) Prime Cost (P.C.) Items

The Bill of Quantities may contain Prime Cost (P.C.) Items, so designated, which are entered as a preliminary allowance to cover the cost of work, materials, goods and services to be provided by a nominated subcontractor or of articles or goods to be purchased by the Contractor in execution of a written order by the Engineer who may designate a particular source of supply or brand of article.

No expenditure or appointment of a subcontractor in respect of a P.C. Item will be authorized unless upon the written instructions of the Engineer. The amount authorized by the Engineer shall be entirely at his discretion and may be more, equal to or less than the amount entered in the Bill of Quantities.

Payment for a Prime Cost Item shall be as follows:

(i) the amount actually paid by the Contractor to the subcontractor or supplier, as the case may be, in execution of the Engineer's written order, plus

(ii) a percentage as tendered by the Contractor on the amount in (i) above to cover all his charges and profits.

The Contractor shall not be entitled to any further payments or to a fee, commission, rebate, discount or similar payment or consideration from the supplier or subcontractor and shall disclose and subtract such amounts from the amount claimed under (i) above.

(iv) Rate only items

Opposite to an item in the Bill of Quantities where no quantity is given but a "rate only" is required, the Contractor shall fill in a rate or price which will constitute payment for any work which may be done under this item. Such a "rate only" item is used where it is estimated that little or no work will be required under the item, or where the item is to be considered as an alternative for another item where a quantity is given, or for variations in rates of application or mix proportions in terms of Clause 1212 of this Division

1214 VARIATION FROM SPECIFIED NOMINAL RATES OF APPLICATION OR NOMINAL MIX PROPORTIONS

The various Divisions of the Technical Specifications prescribe nominal rates of application or nominal mix proportions for materials such as bituminous materials, aggregates, mineral fillers, stabilizing agents, paints and the like. Tenderers shall base their Tenders on these nominal rates of application and mix proportions.

Allowance is made in the various Divisions of the Technical Specifications where such rates of application and mix proportions are given, for variations arising out of different rates of application or mix proportions ordered by the Engineer to suit the materials and conditions on site in every particular case.

Where the actual rates of application or mix proportions, used in the Works, vary from the nominal specified rates or proportions, adjustment of compensation will be made:

(a) as a payment to the Contractor in respect of any authorized increase in quantities from those specified which has been ordered in writing by the Engineer;

OR

(b) as a refund to the Employer in respect of the decrease in quantities from those specified whether such decrease results from an authorized decrease in the rates of application or mix proportions, or whether it results from unauthorized reductions on the part of the Contractor.

Payment for a varied rate shall be based on the actual rate of application used, provided that this does not exceed the rate of application ordered by the Engineer plus any tolerance in the rate of application allowed. If the actual rate of application exceeds the above, payment shall be based on the rate of application ordered plus any tolerance allowed.

If the actual rate of application is below the rate of application ordered, payment shall be based on the actual rate of application regardless of any tolerance allowed. Notwithstanding the above the Engineer shall have the full authority to condemn work which has been constructed at variance with the Specifications or the rates of application ordered by him.

The Employer shall be refunded for any decrease in the specified rates of application or mix proportions at the same price per unit of measurement as that tendered by the Contractor for additional materials required by an increase in the rates of application of mix proportions.

1215 PAYMENTS AND TOLERANCES

The work specified in the various Divisions of the Specifications shall comply with the various dimensional and other tolerances specified in each case. Where no tolerances are

specified, the standard of workmanship shall be in accordance with normal good practice. No representation is made that the full specified tolerances will be available independently of each other and the Contractor is cautioned that the liberal or full use of any one or more tolerances may deprive him of the full or any use of tolerances relating to other aspects of the work. The latter would apply particularly in respect of level tolerances on layer work and the related requirements regarding layer thickness.

In the description of certain pay items, where it is stated that quantities will be determined from the "authorized" dimensions, this shall be taken to mean the dimensions as specified or shown on the Drawings or, if changed, as finally instructed by the Engineer, without any allowance for tolerances specified. If the work is therefore constructed in compliance with the "authorized" dimensions plus or minus any tolerances allowed, quantities will be based on the "authorized" dimensions regardless of the actual dimensions to which the work is constructed.

Where the work is not constructed in accordance with the "authorized" dimensions, plus or minus any tolerances allowed, the Engineer may nevertheless in his sole discretion accept the work for payment. In such cases no payment will be made in respect of quantities of work or material in excess of those calculated from the "authorized" dimensions and where the actual dimensions are less than the "authorized" dimensions, minus any tolerance allowed, quantities for payment shall be based on the actual dimensions as constructed.

DIVISION 1300: CONTRACTOR'S ESTABLISHMENT ON SITE

1301 SCOPE

This Division covers all work involved in the establishment of the Contractor's organisation, camp(s) and plant and equipment on or adjacent to the Site, and the removal thereof after completion.

1302 GENERAL REQUIREMENTS

(a) Camps, equipment and testing facilities

The Contractor shall establish his construction camp on or adjacent to the Site. This will include all accommodation, sanitary conveniences, maintenance and testing facilities necessary for his personnel, plant, equipment, stores, process control, etc.

He shall bring all necessary plant, equipment and personnel to the Site prior to the Commencement of the Works, and remove the same from the Site after completion of the work leaving all areas that have been occupied by him in a clean and tidy condition to the satisfaction of the Engineer/Supervisor.

It is the Contractor's responsibility to identify a suitable site, and the Employer to provide for the Engineer's office, laboratory accommodation and working areas, and camp sites for himself, his senior staff and his junior staff, houses, offices, labourers' accommodation, etc.

The choice of all sites for the establishment of camps shall be subject to the approval of the Engineer.

(b) Legal relations and responsibility to the public

The Contractor shall take steps necessary to comply with the terms of the General Conditions of Contract, particularly in respect of the insurances and indemnities required, and he shall comply with all regulations of Statutory Authorities.

(c) Electricity Supply

The Contractor shall provide and maintain at his own expense his own electrical supply. This supply must be adequate to supply the areas set aside for the housing of his staff and for his own and the Engineer’s Office, and for any housing of the Engineer’s staff.

The Contractor shall provide and maintain all necessary temporary power and lighting and all associated apparatus for the duration of the Contract at his own expense. He must make allowance for the use of the said supplies and equipment by all subcontractors free of charge.

Once equipment becomes redundant and having received the approval from the Engineer the Contractor shall disconnect and remove said equipment and make good any works disturbed at his own expense.

(d) Handing over of the Site

The site will be handed over to the Contractor in a single length unless otherwise specified by the Engineer.

1303 MEASUREMENT AND PAYMENT

Item 13.01 The contractor's general obligations:

(a) Fixed obligations..... lump sum

(b) Value-related obligations ..... lump sum

(c) Time-related obligations ..... month

Payment of the lump sums tendered under sub items (a) and (b), and the rate per month for sub item (c) shall, for the three sub items together, include full compensation for all the contractor's charges in respect of the following items, collectively termed the "contractor's general obligations".

(i) Setting up and maintaining his organization, personnel, camps, accommodation, ablution and other facilities, offices, stores, workshops, other temporary structures, fencing, testing facilities and constructional plant on the site and their removal on completion of the contract.

(ii) Complying with the requirements of the general conditions of contract and section 1200 of the specifications, including the effecting of insurances and providing the sureties required.

(iii) All general site and office overheads, profit, financing costs, risks, legal and contractual responsibilities and other costs and obligations of a preliminary or general nature which are not specifically measured for payment under any other items of payment.

The lump sum tendered under subitem 13.01(a) above shall represent full compensation for the fixed part of the contractor's general obligations, i.e. that part which is substantially fixed and is not a function of the time required for the completion of the contract or of the value of the work.

Should the final value of the work (excluding any payments in terms of clause 49 of the general conditions of contract) increase or decrease by twenty (20) per cent or less in relation to the tendered amount (less any allowances, if any, in the tender for price adjustments in terms of clause 49 of the general conditions of contract), the lump sum tendered for subitem 13.01 (a) shall not be subject to any variation whatsoever. However, should the said increase or decrease of the final value of the work exceed twenty (20) per cent of the tendered amount, the provisions of clause 53 of the general conditions of contract shall apply to that portion of the said increase or decrease which is in excess of twenty (20) per cent of the tendered amount.

Payment of the lump sum tendered under subitem 13.01 (a) will be made in three installments, as follows:

(1) The first installment, 50% of the lump sum, will be paid in the first payment certificate after the contractor has met all his obligations under this section and has made a substantial start with construction in accordance with the approved programme.

(2) The second installment, 35% of the lump sum, will be paid when the value of the work done reaches one half of the tendered amount, excluding contingencies and price adjustments in terms of clause 49 of the general conditions of contract.

(3) The third and final installment, 15% of the lump sum, will be paid when the works have been completed and the contractor has fulfilled all the requirements of this section.

Before any payment is made under this subitem, the contractor shall satisfy the engineer that he has provided camps and construction plant of good quality on the site, the value of which exceeds that of the first installment.

The contractor may also be required to furnish documentary proof that he owns the camps and construction plant on the site, the value of which shall exceed that of the first installment.

In the event of the contractor not being able to satisfy the Engineer as to the ownership of the camps and construction plant, the Engineer shall have the right to withhold parts of any payments to be made under this subitem, until the works have been completed.

The lump sum tendered under subitem 13.01(b) shall represent full compensation for that part of the contractor's general obligations, which is a function of only the value of the work, but not of the period of completion. Should the final value of the work (excluding any payments in terms of clause 49 of the general conditions of contract) increase or decrease by twenty (20) per cent or less in relation to the tendered amount (less any allowances, if any, in the tender for price adjustments in terms of clause 49 of the general conditions of contract), the lump sum tendered for subitem 13.01(b) will be increased or decreased pro rata in full settlement of any difference in value-related general obligations resulting from an increased or decreased value of the work.

However, should the said increase or decrease in the final value of the work exceed twenty (20) per cent of the tendered amount, the above-mentioned pro rata increase or decrease in the lump sum tendered under subitem 13.01(b) shall apply up to the limit of twenty (20) per cent, and the provisions of clause 53 of the general conditions of contract shall apply to that portion of the said increase or decrease which is in excess of the said limit of twenty (20) per cent of the tendered amount.

The lump sum tendered in subitem 13.01(b) will be payable monthly in installments in relation to the value of work done (excluding the value of any price adjustments in terms of clause 49 of the general conditions of contract).

The tendered rate per month for subitem 13.01(c) represents full compensation for that part of the contractor's general obligations, which are mainly a function of construction time. The tendered rate will be paid monthly, pro rata for parts of a month, from the date on which the contractor has received the letter of acceptance in terms of clause 12 of the general conditions of contract, until the end of the period for completion of the works, plus any extension thereof as provided in clause 45 of the general conditions of contract, provided that :

(a) should the works be certified as having been completed before the contractual date for completion of the works, the contractor will then be entitled to payments in regard to the unexpired period for completion:

(b) should the progress of the contractor in terms of the value of work done be in arrear in regard to his approved original programme, payments in respect of this item may be limited to payments for this period, which, in his original programme (after suitable adjustments in respect of the extension of time granted) agree with the actual value of work done.

Any payment made under item 13.01 will not be taken into account when determining whether the value of a certificate complies with the 'minimum amount of interim certificate", as laid down in the appendix to tender. The adjustments specified in subitems (a), (b) and (c) will be made only if the value of the work or the period for completion were to change and it

is agreed that such adjustments will be in full settlement of the changed compensation for amended general obligations.

DIVISION 1400: ACCOMMODATION, SERVICES, AND ATTENDANCE FOR THE ENGINEER'S STAFF

1401 SCOPE

This Division covers the provision of accommodation, vehicles and attendance for the Engineer's supervisory staff. The accommodation shall include the necessary office building, laboratory, houses for the supervisory staffs, furniture, equipment, as well as the provision of all services required

Unless otherwise specified in the Special Provision, the main camp of the contractor as well as the location of the Engineer's office, laboratories and housing accommodation has to be at or near the mid-length of the project.

Camp sites shall be located in an area so as to minimize disruption to local population, faune and flora and water courses; adequate drainage facilities and treatment of sewerage and waste disposals will be provided camp construction will be dismantled and rehabilitated once construction is completed.

1402 GENERAL

The offices and laboratory will be erected by the Contractor on the Site or on land which has been provided by the Employer adjacent to the Site for this purpose and are in close proximity to the Contractor's offices and laboratories. If the Contractor should decide to move his own offices and/or laboratories to a new site, the offices, laboratory and other buildings erected for the use of the Engineer shall be rebuilt by the Contractor at the new site if required, at no additional charge.

The Contractor may not proceed with the permanent works before the required equipment has been provided by him. If the offices for the Engineer and his staff are not ready for occupation when the permanent works is commenced, the Contractor shall be paid under Clause 51 of the Conditions of Contract to provide suitable temporary offices acceptable to the Engineer. (See 1408 below)

The Contractor shall take all reasonable precautions to prevent unauthorised entry to the offices and laboratories and ensure the general security of the offices and laboratories. A security fence shall be erected by the Contractor around the offices and laboratory for the Engineer.

The layout, sitting and orientation of the offices and laboratory or other accommodation shall be to the Engineer's approval and shall be decided upon in consultation with him. Offices, laboratories and residential accommodation, complete with their contents, access roads and hard standings shall be ready for occupation and the use of the Engineer within 120 days of the date for commencement of the Works unless otherwise described in the Contract. If the contractor fails to provide the offices and laboratories with in the time frame stated herein above he shall continue to provide the temporary offices and laboratories at his own cost. This is without prejudicing the Engineer’s right to take other contractual measures.

All offices, testing laboratories and residential accommodation shall be regularly cleaned for so long as they are in use and suitable arrangements shall be made for the disposal of waste arising from the offices, testing laboratories and residential accommodation.

