

Contract No.:

GOVERNMENT URBAN DEVELOPMENT COMPANY LIMITED

GANDHINAGAR

[A WHOLLY OWNED GOVERNMENT OF GUJARAT UNDERTAKING]



BIDDING DOCUMENT FOR

Amreli RoB LC No-19B under SJMMSVY

“Construction of R.O.B in Lieu of LC-19B at Rly. Ch. 16/2 To 16/3 Km. Between Khijadiya to Amreli Station on Amreli - Lathi State Highway” Under programme of SJMMSVY.

VOLUME – II

PART-I

“ITEM WISE SPECIFICATION”

GOVERNMENT OF GUJARAT

By

Vice President (Project)

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(Through e- Procurement Portal only - <https://tender.nprocure.com/>)

M-1 Water

1.1 Water shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil and injurious alkalis, salts, organic matter and other deleterious material which will either weaken the mortar or concrete or cause efflorescence or attack the steel in R.C.C. Container for transport, storage and handling of water shall be clean. Water shall conform to the standards specified in LS. 456-1978.

1.2. If required by Engineer-in-charge it shall be tested by comparison with distilled water. Comparison shall be made by means of standard cement tests for soundness, time of setting and mortar strength as specified in LS. 269-1976. Any indication of unsoundness, change in time of setting by 30 minutes or more or decrease of more than 10 per cent in strength of mortar prepared with water sample when compared with the results obtained with mortar prepared with distilled water shall be sufficient cause for rejection of water under test.

1.3. Water for curing mortar, concrete or masonry should not be too acidic or too alkaline. It shall be free of elements which significantly affect the hydration reaction or otherwise interfere with the hardening of concrete during curing or those which produce objectionable stains or other unsightly deposits on concrete or mortar surfaces.

1.4. Hard and bitter water shall not be used for curing.

1.5. Potable water will be generally found suitable for curing mortar or concrete.

M-2 Lime

2.1 Lime shall be hydraulic lime as per I.S. 712-1973. Necessary test shall be carried out as per I.S. 6932 (Parts I to X), 1973.

2.2 The following field tests for limes are to be carried out:

(1) A very rough idea can be formed about the type of lime by its visual examination i.e. fat lime bears pure white colour, lime in form of porous lumps of dirty white colour indicates quick lime, and solid lumps are the unburnt lime stone.

(2) Acid tests for determining the carbonate content in lime. Excessive amount of impurities and rough determination of class of lime.

2.3 Storage shall comply with I.S. 712-1973. The slaked lime, if stored, shall be kept in a weather proof and damp-proof shed with impervious floor and sides to protect it against rain, moisture, weather and extraneous materials mixing with it. All lime that has been damaged in any way shall be rejected and all rejected materials shall be removed from site of work.

2.4 Field testing shall be done according to I.S. 1624-1974 to show the acceptability of materials.

M-3 Cement

3.1 Cement shall be ordinary Portland slag cement as per LS. 269-1976 or Portland slag cement as per I.S. 455-1976.

M-4 White Cement

4.1 The white cement shall conform to I.S. 80412-E 1978.

M-5 Coloured Cement

5.1 Coloured cement shall be with white or gray Portland cement as specified in the item of the work. 5.2 The pigments used for coloured cement shall be of approved quality and shall not exceed 10 % of cement used in the

Mix. The mixture of pigment shall be properly grounded to have a uniform colour and shade. The pigments shall have such properties to provide for durability under exposure to sunlight and weather.

5.3. The pigment shall have the property such that it is neither affected by the cement nor detrimental to it.

M-6 Sand

6.1. Sand shall be natural sand, clean, well graded, hard strong durable and gritty particle free from injurious amounts of dust clay, kankar nodules, soft or flaky particles shale, alkali; salts organic, matter, loam, mica or other deleterious substance and shall be got approved from the Engineer-in-charge. The sand shall not contain more than 8 percent of silt as determined by field test, if necessary the sand shall be washed to make it clean.