All offices, testing laboratories and residential accommodation equipment shall be of a quality and precision appropriate to its use and shall be delivered new to the Engineer. The

Contractor shall keep all equipment in good condition and shall repair or replace, as instructed by the Engineer, any equipment that becomes defective or unserviceable. All the equipment shall first be calibrated by a competent Authority of the country. Furthermore, The Contractor shall ensure that any equipment needing periodic calibration shall be calibrate on delivery, annually and at other times as and when required by the Engineer.

When major components of the Works are manufactured off the Site, the Contractor shall arrange to make available adequate and secure accommodation at or adjacent to the place of, and during the period of, manufacture and testing.

All the Engineer’s site facilities shall be located as directed by the Engineer. The Contractor together with his bid shall submit a proposed plan regarding the Engineer’s site facilities Water and electric supply shall be provided on 24-hour basis and the Contractor shall pay for any statutory charges associated there with. Pure drinking water shall be supplied or made available for all the facilities.

The Contractor shall start work on the Engineer’s site facilities as soon as practicable from the date of commencement of the works within one hundred twenty (120) days of the date of commencement of the works. In case such facilities are not ready for occupation the time frame stated herein above, the Contractor shall continue to provide to the Engineer/Employer’s Representative personnel the temporary site facilities at his own cost. This is without prejudicing the Engineer’s right to take other contractual actions.

Detailed specifications and plans regarding the site facilities, including, but not limited to, their services, equipment, furnishing and vehicles shall be supplied by the Contractor to the Engineer as soon as practicable from the date of commencement of the works.

Ownership of the Engineer’s offices, laboratory building, housing including, sanitary facilities, installations, fittings, connections etc. becomes the property of the Employer on completion of the project. Also, the ownership of the Engineer’s office furniture and equipment becomes the property of the Employer on completion of the project. The ownership of the mobile radios and laboratory equipment remains to be for the contractor.

1403 OFFICE AND LABORATORY ACCOMMODATION

(a) General

Buildings for offices and laboratories shall be constructed with Hollow Blocks or bricks or of an approved equivalent material. The construction material to be used shall be strong, durable and of an acceptable quality. The office building shall have concrete floors with vinyl floor tiles and the laboratory buildings shall have a concrete floor. Alternatively, offices can be of prefabricated or portable type. The clear height of all offices between floor and ceiling shall be 3.0 m minimum. All windows shall be of the type that can open over the full window area. The ceilings of the buildings shall be of chip wood or any other quality approved by the Engineer.

The area for the Engineer's office and laboratory shall be secured with a 1.8 m high chain link or barbed wire security fence.

Office and laboratory buildings shall be painted with an approved paint after erection.

Each door shall be provided with a lock and two keys.

The various units of accommodation and the fittings shall be constructed in accordance with details approved by the Engineer.

Each hand wash basin shall be fitted with taps and a drain.

Lights shall be of the fluorescent type either double 40-watt, single 80-watt or of the incandescent type according to what is required and approved by the Engineer.

Electric power plug points shall be provided. Each office shall have at least two 15 ampere plug points.

The Engineer shall be provided with an independent telephone line exchange with extensions in number as may be specified in the special provisions and rates shall include the cost of all calls and rental charges.

Blinds shall be provided for each window. They shall be one of two types: Venetian blinds adjustable so as to permit light to enter to room but excluding direct light; Or Opaque roller blinds.

Where described in the Contract telephones shall have a separate connection direct to a telephone exchange for the exclusive use of the Engineer.

All office and laboratory equipment shall be provided in a clean condition to the Engineer's approval and shall be a new one.

Project sign boards shall be erected at locations approved by the Engineer

Carports shall be provided which are constructed so as to protect vehicles parked in them at all times against the direct rays of the sun. The carports shall be at least of $20m^2$ in area and the floors shall consist of a layer of broken stone to alleviate dusty and muddy conditions. Each carport shall be at least 3m wide and shall have a headroom of at least 2m. The roots of all carports shall be waterproof.

(b) Air Conditioning Units and Heaters

The Contractor shall provide and install, unless specified otherwise, air-conditioning units and heaters to offices and laboratories as per details which may be specified tine special provisions.

The air-conditioning units shall be of the electrically operated compressor type with closed circuit and not of the evaporation type. The capacity of the air-conditioning units shall be at least 2.2 kW each.

Heaters shall preferably be of a space-heating type without exposed elements and shall have a capacity of not less than 1.5 kW each.

(c) Offices

The Engineer's Offices shall be contained in a single building unit and shall consist of separate accommodation within the building.

The furniture to be provided shall conform to the requirements listed in Table 1403/1, (See point 1408) and shall be approved by the Engineer.

The various sizes of offices required, unless otherwise specified, shall be as shown in Table 1403/5, and schedules of supplies and equipment to be provided as listed in Table 1403 /2 (See point 1408)

(d) Areas around Offices

The access and other roads around the offices shall be provided by the Contractor. He shall keep them free of mud and dust either by using crushed stone, suitable dust laying oils, bituminous surfacing or other approved means. They shall be well-drained and kept

trafficable at all times. Footpaths shall be similarly treated to provide convenient access to all buildings, between the car park, offices, and laboratory for the Engineer.

(e) Radio Communication System for the Engineer

The radio system shall be entirely separate from any provision for radio communication made by the Contractor for his own use except that the aerial installation may be shared.

The system shall have an operating range, which ensures reception at all parts of the Site and with Addis Ababa.

The Contractor shall maintain the system, dismantling and removing it on the completion of the Contract. An equivalent replacement shall be provided if the system is out of service for more than 24 hours.

(f) Laboratories

The laboratory shall consist of a single building adjacent to the Engineer's Offices, and shall consist of separate accommodation within the building (minimum internal area indicated sq.m.) as indicated in Table 1403/6 unless otherwise directed by the Engineer.

The various sizes of the laboratories required, unless otherwise specified, shall be as shown in Table 1403/6 and schedules of equipment to be provided as listed in Table 1403/3.

The laboratories, fittings, furniture shall conform to the Table 1403/4.

1404 HOUSING ACCOMMODATION FOR THE ENGINEER

(a) General

The Contractor shall provide, erect, furnish, equip and maintain for the duration of the Contract period, any or all of the following housing accommodation. The type of facility and the numbers required are shown in the Bill of Quantities.

(i) Houses – for the engineers shall be

(a) Type A houses - 3 bedrooms, lounge, dining area, a kitchen and toilet room (having a toilet bowel, a wash basin, bath or shower and a mirror). The built up area shall satisfy the minimum floor area indicated in Table 1404/1.

(b) Type B houses - 3 bedrooms, lounge, a kitchen and toilet room (having a toilet bowel, a wash basin, bath or shower and a mirror). The built up area shall satisfy the minimum floor area indicated in Table 1404/1.

(c) Type C houses - 2 bedrooms and a common toilet room (having a toilet bowel, a wash basin, bath or shower and a mirror). The built up area shall satisfy the required floor area indicated in Table 1404/1, unless otherwise specified.

(ii) Apartments - 1,2 or 3 bedrooms in walled garden with garages and staff quarters. The built up area for one bedroom apartment shall not be less than 40-sq. m. and multiples thereof.

(iii) Motel style accommodation-Bedroom, lounge/study and bathroom, self-contained units in terraced arrangement attached to a common kitchen, dining and recreation room area. The built up are shall not be less than 125-sq. m.

(b) Description

The buildings shall be constructed with Hollow Blocks or bricks or prefabricated units or of an approved equivalent material. The construction material to be used shall be strong, durable and of an acceptable quality.

The accommodation to be provided under this section shall be provided at a location to be approved by the Engineer. The buildings shall be according to the standard, specified for the Engineer's offices and conforming to current building and architectural practice in Ethiopia for good quality buildings, and as approved by the Engineer.

(i) Furnishings and equipment shall be as approved by the Engineer.

(ii) The buildings shall be fully air-conditioned and heaters shall be provided wherever required, unless specified otherwise. All areas except kitchen and bathrooms shall have ceiling fans.

(iii) The equipment for the Engineer’s houses shall also include, but not limited to the ones indicated in Table 1404/2, which shall be provided to the satisfaction of the Engineer.

(iv) The facilities shall be fully wired and connected to a 220/250-volt AC power source, with at least two power points in each room and five points in the kitchen.

(v) The living/dining room shall have air conditioning/ heating unit of at least 1.2 kW

(vi) The furniture and equipment for the facilities are to be supplied new and after the completion of the contract all items shall become the property of the Employer.

(vii) There shall be a waterproof protection below concrete floors and waterproof layer at the same level within the brick walls. The quality and thickness of the waterproofing material to be used shall be subject to approval of the Engineer.

(viii) All buildings/ facilities shall have hot and cold running water and servant’s room.

ix) Where the water supply is not connected to the water main, an external elevated cold water storage tank with a capacity of 5000 litres shall be provided in order to obtain a minimum head of 3 m. of water at the taps, together with the pipes leading to the supply tank.

(x) The living quarters, at the contractor’s option if are designed in order to be moved and re-erected on another site on completion of Works, shall be made of timber, fibre cement or other approved material and shall have double walls fitted with insulating material. They shall be lined on the inside with timber or other approved material including ceilings.

(xi) Floors shall be of timber or alternatively of concrete covered with suitable carpeting or vinyl tiles.

(xii) The living quarters shall have a clear height from floor to ceiling of 3.0 m as a minimum.

(xiii) The total area of windows shall be at least 20% of the exterior wall area and all windows shall be of an approved type that open and close readily. All exterior doors and windows shall be provided with insect screens and the windows and doors shall be provided with suitable curtains.

(xiv) Each facility after erection/construction shall be properly painted inside and outside with an approved paint and the paintwork shall be maintained during the Contract period.

(xv) All facilities shall be provided with adequate carports.

(xvi) All the living areas shall be surrounded with their own compound wall or 2.5 m. high chain link security fence with a cranked top with three strands of barbed wire. The fence shall be provided with one gate to each facility.

(xvii) Suitable gravel roads with a minimum width of 3.5 m shall be provided to connect all the facilities. Roads shall have adequate illumination with overhead lights.

(xviii) The Contractor shall provide a day watchman/gardener and night watchman for each facility.

(xix) Except where provided otherwise, the land and accommodation shall be available for the exclusive use of the Employer/ Engineer personnel for the period of the Contract to the end of the maintenance period.

(c) Maintenance

(i) The Contractor shall arrange to maintain the residential accommodation until the issue of the Defects liability Certificate for the complete Works.

(ii) Maintenance includes attending to repairs to various parts of the building, fittings etc. and the connecting services as and when necessary, including the annual interior and exterior paint work and periodic painting of wood and steel work; replacing the broken window/door, maintenance of internal roads and other repairs as directed by the Engineer.

(iii) The Contractor shall arrange to provide uninterrupted supply of electricity and water for the facilities. In case of failure of main water or power supply, suitable arrangements shall be made for providing uninterrupted supply.

1405 SERVICES

(a) Sanitary arrangements

The Contractor shall be responsible for the maintenance of all sanitary services necessary to keep latrines in a clean, neat and hygienic condition.

The Contractor shall also provide for the removal of all rubbish.

(b) Water, electricity and gas

(i) The Contractor shall provide a supply of fresh clean potable water at a constant head of not less than 3 m at the taps. Storage capacity in respect of the laboratory water supply shall not be less than 700 litres.

(ii) The Contractor shall provide the necessary electric power supply at 220/250 volts to the Engineer's offices and laboratory. The power available shall not be less than 10 kVA for the office and 10 kVA for each 40 sq.m. of laboratory space. If 380 volt 3-phase electricity is required for the laboratories, the power available shall not be less than 12 kVA per 50 sq.m. of laboratory space with a minimum of 12 kVA.

(iii) Electrical power and Water shall be supplied to the offices and laboratory 24 hours per day.

(iv) The Contractor shall where required also supply liquid petroleum gas, for any burners used in the laboratory and for any other gas equipment supplied to the Engineer including all other chemicals.

(v) The Contractor shall provide and maintain at his own expense his own electrical supply. This supply must be adequate to supply the areas set aside for the housing of his staff and for his own and the Engineer's Office, and for any housing of the Engineer's staff.

(vi) Once equipment becomes redundant and having received the approval from the Engineer the Contractor shall disconnect and remove said equipment and make good any works disturbed at his own expense.

(vii) The Contractor shall maintain all equipment provided by him and shall always keep them in a serviceable condition and shall replace any item, which becomes unserviceable defective or is lost.

1406 VEHICLES

(a) The Contractor shall provide vehicles for the sole use of the Engineer and his staff. The vehicles shall be new. The vehicles must be comprehensively insured to cover any driver Passengers. The vehicles shall be replaced after 150,000 kms. Ownership of vehicles reverts to the Employer at the end of the Contract.

A description and the type of vehicles is given in Sub clause 1406(b). The Contractor shall provide where directed by the Engineer, experienced drivers, who shall be available to the Engineer at all times. The vehicles shall be provided with fuel and lubricants as required and shall be serviced, maintained and repaired so as to be in a reliable and roadworthy condition at all times.

(b) The following types of vehicles shall be supplied for the sole use of the Engineer.

Vehicle Type A

Passenger Station Wagon, four wheel drive, 8 seater (minimum), with 4.5 litre (minimum) petrol or 4.2 litre diesel engine.

Vehicle Type B

Pick-Up vehicle, four wheel drive, double cab (4 seater) and canopy with 3.0 litre (minimum) petrol or 2.8 litre diesel engine.

Vehicle Type C

Short Wheel Base vehicle, four wheel drive, hardtop, with 3.0 litre (minimum) petrol or 2.8 litre diesel engine.

All vehicles shall be available to the Engineer within 120 days of the date of commencement of the works, or, in default, the Contractor continues to provide temporary vehicles at his own cost. This is without prejudicing the Engineer's right to take other contractual actions. The Contractor shall be responsible for replacement whether temporary or permanent of any vehicle through repair or accident where such vehicle is unavailable to the Engineer for a period of more than 24 hours.

1407 ATTENDANCE

The Contractor shall provide the Engineer with, and maintain continuity of operatives equal to the tasks and capable of performing the functions described in the Contract. Survey operatives shall be capable of assisting Surveyors in manual tasks. Laboratory assistants shall be capable of assisting the Engineer's laboratory staff in manual tasks. Drivers provided for the Engineer's site vehicles shall have a valid driving license and driving

experience suitable for the vehicles supplied. Cleaning staff shall be capable of carrying out duties to the satisfaction of the Engineer.

(i) The Contractor shall provide soap and towels in the offices and laboratories of the Engineer, the services of cleaners and sanitary staff, together with cleaning equipment, and day and night watchmen.

(ii) The Contractor shall provide all assistance such as labourers, all tools and protective clothing, wooden pegs, iron picks and pickets, water, cement and aggregate for concreting, transport for labourers and materials, as may be required by the Engineer and his staff for checking, setting out, surveying, measuring or testing the work.

(iii) The Contractor shall include in his rates in the Bill of Quantities, the cost of all attendance upon the Engineer and his staff. No other payment shall be made in respect of attendance, except items covered by Item 14.08 in the Bill of Quantities.

1408 TEMPORARY FACILITIES OF THE ENGINEER

The contractor shall, between the date of commencement of the works and the handing over of all the site facilities to the Engineer, i.e., for 120 days, provide to the Engineer Temporary site offices, laboratory, housing fully fitted, furnished and equipped to the approval of the Engineer and vehicles including all operating costs.

1409 TABLES

Table 1403/1 Office Furniture

Item	Description	Quantity
1	Desks shall have six drawers and shall have a surface area of at least 1.5 sq. m. and shall be provided with 2 lockable drawers, with 2 keys per lock. This item includes executive chairs (one each).	2
2	Desks shall have three drawers and shall have a surface area of at least 1.2 sq. m. and shall be provided with at least 1 lockable drawer, with 2 keys. This item includes executive chairs (one each).	6
3	Steel general purpose cabinets shall have at least 1.5 sq.m. shelf area and a volume of 0.70 cu.m. Each cabinet shall have a lock with two keys.	2
4	Steel filing cabinets shall each be fitted with four drawers on runners. Each cabinet shall be fitted with a lock and two keys and shall be 1300 mm high, 460 mm wide and 600 mm from front to back.	3
5	Plan chests suitable for storing all the contract drawings.	1
6	Drafting Table with draftsman's stool, the stool shall be fitted with a padded seat and shall be of adjustable type	1
	Conference room shall have furniture as:	
7	Conference table (1.5 m x 0.9 m). Each table shall be square edged so that adjoining tables can form a conference table.	10
9	Chairs shall be sturdy and comfortable	10
10	Black Board	1
11	Side cabinet with glass door	1
12	Table for computer and printer	1

Table 1403/2 Office Supplies and equipment

Item	Description	No
1	Typewriter, 45 cm carridge, electronic daisy wheel with	1
2	interface to computer	5
3	Electronic calculator (as specified)	10
4	Waste paper basket	15
5	Tee square (AO)	2
6	Protractor (200mm)	2
7	Set square (45 degree, 300mm)	2
8	Set square (30/60 degree, 300mm)	1
9	Planimeter	4
10	Triangular scales	5
11	Stapler	15
12	Paper punch	7
13	Heavy duty paper punch	1
14	Heavy duty stapler	1
15	Steel straight edge 1m.	10
16	Filing tray (set of 3)	4
17	Reading lamp	1
18	Camera 35mm autofocus, 35-70mm lens	8
19	Clipboard	2
20	Electric water heater	1
21	Electric refrigerator, 300 litre capacity	2
22	Electric kettle	12
23	Tea cups, teaspoons, knives, forks, plates	2 sets
24	Milk jug, sugar bowls, tea-pot	20
25	Level book	10
26	Field book	1
27	Level (automatic)	2
28	Levelling staff (5m)	20
29	Ranging rod (2m)	1
30	Optical square	2
31	Steel tape 100m.	4
32	Linen tape 30m.	6
33	Steel pocket tape	5
34	Tape repair kit	2
35	Cane knives	2
36	Hammer (5kg)	2
37	Survey umbrella	2
38	Rain gauge	2
39	Thermometer (max/min)	2
40	First Aid kit	1
41	Set of ASTM Standards or equivalent mentioned in the Specification	Complete
42	Adequate supplies of all other office stationary Cutlery and crockery (tea set etc.) as directed by Engineer for the staff	1

Item	Description	No
43	In addition to those items described above the following scheduled items are to provided:	
	Total Station surveying instrument including 2 single prism targets and tripods.	1
	Desktop microcomputer compatible with IBM PC, having the maximum capacity available in the market six months before bid submission, and with a CD Rom, 3.5 inch floppy disc drives, hard disc drive, color monitor, operating on latest soft wares available in the market six months before bid submission, together with the following software: Word processing Spread sheets AutoCAD Other specified soft ware in the special provisions	1
44	Laser printer with carriage for up to A3 paper, plus stationary for the duration of the Contract.	1
45	Photocopier with copy size up to A3, capable of reducing or enlarging between A3 and A4, plus paper and other supplies for the duration of the Contract.	5

All the Equipment including the Total Station surveying instrument including targets and tripods, the computer, all software, the printer and the photocopier shall become the property of the Employer on completion of the Works.

Table 1403/3 Laboratory Equipment

The Contractor shall provide for the site laboratory included in the Contract and for the exclusive use of the supervision team, equipment at least equal to the following list. Substitution of type may be made only upon approval of the Engineer.

Table 1403/3 (a) List of Laboratory Equipment for Asphalt Concrete roads

	Description	Quantity
General		
	Sieves diam. 300 mm ASTM - 3 "downwards to 3/8"	2 no each
	Sieves diam. 200 mm ASTM - 1 "downwards to no. 200"	2 no. each
	200 mm Sieves No. 200	4 no.
	Sieve shaker for 200 and 300 mm dia. sieves	1 no.
	Sieve fond diameter 200 and 300 mm	3 no. each
	Weighing scale elec. 3.5 kg capacity, 0.1 gram	
	accuracy with under water weighing device	2 no.
	Weighing scale 25 kg capacity, 1 gram accuracy	1 no.
	Weighing scale 0.25 kg capacity, 0.01 gram accuracy	1 no.
	Glass plates 0.5 x 0.5 x 0.05 m	2 no.
	Spatulas different shapes and sizes	10 no.
	Moisture content tins	100 no.
	Heating oven with air circulation 50 litres 1 °C accurate	2 no.
	Heating plates 220 V	4 no.
	Pans (different sizes)	6 no.
	Min/max. thermometer	1 no.
	Laboratory Thermometer	2 no.
	Bi-metal Thermometer	6 no.
	Elec. thermometer	2 no.
	Sample splitter 3/4"	1 no.
	Sample splitter 2"	1 no.
	Timing Device	2 no.
	Pair-Asbestos Gloves	as required.
	Pair-Rubber Gloves	as required.
	Deep Cement Pans, 450 x 450 x 75 mm	2 no.
	Chloride, Alkalinity and Water Hardness	1 set
	Pocket Calculator, Scientific	4 no.
	Type 30' and 45' - 300 mm Triangle	2 no.
	Type 30' and 45' - 150 mm Triangle	2 no.
	Metric Ruler	2 no.
	Large Log Book	2 no.
	Pencil Sharpener	2 no.
	150 mm Protractor	2 no.
	Assorted French Curve Set	1 no.
	Claw hammer	2 no.
	Hammer 1 kg	2 no.
	Hammer 2.5 kg	2 no.
	Assorted Screwdrivers (Set)	2 no.

	Description	Quantity
	A4 Clip Board	6 no.
	Cross Section paper (Graphiquest Canson) - Pad	as required.
	Table Brush	3 no.
	Vacuum Pump	1 no.
	Vacuum Pycno-meters, volume 1 lt.	12 no.
	Plastic Tubing Vacuum Line, 15 m	1 no.
	Slide calipers	1 no.
	Micro meter (mm reading)	1 no.
	Riffle box slot 40 mm	2
	Riffle box slot 40 mm	2
	Riffle box slot 7 mm	1
	Flakiness Gauge	1
	Large oven 225 L	2
	Sand Pouring Cylinder 200 mm dia.	2
	Sand Pouring Cylinder 150 mm dia.	2
	Calibration Container 200 mm dia.	1
	Tray 150 mm hole and 200 mm dia.	1
	Calibration Container 150 mm dia.	1
	4.5 kg rammer	2
	Sample Extruder	2
	Sieve Brushes	12
	Wash Bottles	12
	Maximum/minimum thermometer	2
	75 Micron, 450 dia. 300 deep sieves	2
	10 mm approx. 300 mm dia. sieves	2
	50 mm approx. 300 mm dia. sieves	2
	28 mm approx. 300 mm dia. sieves	2
	14 mm approx. 300 mm dia. sieves	2
	Swell tripod for CBR mould	4
	Pycnometers for S.G.	10
	Constant temperature bath 23-56 C	1
	1p 38c thermometer 230-270C	1
	Pycnometer 1000 ml	1
	4.75 mm approx. 300 mm dia	2
	Spacer disk 50 mm thick	24
	Field scale 2.6 kg	3
	Field scale 20 kg	3
	Filter paper (CBR)	10 packs of 100
Soil Investigations		
	Lightweight Penetrometer (Künzelstab)	2 no.
	250 x 250 mm Ground Plate Glass	2 no.
	Liquid limit device (Casagrande)	2 no.
	Modified Proctor hammer 4.5 kg	2 no.
	CBR Laboratory testing machine, hydraulic	1 no.
	Trimming Knife, 6” Blade	4 no.
	Plastic Graduated Cylinder, 1000 ml.	4 no.

	Description	Quantity
	Plastic Graduated Cylinder, 100 ml.	4 no.
	Dynamic Cone Penetrometer, complete with 5 No. spare cones and carrying case	1 set
	Light Weight Dynamic Penetrometer, hand-operated, i.e. complete set with lifting device, 10 extension rods with threaded nipples and carrying case with 5 No. spare cones	1 set
	Cictran DCP 3.0 software package for Dynamic Cone Penetrometer	1 no.
	Wash Bottle	2 no.
	Small Sand Scoop	2 no.
	Flexible Spatula 6" , Blade 1" wide	5 no.
	Moulds for above	24 no.
	Bottom plates for moulds	12 no.
	Perforated bottom plates	12 no.
	Collars for moulds	24 no.
	Surcharge weights	6 sets
	Micrometers with plates and stands for swell	6 sets
	Polyethylene bags 40 lt.	As required
	Polyethylene bags 10 lt.	As required
	Polyethylene bags 2 lt.	As required
	Rubber mallet	2 no.
	Galvanised tray 0.75 x 0.75 m x 0.05 m	5 no.
	Galvanised tray 0.25 x 0.25 x 0.03 m	5 no.
	Trowel	5 no.
	Spoon	5 no.
	Soil Mortar	1 no.
	Soil Pestle	1 no.
Aggregate Testing		
	Aggregate Impact Value Device (complete)	1 no.
	Aggregate Crushing Value	1 set
	Aluminium trays (0.45 x 0.2 x 0.03 m)	10 no.
	Flakiness sieves	1 set
Concrete Testing		
	Concrete test cube moulds 150mm x 150mm x 150mm	24 no.
	Concrete cubes testing equipment (hydraulic press 2000 kn.)	1 no.
	Slump test device	2 sets.
	Trowel	2 no.
	Concrete Test Hammer (Schmidt Hammer or similar)	1 no.
	Slump Cone	3 no.
	Tamping Rod	3 no.
	Straight edge	3 no.
	Steel ruler	3 no.
Field Density Test		
	1" Steel Chisel	4 no.
	Large Sand Scoop	4 no.
	Density Bottle	4 no.
	Mixing Trowel	4 no.
	Rubber Mallet	4 no.

	Description	Quantity
	Field Density Plate	4 no.
	Sampling Spoon	4 no.
	Sand replacement density app., complete with plastic jugs	4 no.
	Plastic Jug	4 no.
	One Gallon Field Can	4 no.
	Nuclear density meter	1 no.
Sand Equivalent Test		
	Sand Equivalent Test Set	1 no.
	Sand Equivalent Stock Solution (1 kg)	10 no.
Mechanical Analysis of Soils		
	Hydrometer	1 no.
	Stopwatch 30 min, 1/5 sec.	1 no.
	Beaker Glass, 250 ml.	1 no.
Asphalt Concrete Testing		
	Bitumen extraction machine (SMM type)	1 no.
	Beakers for above	6 no.
	Solvent	as required
	Extractors	3 no.
	Cartridges for extractors	100 no.
	BI-metal thermometer (0 - 300 °C) 100 and 300 mm	6 no.
	Electrical thermometer (0 -300 °C)	2 no.
	0.10 m core drilling machine with 12 core drills	1 no.
Sampling and Testing Bituminous Materials		
	0.5 lt. Sample Can	24 no.
	0.5 lt. Small Mouth Can	24 no.
	Penetro-meter with 5 needles	1 no.
	Softening point devices including heating	1 no.
Marshall Test		
	Bench Mixer, 15 lt. capacity	1 no.
	Stirring Rod	2 no.
	Automatic Marshall compaction machine with hammer and pedestal	1 no.
	Marshall compaction moulds complete	12 no.
	Filter paper for moulds	As required
	Automatic Compression Machine with flow and stability gauges	1 no.
	Sample ejecting device	1 no.
	Stability Mould	1 no.
	Thermostatically controlled Standard Water Bath to 60 °C	1 no.

Table 1403/3 (b) List of Laboratory Equipment for Asphalt surfaced roads (Double Bituminous Surface Treatment)

Item no	Description	Quantity
1	Set of soil sieves: 3", 2½", 2", 1¾", 1½", 1", ¾", ½", 3/8", ¼, No. 4, 8, 10, 16, 20, 30, 40, 50, 60, 80, 100, and 200 with lid and bottom pan (8 inch in diameter brass)	1
2	Sample splitter max. 1"	1
3	Sample splitter max. 2½"	1
4	Mixing tray (610 X 610 X 63 mm)	2
5	Tray for drying soil 10 X 14 X 2 inch aluminium baking tray	6
6	Heavy duty solution balance 20 Kg capacity X 1 g sensitivity	1
7	Digital analytical balance 330 g capacity X 0.001 g sensitivity	1
8	Bench balance 16 Kg capacity X 5 g sensitivity	1
9	Plate form scale 100 kg capacity 50 g sensitivity	1
10	Standard proctor mould	1
11	Standard compaction rammer	1
12	6 inch sand density cone apparatus	1
13	Universal extruder	1
14	Liquid limit device with counter including grooving tool	1
15	Plastic limit set	1
16	Constant temperature water bath	1
17	Hydrometer jar 1000ml with rubber bung	6
18	Soil hydrometer 152 H	1
19	Sodium hexametaphosphate 1000g	1
20	High speed stirrer	1
21	Oven 20 lit Capacity	1
22	CBR mechanical loading press motor operated	1
23	CBR mould with solid CBR base	4
24	Filter screen	8
25	Spacer disc	1
26	Annular surcharge	8
27	Slotted surcharge	8
28	Dial gauge tripod	1
29	Dial gauge 10 mm X 0.01 mm	1
30	Swell plate	4
31	Straight edge	1
32	Concrete compression tester	1
33	150 mm single cube mould	12
34	Steel slump cone test set	2
35	Sand absorption cone and tamper	1
36	Unit weight measure 3 lit. capacity	1
37	Unit weight measure 14 lit capacity	1
38	Density basket	1
39	Reference colours glass	1
40	Graduated impurities test bottle 500 ml	1
41	Spatula	1
42	Evaporating dish	2

Item no	Description	Quantity
43	Washing sieve No 200 (stainless 8 in)	2
44	Sieve No 4 and 3/4" (stainless 450 mm)	1
45	Sieve brushes (course and fine)	1
46	Plastic beakers 400 ml	2
47	Graduated cylinder 250 ml	2
48	Graduated cylinder 25 ml	6
49	Plastic wash bottle	2
50	Soil scoop (Aluminium)	1
51	Sampling spoon	1
52	Rubber Mallet	1
53	Thermometer	2
54	Tong	1
55	Equipment for penetration of bituminous materials	1 set
56	Equipment for kinematic and absolute viscosity	1 set
57	Saybolt Furol viscometer	1 set
58	Specific gravity test equipment for bituminous materials	1 set

Table 1403/3 (c) List of laboratory equipment for gravel surfaced roads

Equipment description	Soil test Model No.	Quantity Required	
		Unit	Nr.
A. Equipment			
Laboratory Oven, Capacity 240 Lit.	L-158	Each	1
Laboratory Oven Capacity 50 Lit.	L-6	Each	1
Hot Plate (max tmp. 350^0C)	L-236	Each	1
Burner (Gas) Two Flames	-		2
Bunsen Burner with Tripod	-		1
Heavy Duty Balance (20 kg)	L-500	Each	1
Triple Beam Balance (2610 gr.)	L-410	Each	3
Triple Beam Balance (311 gr.)	L-817	Each	3
Platform Balance (115 kg.)	L-855M	Each	1
Wall Clock	-	Each	1
Stop Watch	Lt-475	Each	1
Vernier Caliper	-	Each	1
Thermometer General 0-200^0C	-	Each	2
Max. & Min. Thermometer	-	Each	1
Sapling Tools Complete	-	Each	1
Togs	G -120	Each	2
Dissector	G - 61	Each	1
Breaker (Pyrex) 250 ml	G - 5	Each	3
Breaker (Pyrex) 500 ml	G - 8	Each	4
Breaker (Pyrex) 1000 Ml.	G – 9	Each	6
Funnel 250 ml	-	Each	2
Funnel 500 ml	-	Each	2
Volumetric Flask Stoppered 100 ml	G – 40	Each	4
Volumetric Flask Stoppered 250 ml	G – 26	Each	4
Volumetric Flask Stoppered 500 ml.	G – 27	Each	4
Volumetric Bottle Flask 250 ml.	G – 41	Each	4
Volumetric Bottle Flask 500 ml.	G – 42	Each	4
Wash Bottle 100 ml	G - 10	Each	2
Wash Bottle 250 ml.	G - 10	Each	2
Wash Bottle 500 ml.	G – 10	Each	2
Graduate Cylinder 100 ml	G – 18	Each	3
Graduate Cylinder 250 ml.	G – 19	Each	2
Graduate Cylinder 1000 ml	G – 21	Each	8
Reagent Bottle Stoppered 2 lit	-	Each	2
Aluminum Cans with cover 2” dia.	LT – 30	Each	As Req.
Aluminum Cans with cover 4” dia.	LT – 30	Each	As Req.
Scoop	CN – 502	Each	2
Brush (Fine)	-	Each	3
Wire Brush Coarse	CL-375	Each	3
Wire Brush Fine	CL-316	Each	3
Bucket 12 lit.	-	Each	3
Trolley	-	Each	1
Shovel (Large)	DR – 26	Each	1
Pickaxe	-	Each	4

Equipment description	Soil test Model No.	Quantity Required	
		Unit	Nr.
Sample splitter (Coarse)	CL – 287	Each	1
Sample Splitter (Fine)	CL - 280	Each	1
Sieve Shaker for 8” Dia.		Each	
Sieve (Motorized)	DL – 300A	Each	1
Seive Shaker for 8” Dia		Each	
Seive (motorized)	CL – 343	Each	1
Tin Pan/Tray 12” x 12” x 2”	Local Made	Each	18
Tin Pan/Tray 16” x 12’ x 3”	Local Made	Each	16
Tin Pan/Tray 24” x 16” x 3”	Local Made	Each	12
Tin Pan/Tray 20” x 16” x 4”:	Local Made	Each	10
Mortar Porcelain 200 mm with	CL – 281		
Rubber covered pestle	CL – 282	Each	1
B. Sieve Analysis For Coarse & Fine Aggregates			
Sieves set diam. 8’’ mm 3’’ downwards to no. 200”	ASTM-1	each	2
Wt Washing No. 200	CL 385	Each	3
Pan	CB-8500	Each	3
Cover	CB-8506	Each	3
C. Attergerg Limits			
Liquid Limit Test Set (with all accessories)	CL – 209	Each	2
Plastic Limit Test Set (with all accessories	CL – 257	Each	2
Shrinkage Limit Set (with all accessories)	CL – 256	Each	1
D.Unit Weight & Specific Gravity Test For Coarse And Fine Aggregate			
Density Basket (Brass	G-340	Each	1
Sand Absorption Cone & Tamper	G-325	Each	1
Pyconometer 25 ml.	G-341	Each	1
Pycnometer 50 ml	G-342	Each	1
Pycnometer 100ml	G-343	Each	1
E. Soundness Test For Coarse & Fine Aggregate			
Distilled Water	-	1	As rqd.
Sodium Sulfate Solution	-	kg	As rqd.
F. Modigied Compaciton Test			
Straight edge	CN-838	Each	2
Scoop	CN-505	Each	2
Scoop	CN-502A	Each	2
Mixing Spoons	CN – 995	Each	2
Sample Ejector	P – 103	Each	1
Modified Compaction Hammers 10 lb.	CN – 416	Each	4
Modified Compaction Model 6” Dia	CN – 403	Each	4
Preparation Knife	CN – 89	Each	1
Wooden Hammer	-	Each	2
Mixing Tray 24” x 24” x3”	-	Each	As rqd.
G. Cbr Laboratory Test			

Equipment description	Soil test Model No.	Quantity Required	
		Unit	Nr.
Soaking Tank 60” x 120” x 24”	-	Each	1
Addition CBR Model 6” Dia. With collars plate, screws	CN – 450	Each	15
Filter Screens	CN – 556	Packet	As rqd.
Swell Plates	CN – 400	Each	15
Surcharge Weight	CN – 557	Each	30
Surcharge Weight (Slotted)	CN – 558	Each	2
Tripod attachment	CN – 401	Each	15
Dail Indicator	LC – 8	Each	15
Spacer Disc	CN – 393	Each	2
CBR Loading Press (hydraulic)	CN – 472	Each	1
Providing Ring 2000 lb.	Pr – 60	Each	1
Providing Ring 6000 lb.	-	Each	1
Providing Ring 10000 lb.	-	Each	1
H. Field Density Test			
Sand Cone Bottle	CN – 992	Each	5
Density Plate	CN- 994	Each	5
Plastic Jug for Sand	-	Each	5
Replacement Jug	CN – 993	Each	5
Spoon	CN-995	Each	5
Plastic Bags	-	Each	As rqd.
Chisel 12”	CN-998	Each	5
Hammer 2.5 lb.	-	Each	5
Field Balance	L-770B	Each	5
Speedy Moisture Tester	MG-320	Each	5
Sieve No. 30 (0.60 mm)	CB-830	Each	5
Density Sand Bag	-	Bags	As rqd.
Nuclear Density Gauge	-	Set	2
I. Concrete & Cement Test			
Compressive Strength Machine with possibility of Tensile Strength		Each	1
Heavy duty (250,000 lb.)	CT – 755	Each	1
Vibrator	CT – 106	Each	1
Concrete Tray	CT-58	Each	As rqd.
Cylinder Mold Heavy Duty 6” dia.	CT-35	Each	4
Cylinder Capping Apparatus	CT-56-4	Each	24
Concrete Capping Compound	CT-55	Each	6
Slump Test	CT-69	Each	1
Cube Molds 6” x 6” x 6”	CT-60	Each	1
Tamper	G-325	Each	3
Schmidt Concrete Test Hammer	CT-320	Each	4
Steel Straight Edge	-	Each	1
Steel Scale	-	Each	1
Curing Tank with temperature control	-	Each	As rqd.
Hand Gloves (Rubber)	-	Each	1
Trowel Triangular Blade	CT-67	Each	2
Cement Mold Brush	CT-68B	Each	4

Equipment description	Soil test Model No.	Quantity Required	
		Unit	Nr.
J.SOIL INVESTIGTION AND SAMPLING			
Post-hole Auger 4 in Helical Auger 2 in	DR – 34 A – 4	Each Each	1 1

Table 1403/3 (d) List of Laboratory Equipment for bridge structures

Item No	Item And Description	Quantity	Catalogue No. Or Mon. No.
1	Concrete Compression Tester 250,000 lb. capacity motorized (220 V 60 Hz.)	1	CT-755
2	Safety Guard	1	CT-717
3	Splitting Tensile Bearing Bar	1	CT-113
4	Cylinder Molds-reusable plastic 6” x 12” long (prefer seamless molds)	12	CT-153
5	Cylinder Caper (6”)	1	CT-53
6	Warming Pot 220 V with Capping ladle	1	L-116-4
7	Cyclap capping compound 50 lb.	4	CT-59B
8	Cylinder curing tank 2 ft wide x 2 ft deep x 6 ft long with rounded ends	1	
9	Concrete Test Hammer	1	CT-320AM
10	Slump Cone Mold Slump Cone Base and Tamping Rod	1 1 Set	CT-69 CT-88 and CT-22
11	Air Entertainment Meter	1	CT-129
12	Organic Impurities Test Set	1	CT-95
13	Platform Beam Scale for Site measurement of bulk Density	1	L-860
14	Forced Draft Oven 1,600 W 220 V AC(same as for soil lab) 19” x 15” x 18”	1	L-24
15	Electronic Balance -27 kg. cap. (same as for soil lab)	1	L-620A
16	Electronic Balance 220 V (same as for soil lab)	1	L-1115
17	Aggregate Shaker 220 V (same as for soil lab)	1	CL-325H-8
18	Set of Sieves includes 3/4, 3/8 in Nos. 4,8,16,30,50,100 lid and bottom pan (8 in brass)	1	CBC Model
19	Motorized Sieve Shaker (same as for soil)	1	CL-500-2
20	Galvanized Mixing/drying Tray (24 x 24 x 3”)	2	CT-58
21	Mixing/drying Pans Stainless (16 x 11 x 2½”)	6	LT-610
22	Drying Pans Aluminum 9 x 13 x 2	10	LT-608

Item No	Item And Description	Quantity	Catalogue No. Or Mon. No.
23	Drying Pans 7 in stainless	10	LT-602
24	Aggregate Scoop Pan	2	CL-292
25	Scoop Stainless Steel 5 ½ x 11½ “	 1	
26	Scoop $3^1/_4$ x 5” Aluminum	2	CN-502
27	Tongs	1	G-120
28	Plastic Wash Bottles (same as for soil lab)	 6	 G-97
29	Aluminum Moisture Tins 2 x 7/8” high (same as for soil lab) $3^1/_2$ x 2 in. high	 24 24	 LT-16 LT-19
30	Galvanized Pails 3½ gal.	2	LT-146
31	Specific Gravity Set	1	CT-92
32	Sodium Hydroxide Solution(pints) Colour Chart	6 1	CT-98 CT-97
33	Metal Dust Pan and Brush	1	
34	General Tool Kit	1	
35	ASTM Standards for Concrete & Mineral Aggregates (04-02)	1	LT-750
36	Portable Fume Hood	1	
37	Vent Ducting - Flexible	1	
38	Vent outlet	1	

Table 1403/4 Laboratory Fittings and Furniture

Item	Description	Quantity
	Ordinary chairs, 15 ampere 220 volt electricity plug points, and lights shall be as specified for offices.	
1	Metal table	3
2	Metal chairs	12
3	Shelf space provided against walls shall be of heavy construction and shelving shall be in a suitable timber or steel material as required. Shelving below work tables shall be 390 mm above floor level. Shelving above working areas shall be 1 980 mm above floor level.	
4	Work bench areas shall be of two types as may be required: (1) Wooden construction. The tops shall be hard and smooth, free from warping or other defects. (2) Concrete tops. The tops shall be at least 75 mm thick concrete slabs with a smooth hard steel trowelled finish. All work benches shall be sturdy and the upper surface shall be 920 mm above floor level	
5	Concrete working floors shall be at least 125 mm thick and provided with a hard smooth finish. The working floors shall be either entirely open or under a lean -to roof required.	
6	Wash basins shall be as ordered either in stainless steel or precast concrete with an area of at least 0.3 sq.m. and minimum depth 0.3 m. They shall be provided with swan neck type laboratory taps and drain pipe.	2
7	Fire extinguishers shall be of the BCF (Bromochlorodifluoromethane) type manufactured to BS 1721 and suitable for Types A, B, C and E fires. The extinguishers shall contain no less than 2.5 kg of extinguishers fluid and shall be fitted to the wall at a suitable position by means of quick release brackets. They shall be freshly charged and the seals shall be unbroken.	
8	Extractor fans shall be mounted where required in such a manner that they will operate silently. They shall have a capacity of at least 0.15 kW each.	

Table 1403/5 Floor area for Engineer's Office

Item	Description	Area (m^2)
1	Resident Engineer's Office	12
2	Assistant Resident Engineer's Office	10
3	General Office (partitioned as required)	60
4	Secretary's Office	8
5	Conference Room	15
6	Computer Room	8
7	Kitchen Unit	6
8	Ablution Unit	2
9	toilets + 1 wash basin	6
10	Other Miscellaneous rooms as may be ordered by the Engineer Total Floor Area shall be 200 m^2, unless otherwise specified.	53

Table 1403/6 Floor area for Laboratory

Item	Description	Area (m^2)
1	Soils Laboratory	40
2	Oven and soaking room	20
3	Sample storage	15
4	Office	10
5	Store	15
	Total area shall be 100 m^2, unless otherwise specified	

Table 1404/1 –Floor area for Housing Accommodation to the Engineer/Supervisor

Room Type	Minimum Floor Area (m^2)
Lounge	20
Dining Area	12
Kitchen	8
Bedroom	15
Toilet room	9

The total floor area for type a and type b houses shall not be less than 120 m^2 and 85 m^2, unless otherwise specified.

Table 1404/2 Equipment for the Engineer's housing

Item	Description	No.
1	Refrigerator-freezer combination, 1.0 cu. m. minimum;	1
2	Four plate stoves complete with grill, oven and splash plate;	1
3	Electric water heater(s) with a total capacity of 200 litres;	1
4	Built in wardrobes (app. Size 1980 mm x 915 mm x 485 mm) in the bedroom or metal wardrobes in the bedrooms;	
5	Beds including mattresses and box springs, adequate for 4 adults in each house/ apartment.	
6	The motel type housing (dormitory) shall have one queen size bed with mattresses and box springs, one table with chair, 165 litre refrigerator, air conditioning/ heating unit of at least 1.2 kW and one wardrobe/ cupboard.	

14010 MEASUREMENT AND PAYMENT

Any thing specified for the Engineer's facilities shall be deemed to be covered by the relevant items, unless otherwise, a separate pay item is established for it.

Item 14.01 Office Building Complete as specified including furniture (Table 1403/1 & Table 1403/5) .....sq. m

Item 14.02 Laboratory Building Complete as specified including furniture (Table1403/6) .....sq. m

The measurement of construction of the office and laboratory buildings shall be on square meters of plinth area (including corridor and veranda) of the accommodation. Except for items detailed elsewhere in the contract, the payment includes that of providing the necessary fittings, installations in accordance with the details given in contract and the furniture, equipment and supplies.

Item 14.03 Items measured and paid for by the lump sum

(i) Office Equipment as per Table 1403/2 .....lump sum

(ii) Laboratory Equipment as per Table 1403/3 .....lump sum

Payment at the lump sum tendered shall be in full compensation for providing the complete service or installation and the use thereof including any fixed and usage charges payable to local or other authorities.

Item 14.04 Services

Provision of water, electricity, L.P gas, tanks, sewage and rubbish removal, cleaning services, all as specified in Sub-Clause 1405 and including the construction and maintenance of the access roads, footpaths, fencing, car parks etc:

a) Fixed Costs…… .....…Lump Sum

b) Maintenance and Services for offices and laboratories..... ....month

Payment of the lump sum tendered shall be in full compensation for providing the services specified.

Item 14.05 Vehicles for Engineer and his staff

Vehicle type A.....number (no.)

Vehicle type B.....number (no.)

Vehicle type C.....number (no.)

The unit of measurement shall be the number of vehicles as specified in Clause 1406, which are provided on the Engineer's instructions.

Item 14.06 Provision of fuel and lubricants and the servicing, maintenance, and repair of vehicles for the Engineer and his staff

(a) Fuel, service and maintain vehicle, vehicle Type A .. .. (veh.-mth)

(b) Fuel, service and maintain vehicle, vehicle Type B ..... (veh.-mth)

(c) Fuel, service and maintain vehicle, vehicle Type C ..... (veh.-mth)

The unit of measurement shall be the number of vehicles multiplied by the calendar month.

(d) Fuel, service and maintain vehicle in excess of 3000 km for any vehicle in any one calendar month, vehicle Type A ..... .kilometer (km)

(e) Fuel, service and maintain vehicle in excess of 3000 km for any vehicle in any one calendar month, vehicle Type B ..... kilometer (km)

(f) Fuel, service and maintain vehicle in excess of 3000 km for any vehicle in any one calendar month, vehicle Type C ..... .kilometer (km)

The measurement for this item shall be based on the cumulative distance travelled by each vehicle.

Item 14.07 Attendance upon the Engineer and his staff

(a) Driver for the Engineer's vehicles .....…man - month (man-mth)

(b) Chairman .....…..man - month (man-mth)

Item 14.08 Additional office and laboratory equipment ordered by the Engineer

(a) Additional equipment..…….... .....Provisional Sum (Prov. Sum)

(b) Allow percentage on-cost to invoiced amounts for equipment supplied under..... Item 14.08 (a)..... .....…Percentage (%)

Payment for Item 14.08 (a) shall be the sum of the invoiced amounts for any additional equipment ordered by the Engineer under this item.

Payment for Item 14.08 (b) shall be the tendered percentage of the amount paid under Item 14.08(a).

Item 14.09 Building, House Type, Complete, as specified, including fixtures

a) Type A housing …….....(sq. m)

b) Type B housing …….....(sq. m)

c) Type C housing …….....(sq. m)

Item 14.10 Building, Apartment Type, Complete, as specified, including fixtures ..... (sq. m)

Item 14.11 Motel style accommodation complete including, as specified, fixtures .... (sq. m)

The measurement of construction of the residential accommodation shall be on square meters of plinth area (including corridor and veranda) of the accommodation. Except for items detailed elsewhere in the contract, the payment includes that of providing the necessary fittings, installations in accordance with the details given in contract and the furniture, equipment and supplies.

In case the Contractor fails to complete and hand over the complete residential accommodation within the period stipulated in Sub-Clause 1402 above, an amount of Ethiopian Birr 50,000 per month or part thereof shall be debited to the Contractor's account for the period of delay.

The measurement for maintenance of supervisory staff residential accommodation shall be in maintenance months and shall be made on completion of satisfactory maintenance every month. If at any stage the Contractor fails to carry out the required maintenance satisfactorily, an amount of Ethiopian Birr 20,000 or part thereof shall be debited to the Contractor's account. In addition, the months during which the Contractor fails to carry out the required maintenance satisfactorily shall not be measured for payment.

The work provided in this item shall be as shown in the Bill of Quantities. The Contract unit rate for constructing and providing residential accommodation for Engineer/ Employer supervisory staff shall include all the expenses for the work described, supply of furniture and equipment, including provision of uninterrupted supply of water and power.

Item 14.12 Items measured by number

(a) Air conditioning unit ..... (no.)

(b) Heater ..... (no.)

(c) Gas burners (including provision of gas installation) ..... (no.)

The unit of measurement shall be the authorized number of units supplied and installed, complete and in accordance with the Specifications and Drawings together with all minor fittings, brackets, connections, leads, mountings, etc.

Item 14.13 Services for residential accommodation(s)..... per month

Provision of water, electricity, LP gas, tanks, sewage and rubbish removal, cleaning services, all as specified in this section and including the construction and maintenance of the access roads, footpaths, fencing, car parks etc:

Item 14.14 Temporary facilities of the Engineer

(i) Office fully fitted, furnished and equipped including all services……..... ……month

(ii) Laboratory fully fitted, furnished and equiped including all services…. ..... .month

(iii) Housing Accommodation fully fitted, furnished and equiped including all services

(a) Type A houses……..... .month

(b) Type B houses……..... ….month

(c) Type C houses……..... …month

(iv) Vehicles including all operating costs

(a) Type A…… ..... ….month

(b) Type B…… ..... ……month

(c) Type C…… ..... month

Payment of the lump sum tendered items shall be in full compensation for providing the services specified

Payment for items 14.01, 14.02, 14.03, 14.04 (a), 14.09, 14.10, 14.11 and 14.12 shall be made as follows:

80% of the amount will be paid when the item is provided and erected, fitted or installed to the Engineer's satisfaction. A further 10% will be paid when the value of all permanent work done, excluding escalation, exceeds one-half of the tendered amount, and the remaining 10% will be payable in the certificate which follows the removal of the items from the site.

Payment at tendered unit rates for the various items of payment scheduled in this Division, shall be in full compensation for providing, procuring erecting, installing and/or fitting the item or service as may be required or specified, for the use of the item or service including replacements when defective and all transport, handling and other costs.

For time related cost items, the rate shall continue to be applicable during any extended period of the construction work, unless other rates agreed by the contracting parties.

Payment under Item 14. 05 shall be made in full in the payment certificate following the date of handover of the vehicle to the Engineer.

DIVISION 1500: TRAFFIC MANAGEMENT

1501 SCOPE

This Division covers the construction and maintenance of temporary traffic diversions, barricades, signs, and the provision and operation of traffic lights and everything necessary for the safe and easy passage of all public and construction traffic during the performance of the Contract including the reinstatement of traffic diversions.

1502 GENERAL REQUIREMENTS

(a) General

The existing road reserve will be handed over to the Contractor for maintenance purposes in lengths in accordance with the requirements of the works program and as agreed upon unless otherwise specified by the Engineer.

At least 30 days prior to commencement of the Works the Contractor shall prepare and submit to the Engineer for approval a Traffic Management Plan which will ensure the safe and easy passage of public and construction traffic through or around the Works at all times.

The Contractor should allow for maintaining through traffic at all times. In exceptional circumstances road closures of up to one-hour duration may be permitted by the Engineer. The Contractor shall give reasonable notice of any proposed road closures.

On completion of a day's work the Contractor shall leave the works in such a condition to allow the safe passage of through traffic. The Contractor shall be responsible for complying with all regulations relating to the temporary closure of roads.

Should the road width be restricted or should there be any form of obstruction or danger to traffic, the Contractor shall supply adequate flagmen, signs, barriers, lights, communications and staff to ensure that the traffic is safely conducted though the Works.

(b) Minimum vertical clearance

The minimum vertical clearance over any portion of a bypass shall be 5.3 m

If the minimum clearance available is less than 5.3 m, the minimum clearance shall be indicated on approved signs at approved locations on and in advance of the obstruction.

(c) Property and survey monuments

Where possible, Traffic Diversions shall be constructed so as not to damage or displace property or trigonometrical survey monuments. In exceptional cases where this is not possible the Contractor shall notify the Engineer in good time so that he may arrange to have these suitably referenced before they are displaced.

(d) Access to properties

The Contractor shall also provide and allow access to persons whose properties fall within or adjoin the area over which he is working and in this respect the Contractor's attention is drawn to the Conditions of Contract. No separate payment shall be made for the provisions and maintenance of such accesses and facilities except where they extend beyond the road reserve.

(e) Public services

Public services affected by temporary diversions shall be treated in a similar manner as services affected by the permanent works and payment shall be made in accordance with the provisions of section 1200 of these specifications.

(f) Temporary works

The Traffic Diversions provided by the Contractor shall include the construction of temporary fences, drainage works, and other incidentals considered necessary by the Engineer.

1503 TRAFFIC BARRIERS, SIGNING AND LIGHTING

(a) Traffic Barriers:

The Contractor shall provide, erect and maintain barricades, traffic signs and warning boards, to the satisfaction of the Engineer.

(b) Traffic Signing:

The Contractor shall provide warning lights and a sufficient number of flagmen and he shall take all necessary precautions for the protection of the Works and for the safety of the travelling public.

(c) Traffic Lights:

The Contractor may provide traffic control by means of three phase traffic lights at locations where there is inadequate width for two way traffic or where construction plant disrupts the flow of through traffic.

Traffic lights used in these circumstances shall be permanently manned.

1504 CONSTRUCTION OF TEMPORARY TRAFFIC DIVERSIONS

(a) General

Where described in the Contract, the Contractor shall provide temporary traffic diversions for the public traffic around the Works.

The temporary traffic diversions provided by the Contractor shall include the construction of all necessary temporary fences, drainage works and other incidentals.

(b) Maximum Length

Unless otherwise permitted by the Engineer the maximum length of a temporary traffic diversion shall be 10 kilometres.

(c) Minimum Width

Temporary traffic diversions shall be a minimum of 3.5 metres and 7.5 metres width for single and two way traffic respectively.

1505 ACCOMMODATION OF TRAFFIC WHERE THE ROAD IS CONSTRUCTED IN HALF WIDTHS

Where it is necessary or impracticable to construct temporary diversions, the Contractor shall construct the road in half widths, allowing traffic to use that half of the road not under construction at the time. The lengths of the half width construction shall be kept to a minimum, with provision for traffic traveling in opposite directions to pass at frequent intervals.

The Contractor shall so arrange his work that the traffic will at all times have free one-way access to at least half the width of the roadway during the construction period. He shall maintain that half of the road, which is being used for traffic for the time being to the satisfaction of the Engineer.

The maximum length of a single working lane shall be 500 meters alternating as shown below:



The maximum width shall be 3m. (Alternating one-way traffic at a time).

Should the road not be in a safe trafficable condition for two-way traffic over the whole width at the end of each day's work, the Contractor shall supply adequate flagmen, signs barriers, lights and necessary staff at his own cost to ensure a reasonable free flow of traffic alternately in each direction throughout the whole period that the roadway is open to one-way traffic only.

No separate payment will be made to the Contractor for working in half widths.

1506 TEMPORARY DRAINAGE WORKS

The Contractor shall construct the necessary temporary drainage works to deal adequately with any surface run-off, such as side drains, catch water drains, miter drains, culverts, etc.

Temporary culverts shall be installed on existing drainage channels wherever required by the Engineer and of sizes and types ordered by him. Any suitable metal or precast concrete culverts salvaged from an existing road or abandoned bypass may be re-used if in a good condition and approved by the Engineer.

1507 EARTHWORKS FOR TRAFFIC DIVERSIONS

The Contractor shall shape and grade the Traffic Diversions making full use of all material that can be obtained from alongside the Traffic Diversions, from side cut or from the immediate vicinity. If sufficient material cannot be obtained in this manner, he shall import material from other sources. Where necessary, cuts shall be made to obtain a satisfactory vertical alignment.

The Contractor shall also perform the necessary clearing and grubbing including the removal of all trees and stumps. Where the existing ground is not sufficiently dense in its natural condition, it shall be compacted as specified in Series 4000 for earthworks these Specifications prior to the construction of the earthworks.

All fill material shall be spread and compacted in accordance with series 4000.

1508 GRAVELLING OF TRAFFIC DIVERSIONS OR OF EXISTING ROADS USED AS TRAFFIC DIVERSIONS

When the earthworks for Traffic Diversions as described in Clause 1507 have been completed, those portions of the Traffic Diversions and of existing gravel roads used as Traffic Diversions indicated by the Engineer, shall be provided with a wearing course of suitable granular material approved by the Engineer.

The Contractor shall provide, spread, water, mix and compact such material to a density where it can carry traffic without undue wear and tear. The granular material shall be spread and compacted in accordance with series 4000.

In case of disagreement between the Engineer and the Contractor as to the adequacy of the compaction a dry density equal to 93% of AASHTO T180 density shall be taken as the required minimum density.

1509 SELECTED- GRAVEL LAYERS, CRUSHED STONE OR ASPHALT BASE, STABILIZATION, AND ROAD MARKING REQUIRED FOR BITUMEN-SURFACED TEMPORARY DIVERSIONS

Where specified in the project specifications or required by the engineer, gravel layers of selected subgrade or subbase quality, crushed-stone base, asphalt base or stabilized gravel layers shall be constructed and road marking shall be done by the contractor, all in accordance with the requirements of the relevant sections of these specifications and the engineer's instructions.

1510 EXISTING ROADS USED AS TEMPORARY DIVERSIONS

Where existing roads are to be used as temporary diversions, the contractor shall, after consultation with the owner or authority having control of such road, carry out any repairs, alterations or additions to such roads as may be required to bring them in a condition suitable for traffic. This work will be paid for as stipulated hereinafter.

1511 BITUMEN SURFACED TEMPORARY DIVERSIONS

Where required in the project specifications or by the engineer, temporary diversions shall be provided with bituminous surfacing in accordance with the requirements of series 6 000 or of the project specifications. or as may be prescribed by the Engineer.

1512 MAINTENANCE OF GRAVEL TRAFFIC DIVERSIONS

All gravel Traffic Diversions shall be maintained by the Contractor in a safe trafficable condition. Whenever required by the Engineer, the traffic diversion shall be bladed and rolled by means of self-propelled graders and rollers to provide a smooth riding surface free of corrugations. All potholes shall be promptly repaired.

The Contractor shall water the Traffic Diversions to keep down dust or in order to facilitate the proper blading of the surface. All drainage works shall be maintained in good working order.

1513 MAINTENANCE OF EXISTING ROADS

All existing roads shall be maintained by the Contractor in a safe trafficable condition. Wherever required by the Engineer, gravel roads shall be bladed and rolled by means of self-

propelled graders and rollers to provide a smooth riding surface free of corrugations. All potholes shall be promptly repaired.

The Contractor shall water the gravel roads to keep down dust or in order to facilitate the proper blading of the surface. All drainage works shall be maintained in good working order.

1514 THE CONTRACTOR'S USE OF TRAFFIC DIVERSIONS

When the Contractor constructs Traffic Diversions, haul or construction roads at his own initiative for accommodating construction traffic, he shall construct and maintain them at his own cost and only in accordance with details previously agreed upon in writing with the Engineer. Such roads shall be removed and the surface properly reinstated when no longer required, also at the Contractor's own cost.

The Contractor shall have the right to use public roads including Traffic Diversions open to public traffic, but where his own traffic causes excessive damage or wear to such roads or constitutes a hazardous condition to public traffic, the Engineer shall have the right to regulate his traffic over such Traffic Diversions and require the Contractor to provide at his own cost such maintenance, including wearing course gravel and watering, as in the Engineer's opinion is necessary in addition to what would be required to properly maintain the Traffic Diversions when not used by the Contractor's construction traffic. Where regulation of the Contractor's traffic does not alleviate the traffic hazard satisfactorily or the maintenance of the Traffic Diversions cannot be or is not properly executed, the Contractor shall, where conditions permit, divert his traffic over construction roads provided and maintained at his own cost.

1515 REMOVAL OF TRAFFIC DIVERSIONS

When traffic is routed permanently onto the new road following the completion of construction, the Traffic Diversions, which are no longer required, shall be removed and the area reinstated to its natural condition.

1516 MEASUREMENT AND PAYMENT

Item 15.01 Accommodating traffic and maintaining temporary diversions..... .... Kilometer (km)

The unit of measurement shall be the kilometer, measured along the centre lines of temporary diversions, existing roads used as temporary diversions, and roads constructed in half-widths. It shall not include sections along which the traffic is diverted onto existing roads where the contractor is not responsible for the maintenance of such existing roads.

The tendered rate shall include full compensation for accommodating traffic and maintaining temporary diversions, including roads constructed in half-widths and existing roads used as temporary diversions during construction and maintenance periods, but excluding maintenance and repair work for which payment is specifically made under the other pay items provided in section 1500. The tendered rate shall also include full compensation for the provision of communications equipment required for regulating the traffic arranging for the moving of services, solving traffic problems, complying with the legal requirements of all authorities concerned, for providing temporary access to private property, and for the provision and maintenance of temporary drainage, but excluding the work specifically paid for under item 15.11. The tendered rate shall also include full compensation for the specified general requirements and all incidental items of cost, which are required under the

provisions of section 1500, and which are not specifically paid for under the other pay items provided in section 1500.

Payment will be made in two equal installments in respect of each section. The first installment will be made when suitable temporary diversions have been approved for use or when traffic is taken over half-width construction. The second installment will become due when the traffic can be accommodated on the new road, all temporary diversions have been obliterated and all general obligations of the contractor have been complied with, all to the satisfaction of the engineer.

Item 15.02 Earthworks for temporary deviations:

(a) Shaping of temporary diversions ..... kilometer (km)

The unit of measurement shall be the kilometer of temporary diversions shaped, compacted and constructed in accordance with the provisions of clause 1506 of this section. Where the contractor has to provide access roads to private property, the length of such access roads outside the road reserve shall also be included in the quantity measured for payment.

The tendered rate shall include full compensation for clearing and grubbing where necessary, the removal of small trees and stumps, the shaping and grading, watering, mixing and compacting of the material and all cuts and fills constructed from material obtained from alongside the temporary diversions or side cut, but including only such portions of the fills which are less than 0.5 m in height.

(b) Cut and borrow to fill.....cubic metre (m^3)

The unit of measurement shall be the cubic metre of fill measured in- situ from levelled cross-sections taken before and after construction where such material is either imported from a locality more than 100 m from the point of use or is utilised in a portion of a fill which is in excess of 0.5 m above the original ground level.

Where measurement by cross-sections is impractical the volume can be assumed to be equal to 70% of the loose volume measured in trucks in the case of soil and gravel material, and equal to 60% of the loose volume in trucks in the case of hard material consisting predominantly of particles of which the maximum dimension exceeds 100 mm.

The tendered rate shall include full compensation for procuring, furnishing and the placing all the classes of material, including transporting over a free-haul distance of 1.5 km.

(c) Cut to spoil.....cubic meter (m^3)

The unit of measurement shall be the cubic metre of authorized excavation taken from cut in temporary diversions or removed from fill in temporary diversions which are no longer required and carted to spoil on the instructions of the engineer, all measured in situ before excavation by means of levelled cross-sections.

The tendered rate shall include full compensation for excavating in all classes of material, loading, transporting, off-loading, including the shaping and levelling of spoil material and transporting over a free-haul distance of 1.5 km.

Item 15.03 Temporary traffic - control facilities:

(a) Flagmen ..... man-day

(b) Portable STOP and GO-RY signs .....number (No)

(c) Temporary traffic - control signals as specified or as shown on the drawings ....number (No)

(d) Amber flicker lights..... number (No)

(e) Road signs, R-and TR-series(size indicated) ..... number (No)

(f) Road signs, TW-series (size indicated) ..... number (No)

(g) Road signs, STW-, DTG-,TGS- AND TG-series (excluding delineators and barricades) ..... .square metre (m^2)

(h) Delineators (DTG5OJ) (size indicated):

(i) Single ..... number (No)

(ii) Mounted back to back..... number (No)

(i) Movable barricade/road sign combination (size indicated..... number (No)

(j) Traffic cones (size indicated) ..... number (No)

(k) Single guardrails attached to posts ..... metre (m)

(l) Movable barriers (type indicated) ..... metre (m)

(m) Two-way communication devices ..... number (No)

(a) Flagmen

The unit of measurement shall be a day worked by a flagman.

The tendered rate shall include full compensation for a flagman who is required to control traffic by way of flags or portable STOP and GO-RY signs and shall include the provision of flags and safety jackets.

(b), (c), (d). (e), (f) and (h)

The unit of measurement shall be the number of each sign provided, and. as may be applicable, completely erected.

The tendered rates shall include full compensation for providing, and where applicable, erecting each sign complete. In the case of subitem (b) it shall also include moving the sign as may be necessary.

(g) The unit of measurement shall be the square metre of sign face, measured on the face of each item provided. The tendered rate shall include full compensation for providing and erecting each sign, complete with posts.

(i) The unit of measurement shall be the number of movable barricades, complete with road signs provided. The tendered rate shall also include full compensation for moving the barricades to fresh positions as and when necessary.

(j) The unit of measurement shall be the number of cones provided and the measured quantity shall be the maximum number in use at any one time in accordance with the layout shown on the drawings or as directed by the engineer. The tendered rate shall also include for all moves to new positions for the duration of the contract.

(k) The unit of measurement shall be the metre of straight or curved temporary guardrails erected, complete with end units, posts, reflective plates, etc.

(l) The unit of measurement shall be the metre of each type of movable barriers provided and shall include the initial erection.

(m) The unit of measurement shall be the number of two-way communication devices ordered by the engineer for the duration of the contract.

The tendered rate shall include full compensation for the supply of two-way communication devices suitable for the control of one-way traffic when half the width of the roadway is closed for construction purposes. The tendered rate shall also include full compensation for the maintenance of the devices and for the provision of operating staff for the duration of the contract.

General:

The tendered rates for the respective traffic control facilities shall include full compensation for the supply and initial erection complete with posts, stakes, portable stands and sandbags as may be required, for cleaning and maintenance, for covering with non-transparent material when temporarily not required and removal off the site when no longer required. 75% of the tariff will be payable when the items have been provided and erected in position for their first use on site and 25% when finally removed from the site. Facilities which become unserviceable or are damaged by vehicles or stolen, in particular delineators, shall be replaced promptly at no additional cost.

Item 15.04 Relocation of traffic-control facilities..... lump sum

The tendered lump sum shall include full compensation for dismantling, storing if necessary, transporting, re-erecting and inspecting the traffic-control facilities, and for all labour, equipment, construction plant and incidentals necessary to execute the work complete as specified or shown on the drawings.

Item 15.05 Gravelling and repair of temporary diversions and existing gravel shoulders used as temporary diversions :

(a) Temporary diversions .....cubic metre (m^3)

(b) Existing gravel shoulders.....cubic metre (m^3)

The unit of measurement shall be the cubic metre of gravel provided as wearing course for the surfacing of temporary diversions and existing gravel shoulders, computed from the dimensions of the layer as actually constructed in place, in accordance with the engineer's instructions.

Where measurement by the above method is considered to be impracticable by the engineer, the volume may be computed by taking 70% of the loose volume of the gravel as measured in the hauling vehicles.

The tendered rate shall include full compensation for procuring, furnishing, placing and compacting the gravel wearing course, including a free-haul distance of 1.5 km, and the repair of local sections of the temporary diversions and gravel shoulders.

Item 15.06 Watering of temporary diversions.....kilolitre (kl)

The unit of measurement shall be the kilolitre of water applied to the temporary deviations on the written instruction of the engineer. Water required for the construction of temporary diversions will not be measured for payment.

The tendered rate shall include full compensation for the supply, transport and application of the water. Overhaul shall not apply to transporting the water used for the watering of temporary diversions.

Item 15.07 Blading by road grader of:

(a) Temporary diversions ..... kilometer-pass (km-pass)

(b) Existing roads used as temporary diversions ..... kilometer-pass (km-pass)

(c) Existing gravel shoulders used as temporary diversions.....
..... kilometer- pass (km-pass)

The unit of measurement for using a road grader to blade the surfaces of temporary diversions, existing roads and existing gravel shoulders used as temporary diversions shall be the kilometer-pass, that is, each kilometer of the full width of the temporary diversions, the entire surface of which has been bladed by one pass of the road grader. In the case of temporary diversions constructed as two separate one-way roads, they shall be considered as one full width of the temporary diversions for purposes of measurement.

Only the number of kilometer-passes actually authorized by the engineer, in writing, will be measured.

Where the blading of temporary diversions has not been carried out satisfactorily and the surface has not been improved as much as can reasonably be expected from such an operation, the contractor shall carry out further grading work at his own expense until a satisfactory result is obtained.

The tendered rate shall include full compensation for providing the road graders and operators, flagmen, guards, barricades, signs and all other costs incidental thereto and for blading the temporary diversions to a smooth surface free from corrugations.

Item 15.08 Repairs, alterations and/or additions to existing roads used as temporary diversions.....provisional sum

The provisional sum provided to cover the cost of work ordered by the engineer in terms of clause 1510 of the specifications shall be expended in accordance with the provisions of clause 48 of the general conditions of contract. Where the exact nature of the work can be determined in advance, provision may be made in the project specifications for suitable rates to be tendered in lieu of providing a provisional sum.

Item 15.09 Accommodation of traffic where the road is constructed in half-widths ..... kilometer (km)

The unit of measurement for accommodating traffic where the road is constructed in half-widths shall be the kilometer measured along the centre line of the road which road is constructed in half-widths on the written instructions of the engineer.

The tendered rate shall include full compensation for providing all plant, equipment, tools, transport, labour, supervision, flagmen, guards, road signs, lights, barricades and all other incidentals necessary for the proper and safe handling of traffic as specified and shall also include full compensation for all additional costs and work resulting from constructing the road in half widths.

Item 15.10 Traffic signals.....provisional sum

The provisional sum provided to cover the cost of providing traffic signals shall be expended in accordance with the provisions of clause 48 of the general conditions of contract.

Item 15.11 Temporary culverts:

(a) Provision and laying of temporary prefabricated culverts complete (state size, type and bedding) ..... metre (m)

The unit of measurement shall be the metre of culvert provided and installed by the contractor.

The tendered rate shall include full compensation for procuring and furnishing new culverts, all excavations, bedding, laying the culverts and backfilling.

(b) Re-use of prefabricated culverts complete state type, size and type of bedding). ....metre (m)

The unit of measurement shall be the metre of culvert installed.

The tendered rate shall include full compensation for taking up the culverts from their previous positions and installing the culverts in fresh positions, including all excavations, backfilling and bedding, the loading and transporting and off-loading of the culverts.

(c) Eventual removal of prefabricated culverts .....metre (m)

The unit of measurement shall be the metre of culvert removed.

The tendered rate shall include full compensation for the eventual removal of prefabricated culverts that are not to be re-used, including excavation, taking up the culverts, loading, transporting, off-loading and stacking the culverts at an approved location, including a free-haul of 1.5 km, and the reinstatement of surfaces. The culverts remain the property of the employer.

(d) Overhaul on excavated material carted to spoil, backfill material (but excluding Portland cement), prefabricated culverts removed and reinstalled, and prefabricated culverts removed and stacked, for haul in excess of a free-haul distance of 1.5 km . ..... cubic metre-kilometer(m^3-km)

Measurement and payment for overhaul shall be made in accordance with the provisions of section 1700.

In the case of culverts, the outer volume of each culvert shall be measured.

Item 15.12 In - situ preparation and compaction of existing gravel shoulders to 93% of Modified AASHTO density ..... cubic metre (m^3)

The unit of measurement shall be the cubic metre of shoulder material prepared and compacted as specified.

The tendered rate shall include full compensation for ripping, shaping, mixing, watering, compacting to a depth of 150 mm below the final road surface, and for all labour, equipment, construction plant and incidentals necessary to execute the work as specified or shown on the drawings.

General notes:

The following pay items described in other sections will be listed under this section in the schedule of quantities where they relate to work executed under this section.

(1) Overhaul as specified in Division 1700.

(2) The clearing and grubbing of large trees as specified in Series 2000.

(3) The removal of overburden as specified in Series 4000.

(4) The construction of mass earthworks and pavement layers as specified in Series 4000.

(5) Bituminous seals as specified in series 6000 or in the project specifications.

(6) Temporary fencing as specified in Series 9000.

(7) Road markings as specified in Series 9000.

DIVISION 1600: ENVIRONMENTAL PROTECTION AND MITIGATION MEASURES

1601 SCOPE

This Division covers all work necessary for the protection of the environment and mitigation measures to be taken.

1602 LANDSCAPE PRESERVATION

(a) General

The Contractor shall exercise care to preserve the natural landscape and shall conduct his construction operations so as to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings m the vicinity of the work. Except where clearing is required for permanent works, approved construction roads, earthworks operations; all trees, native shrubbery, and vegetation shall be preserved and shall be protected from damage by the Contractor's construction operations and equipment. The edges of clearings through trees, shrubbery, and vegetation shall be irregularly shaped to soften the undesirable visual impact of straight lines. Movement of labour and equipment within the right-of-way and over routes provided for access to the work shall be performed in a manner to prevent damage to grazing land, crops, or property.

Except as otherwise provided in Series 4000 special reseeding or replanting will not be required under this Specification; however, on completion of the work, all work areas not seeded shall be scarified and left in a condition which will facilitate natural re-vegetation, provide for proper drainage, and prevent erosion. All unnecessary destruction, scarring, damage, or defacing of the landscape resulting from the Contractor's activities shall be reinstated, replanted, reseeded or otherwise corrected as directed by the Engineer.

(b) Temporary Traffic Diversions and Haul Roads

The location and alignment of temporary traffic diversions and haul roads shall be subject to the approval of the Engineer. When no longer required these roads shall, if required by the Engineer, be restored to the original contour and made impassable to vehicular traffic. The surfaces of such roads shall be scarified as necessary to create a condition, which will facilitate natural re-vegetation, provide for proper drainage, and prevent erosion.

(c) Contractor’s Facilities

Workshop, office, storage and plant areas shall be located and arranged in a manner that will preserve trees and vegetation to the maximum practicable. On abandonment, all temporary buildings, including concrete footings and slabs, and all construction materials and debris shall be removed from the site and disposed of to the satisfaction of the Engineer. The area shall be re-graded, as required so that all surfaces drain naturally, blend with the natural terrain, and are left in a condition that will facilitate natural re-vegetation, provide for proper drainage, and prevent erosion.

(d) Blasting Precautions

In addition to Dairy requirements of local regulations, the Contractor shall adopt precautions when using explosives, which will prevent scattering of rocks, stumps, or other debris outside the work area, and prevent damage to surrounding trees, shrubbery and vegetation.

(e) Quarries, Borrow Pits, Plant and Storage Areas etc.

When they are no longer required, all quarry sites, borrow pits and areas used for the disposal or storage of surplus materials and asphalt plants, shall be reinstated by landscaping including the replacement and spreading of topsoil as directed by and to the satisfaction of the Engineer.

1603 TEMPORARY SOIL EROSION CONTROL

(a) General

These Works shall consist of temporary control measures as described in the Contract or required by the Engineer during the process of the Works, to control soil erosion and water pollution by use of berms, dikes, silt fences, brush barriers, dams, sediment basins, filter mats, netting, gravel, mulches, grasses, slope drains, and other erosion control devices or methods. Appropriate control measures will be required to avoid emission of high concentration of sediments into wetlands, swampy areas and other particular sensitive areas.

The temporary erosion control provisions shall be coordinated with permanent erosion control measures to ensure economical, effective and continuous erosion control throughout the period of the Works.

(b) Construction

A schedule of proposed temporary (and permanent) soil erosion control Works shall be developed by the Contractor at the commencement of the Contract, in consultation with the Engineer and to his satisfaction.

The Contractor shall carry out (and maintain) temporary erosion control to prevent soil erosion that will adversely affect construction operations, damage adjacent properties, or cause contamination of adjacent streams or other watercourses, lakes, ponds, swamps or other areas of water impoundment. Such Works may involve construction of temporary berms, dikes, dams, sediment basins, slope drains or use of temporary mulches, mats, seeding or other control devices or methods as necessary to control erosion. The slopes of cuttings and embankments shall be seeded and mulched as the work proceeds, to the extent considered desirable and practicable by the Engineer.

Temporary erosion control may include construction outside the right-of-way where such work is necessary, as a result of roadway construction, such as borrow pit and quarry operations, haul roads and equipment storage areas.

The Contractor shall incorporate all permanent erosion control features as described in the Contract into the Works at the earliest practicable time as outlined in his schedule, to minimize the need for temporary erosion control measures.

Where erosion is a problem, clearing and grubbing operations shall be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if conditions permit; otherwise, temporary erosion control measures may be required between successive construction stages.

The Engineer will limit the area of clearing and grubbing, excavation, borrow and embankment operations in progress commensurate with the Contractor's capability and progress in keeping the finished grading, mulching, seeding and other permanent erosion control measures current in accordance with the schedule. Should, seasonal limitations make such co-ordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified.

The Engineer may increase or decrease the amount of surface area of erodible earth material to be exposed at one time by clearing and grubbing, excavation, borrow and fill operations as determined by his analysis of project conditions.

In the event that temporary erosion control measures are required due to the Contractor's negligence, carelessness or failure to install permanent controls as part of the Works, scheduled or ordered by the Engineer, such Works shall be carried out by the Contractor.

1604 PRESERVATION OF TREES AND SHRUBBERY

(a) Preservation

All trees and shrubbery which are not specifically required to be cleared or removed for construction purposes shall be preserved and shall be protected from any damage that may be caused by the Contractor's construction operations and equipment. Special care shall be exercised where trees or shrubs are exposed to damage by construction equipment, blasting, excavating, dumping, chemical damage, or other operations, and the Contractor shall adequately protect such trees by use of protective barriers or other methods approved by the Engineer. The removal of trees or shrubs will be permitted only after prior approval by the Engineer.

The layout of the Contractor's construction facilities such as workshops, warehouses, storage areas, and parking areas; location of access and haul routes; and operation in borrow and spoil areas shall be planned and conducted in such manner that all trees and shrubbery not approved for removal by the Engineer shall be preserved and adequately protected from either direct or indirect damage by the Contractor's operations.

Except in emergency cases or when otherwise approved by the Engineer, trees shall not be used for anchorages. Where such use is approved, the trunk shall be wrapped with a sufficient thickness of approved protective material before any rope, cable, or wire is placed.

(b) Repair or Treatment of Damage

The Contractor shall be responsible for damage to trees and shrubs caused by his operations. The term "damage" shall include, without limitation, bruising, scarring, tearing, and breaking of roots, trunk or branches. All damaged trees and shrubs shall be repaired or treated without delay. The Engineer will determine the method of repair or treatment to be used for damaged trees and shrubs as recommended by an experienced horticulturist or tree surgeon provided by the Contractor. All repairs or treatment of damaged trees shall be performed under the direction of an experienced horticulturist or tree surgeon provided by the Contractor.

(c) Replacement

Trees or shrubs that, in the opinion of the Engineer, are beyond saving shall be removed and replaced early in the next planting season. The replacement shall be of the same species, or other approved species, and of the maximum size that is practicable to plant and sustain

growth in the particular environment. Replacement trees and shrubs shall be stayed, watered, and maintained for a period of one year. Any replacement tree or shrub that dies shall be removed and replaced, as directed by the Engineer, with such replacements being maintained for a period of one year from the date of replacement.

1605 PREVENTION OF WATER POLLUTION

(a) General

The Contractor's construction activities shall be performed by methods that will prevent the entry, or accidental spillage, of solid matter, contaminants, debris, and other pollutants and wastes into streams, flowing or dry watercourses, lakes, and underground water sources. Such pollutants and wastes include, but are not restricted to, refuse, garbage, cement, concrete, sanitary waste, industrial waste, radioactive substances, oil and other petroleum products, aggregate processing tailings, mineral salts and thermal pollution.

Dewatering work for structure foundations or earthwork operations adjacent to, or encroaching on, streams or watercourses shall be conducted in a manner to prevent muddy water and eroded materials from entering the streams or watercourses by construction of intercepting ditches, bypass channels, barriers, settling ponds, or by other approved means. Excavated materials or other construction materials shall not be stockpiled or deposited near or on stream banks, lake shorelines, or other watercourse perimeters where they can be washed away by high water or storm runoff or can in any way encroach upon the watercourse itself.

Increases in turbidity in a stream or other bodies of water that are caused by construction activities shall be strictly controlled. When necessary to perform required construction work in a stream channel, the turbidity may be increased, as approved by the Engineer for the shortest practicable period required to complete such work. This required construction work may include such work as diversion of a stream, construction or removal of cofferdams, specified earthwork in or adjacent to a stream channel, pile driving, and construction of turbidity control structures. Mechanised equipment shall not operate in flowing water except as necessary to construct crossings or to perform the required construction.

Wastewater from aggregate processing, concrete batching, or other construction operations shall not enter streams, watercourses, or other surface waters without the use of such turbidity control methods as settling ponds, gravel-filter entrapment dikes, approved flocculating processes that are not harmful to fish, recirculation systems for washing of aggregates, or other approved methods. Any such wastewater discharged into surface waters shall contain the least concentration of settleable material possible. For the purpose of this Specification, settleable material is defined as that material which will settle from the water by gravity during a one hour quiescent detention period.

(b) Compliance with Laws and Regulations

The Contractor shall comply with all applicable Ethiopian laws, orders, regulations, and water quality standards concerning the control and abatement of water pollution.

1606 ABATEMENT OF AIR, DUST, NOISE AND LIGHT POLLUTION

(a) Abatement of Air Pollution

The Contractor shall comply with applicable Ethiopian laws and regulations concerning the prevention and control of air pollution. Notwithstanding the above in conduct of construction activities and operation of equipment, the Contractor shall utilise methods and devices as are, reasonably available to control, prevent, and otherwise minimise emissions or discharges of air contaminants.

The emission of dust into the atmosphere shall be strictly controlled during the production, handling, and storage of concrete and road aggregates, and the Contractor shall use such methods and equipment as are necessary for the collection and disposal, or prevention, of dust during these operations. The Contractor's methods of storing and handling cement and pozzolans shall also include means of eliminating atmospheric discharges of dust.

Equipment and vehicles that show excessive emissions of exhaust gases due to poor engine adjustments, or other inefficient operating conditions, shall not be operated until corrective repairs or adjustments are made.

Burning of materials resulting from clearing of trees and brush, combustible construction materials, and rubbish will be permitted only when atmospheric conditions for burning are considered favorable and when authorized by the Engineer. In lieu of burning, such combustible materials may be disposed of by other methods as provided in Clause 1609. Where open burning is permitted, the burn piles shall be properly constructed to minimise smoke, and in no case shall unapproved materials, such as tyres, plastics, rubber products, asphalt products, or other materials that create heavy black smoke or nuisance odours, be burned.

Dust nuisance resulting from construction activities shall be prevented in accordance with the requirements of clause 1606(b).

(b) Dust Abatement

During the performance of the work required by this Specification or any operations appurtenant thereto, whether within the right-of-way provided by the Contracting Authority or elsewhere, the Contractor shall furnish all the labour, equipment, materials, and means required, and shall carry out proper and efficient measure, wherever and as often as necessary to reduce the dust nuisance, and to prevent dust which has originated from his operations from damaging crops, orchards, cultivated fields, and dwellings, or causing a nuisance to persons. The Contractor will be held liable for any damage resulting from dust originating from his operations under this Specification on the right-of-way or elsewhere. 'The Engineer may direct sprinkling or other measures for dust abatement if necessary to obtain adequate control. In particular in towns and villages water sprinkling will be required as often as necessary to reduce the dust nuisance.

To reduce the dust problem the Engineer may direct the Contractor to install temporary speed limit traffic signs on those sections of the road where dust development is considerable.

(c) Noise Abatement

The Contractor shall comply with applicable Ethiopian laws, orders, and regulations concerning the prevention, control, and abatement of excessive noise.

Blasting, the use of jack hammers, rock crushing, or other operations producing high intensity impact noise may be performed at night only upon approval of the Engineer.

(d) Light Abatement

The Contractor shall exercise special care to direct all stationary floodlights to shine downward at an angle less than horizontal. These floodlights shall also be shielded so as not to be a nuisance to surrounding areas. No lighting shall include a residence in its direct beam.

The Contractor shall be responsible for correcting lighting problems when they occur as directed by the Engineer.

1607 PRESERVATION OF HISTORICAL, ARCHAEOLOGICAL AND CULTURAL REMAINS

If the Contractor discovers evidence of possible scientific, historical, archaeological or cultural interest or value during the execution of the works, he shall immediately notify the Engineer giving the nature and location of his findings. Written confirmation shall be forwarded within 2 days. he Contractor shall exercise care so as not to damage artifacts or fossils uncovered during excavation operations and shall provide such cooperation and assistance as may be necessary to preserve the findings for removal or other disposition by the Contracting Authority.

Where appropriate by reason of a discovery, the Engineer may order delays in the execution of, or changes in the methods of, executing the work, or both. If such delays, or changes, or both, are ordered, the period of performance and Contract price shall be adjusted in accordance with the applicable articles in the General Conditions of Contract.

The Contractor shall include this requirement in any sub-contracts for the construction of part of the works that he may enter into.

1608 PESTICIDES

Pesticides include herbicides, insecticides, fungicides, etc., surface disinfectants, animal rerepellents, and insect repellents. Should the Contractor find it necessary to use pesticides in work areas of this Contract, he shall submit his plan for such use to the Engineer for written approval.

The Contractor shall read and comply with all labelling requirements when using pesticides.

1609 CLEANUP AND DISPOSAL OF WASTE MATERIALS

(a) Cleanup

The Contractor shall, at all times, keep the construction area, including storage areas used, free from accumulations of waste materials or rubbish.

All waste water and sewage from office, residential and mobile camps shall be piped to soak pits or other disposal areas constructed in accordance with local regulations, and, where and when such regulations require it, the Contractor shall obtain a permit or other appropriate documentation approving the disposal methods being used.

All used fuels, oils, other plant or vehicle fluids, and old tyres and tubes shall be collected to a central disposal point, on a regular basis and disposed of as specified below.

All household, office, workshop and other solid waste shall be collected to a central disposal area, on a daily basis and disposed of in a manner approved by the Engineer.

Servicing of plant, equipment and vehicles shall, whenever possible, be carried out at a workshop area. This workshop area shall be equipped with secure storage areas for fuels, oils and other fluids constructed in such a way as to contain any spillages which may occur, and similar storage where used fluids can be stored securely prior to their disposal.

When the servicing of plant, equipment and vehicles is carried out away from the workshop area it shall be done at locations and in such a manner as to avoid spillage and contamination of streams and other drainage courses. Any spillages shall be cleaned up by either burning in place or collecting the contaminated soils and burning them at the central disposal area, all to the satisfaction of the Engineer.

Prior to completion of the work, the Contractor shall remove from the vicinity of the work all plant facilities, buildings, rubbish, unused materials, concrete formworks, and other similar material, belonging to him or used under his direction during construction, All work areas shall be graded and left in a neat manner conforming to the natural appearance of the landscape as provided in Clause 1602.

Any residue deposited on the ground from washing out transit mix trucks or any similar concrete operations shall be buried or cleaned up in a manner acceptable to the Engineer.

In the event of the Contractor's failure to perform the above work, the work may be performed by the Contracting Authority, at the expense of the Contractor and his sureties shall be liable thereof.

(b) Disposal of Waste Material

Waste materials including, but not restricted to, refuse, garbage, sanitary wastes, industrial wastes, and oil and other petroleum products, shall be disposed of by the Contractor. Disposal of combustible materials shall be by burying, where burial of such materials is approved by the Engineer; by burning, where burning of approved materials is permitted; or by removal from the construction area. Disposal of non-combustible materials shall be by burying, where burial of such materials is approved by the Engineer, or by removal from the construction area. Waste materials removed from the construction area shall be dumped at an approved dump.

(c) Disposal of Material by Burying

Only materials approved by the Engineer may be buried. Burial shall be in pits and the location, size and depth of which shall be approved by the Engineer. The pits shall be covered by at least 600mm of earth material prior to abandonment.

(d) Disposal of Material by Burning

All materials to be burned shall be piled in designated burning areas in such a manner as will cause the least fire hazards. Burning shall be thorough and complete and all charred pieces remaining after burning, except for scattered small pieces, shall be removed from the construction area and disposed of as otherwise provided in this Section.

The Contractor shall, at all times, take special precautions to prevent fire from spreading beyond the piles being burned and shall be liable for any damage caused by his burning operations. The Contractor shall have available, at all times, suitable equipment and

supplies for use in preventing and suppressing fires and shall be subject to all laws and regulations locally applicable for pre-suppression, suppression, and prevention of fires.

(e) Disposal of Material by Removal

Material to be disposed of by removal from the construction area shall be removed from the area prior to the completion of the work under the Contract.

Materials to be disposed of by dumping shall be hauled to an approved dump. It shall be the responsibility of the Contractor to make any necessary arrangements with private parties and with local officials pertinent to locations and regulations of such dumping.

DIVISION 1700: OVERHAUL

1701 SCOPE

This section covers the hauling of overhaul material as defined herein from the place of excavation or stockpile to the position of placement, where such haul distance is in excess of the free-haul distance as defined herein.

1702 DEFINITIONS

Overhaul material

Overhaul material shall be transported material to which overhaul shall apply when hauled in excess of the free-haul distance and shall include only the following materials:

(i) Gravel, soil or rock materials used in the construction of fills, pavement layers, banks and dykes.

(ii) Topsoil, gravel prescribed by the engineer as wearing course for temporary deviations, and selected gravel material used for backfilling drain and culvert excavations, but excluding permeable material used In filter drains.

(iii) Spoil material resulting from the authorized excavations of the road prism, drains, culverts and other structures and from fills in temporary deviations which are no longer required.

(iv) Crushed stone used in the construction of sub base and base, but only when overhaul applies in the circumstances specified in item 51.01 of clause 5113.

(v) Materials (irrespective of the type of material) cut from existing pavement layers and transported to spoil, or direct to fill elsewhere on the site, or to approved stockpiles, or from stockpiles to the point of application.

(vi) Materials and products specified elsewhere in the contract.

After reprocessing ordinary overhaul only shall apply to asphalt or any other material that has been reprocessed in a plant for recycling, and no restricted overhaul shall apply.

Overhaul

Two types of overhaul shall apply to this contract, and, depending on circumstances, any one or both may apply in respect of the same hauling operation.

Restricted overhaul shall apply to fill material from cut and borrow and to spoil material from excavations when hauled in excess of the free-haul distance of 0.5 km in respect of haul up to and including 1.0 km, and shall be measured and paid for by the cubic metre of material hauled between or over these distances.

Ordinary overhaul shall apply to all overhaul material in respect of haul in excess of 1.0 km, and shall be measured by the product of the volume of material hauled, measured as specified hereafter, and the overhaul distance as defined in sub clause 1702(e) hereof.

Both restricted and ordinary overhaul shall be paid in respect of material having a free-haul distance of 0.5 km when hauled in excess of 1.0 km.

Haul distance

The haul distance for cut to fill shall be the distance between the centre of volume of the overhaul material in the cut before excavation and the centre of volume of the portion of the fill constructed with the overhaul material.

The distance between the centres of volume shall be measured along the centre line of the road, and any additional distance of haul ascribed to the following of a different haul route will not be considered. Cut and fill volumes for ramps, road approaches and connections on either side of the road shall be considered as concentrated at the centre line of the main roadway under construction for computing overhaul quantities for payment, unless otherwise specified In the project specifications.

The haul distance for borrow material and cut to spoil material shall be measured along the shortest route determined by the engineer as being feasible and satisfactory. Should the contractor choose to haul material over some other longer route, computations for payment shall nevertheless be based on the haul distance measured along the shortest route designated by the engineer. The haul distance for borrow materials and cut to spoil shall be measured to the nearest 0.1 km.

Free -haul distance

The free- haul distance shall be the distance up to which overhaul material may be hauled before overhaul becomes payable. This distance shall be 1.0 km in the case of all overhaul materials, except cut and borrow to fill and cut to spoil material where the free-haul distance is 0.5 km.

Overhaul distance

The overhaul distance applying to item 17.02 shall be the haul distance as defined above, less 1.0 km, measured to the nearest 0.1 km.

1703 MEASUREMENT AND PAYMENT

Quantity of material

The quantity of material overhauled shall in all cases be measured in the same manner as the item to which the overhaul applies.

Item 17.01 Overhaul on material hauled in excess of a free - haul distance of 0.5 km, for haul up to or through 1.0 km (restricted overhaul).....cubic metre (m^3)

The unit of measurement shall be the cubic metre of overhaul material hauled over the distance given above.

Item 17.02 Overhaul on material hauled in excess of 1.0 km (ordinary overhaul) ....cubic metre-kilometre (m^3-km)

The unit of measurement shall be the cubic metre of overhaul material hauled in excess of 1.0 km, multiplied by the overhaul distance.

The tendered rates for overhaul shall include full compensation for hauling material in excess of the free-haul distance

1704 NOTES:

In the special cases detailed below, overhaul shall be measured as follows:

(1) Gravel crushed and/or screened (series 6000)

The haul distance on crushed and/or screened gravel shall be taken from the point of excavation or borrow to the crushing/screening plant and thence to the point of final use in the road or, in the case of material sieved out and discarded, to the point where finally placed. Overhaul shall be the total haul distance, minus the 1.0 km free-haul.

(2) Crushed-stone base or subbase material (serie 5000)

The following applies to crushed-stone base or subbase material as specified in series 5000 to which overhaul applies, i.e. material not obtained from commercial sources.

The haul distance shall be measured from the approved borrow pit to the crusher site and thence to the point where used on the road. The quantity shall be the actual quantity only of subbase or base material measured for payment and does not include material excavated but discarded or lost at the crusher.

(3) Oversize material removed from the road (sub clause 4405(d))

The haul on all oversize material removed from the road and taken to spoil shall be considered as two haul operations, and overhaul shall be calculated separately as follows:

(a) Haul from the point of procurement of the oversize material to the point where it is deposited on the road

Haul and overhaul shall be calculated in the normal manner, but no overhaul will be payable on the first portion of the oversize material which does not qualify for payment under any item for the "removal of oversize material".

(b) Haul from the point where it is bladed of the road to the point of disposal

The haul distance shall be from the point alongside the road where the oversize material is bladed off to the point where it is finally deposited. Overhaul shall apply to all oversize material removed, including material not paid for under any item for the "removal of oversize material". Overhaul shall be the haul distance minus the 1.0 km free-haul.

(4) Pavement layers constructed from materials mixed in a mixing plant and placed by paver

Measurement of and payment for overhaul in regard to material used in pavement layers, which has been mixed in a mixing plant and placed by paver, shall be the same as that in regard to material in pavement layers not mixed in a mixing plant or placed by paver, excepting that the haul distance shall be measured along the shortest direct route from the approved source to the locality where the material is placed on the road, irrespective of whether the material has been handled by a longer route from the source to the mixing plant and thence to the location where it was placed on the road.

The tendered rates for item 17.01 and 17.02 shall also include full compensation for handling the material for that distance by which the actual route is longer than the shortest direct route.