6.2. Coarse Sand:

The fineness modulus of coarse sand shall not be less than 2.5 and shall not exceed 3.0. The sieve analysis of coarse shall be as under:

I. S. Sieve Designation	Percentage by weight passing sieve	I. S. Sieve Designation	Percentage by weight passing sieve
4.75 mm.	100	600 Micron	30 – 10
2.36 mm.	90 To 100	300 Micron	5 – 70
1.18 mm.	70 – 100	150 Micron	0 – 50

6.3 Fine Sand:

The fineness modulus shall not exceed 1.0. The sieve analysis of fine sand shall be as under

I. S. Sieve Designation	Percentage by weight passing sieve	I. S. Sieve Designation	Percentage by weight passing sieve
4.75 mm.	100	600 Micron	40 – 85
2.36 mm.	100	300 Micron	5 – 50
1.18 mm.	70 – 100	150 Micron	0 - 10

M-7 Stone Dust:

7.1 This shall be obtained from crushing hard black trap or equivalent. It shall not contain more than 8% of silt as determined by field test with measuring cylinder. The method of determining silt contents by field test is given as under

7.2 A sample of stone dust to be tested shall be placed without drying in 200 mm. measuring cylinder. The quantity of the sample shall be such that it fills the cylinder up to 100 mm. mark. The clean water shall be added up to 150 mm. mark. The mixture shall be stirred vigorously and the content allowed to settle for 3 hours.

7.3. The height of silt visible as settled layer above the stone dust shall be expressed as percentage of the height of the stone dust below. The stone dust containing more than 8% silt shall be washed so as to bring the silt content within the allowable limit.

7.4. The fineness modulus of stone dust shall not be less than 1.80.

M-8 Stone Grit:

8.1. Grit shall consist of crushed or broken stone and be hard strong, dense, durable, clean, of proper gradation and free from skin or coating likely to prevent adhesion of mortar Grit shall generally be cubical in shape and as far as possible flaky elongated pieces shall be avoided. It shall generally comply with the provisions of I.S. 383-1970. Unless special stone of particular quarries is mentioned, grit shall be obtained from the best black trap or equivalent hard stone as approved by the Engineer-in-charge. The grit shall have no deleterious reaction with cement.

8.2. The grit shall conform to the following gradation as per sieve analysis:

I.S. Sieve Designation	Percentage by weight passing through sieve
12.50 mm	100 %
10.00 mm	85 – 100 %
4.75 mm	0 – 20 %
2.36 mm	0 – 25 %

8.3. The crushing strength of grit will be such as to allow the concrete in which it is used to built-up the specified strength of concrete.

8.4. The necessary tests for grit shall carried out as per the requirements of I.S. 2386 (Parts I to VII) 1963, as per instructions of the Engineer-in-charge. The necessity of test will be decided by the Engineer-in-charge.

M-9 Cinder:

9.1 Cinder is well burnt furnace residue which has been fused or sintered into lumps of varying sizes.

9.2. Cinder aggregates shall be well burnt furnace residue obtained from furnace using coal fuel only. It shall be sound clean free from clay, dirt, ash or other deleterious matter.

9.3. The average grading for cinder aggregates shall be as mentioned below:

I.S. Sieve Designation	Percentage passing
20 mm	100
10 mm	86
4.75 mm	70
2.36 mm	52

M-10 Lime Mortar:

10.1. Lime shall conform to specification M-2. Water shall conform to specification M-1.

Sand shall conform to specification M-6.

10.2. Proportion of Mix:

10.2.1. Mortar shall consist of such proportions of slaked lime and sand as may be specified in the item. The slaked lime and sand be measured by volume. .

10.3. Preparation of mortar:

10.3.1. Lime mortar shall be prepared by wet process as per I.S. 1625-1971. Power driven mill shall be used for preparation of lime mortar. The slaked lime shall be placed in the mill in an even layer and grind for the 180 revolutions with sufficient water. Water shall be added as required during grinding (care being taken not to add more water) that will bring the mixed material to a consistency of stiff paste. Thoroughly wetted sand shall then be added evenly and the mixture ground for another 180 revolutions.

10.4 Storage:

10.4.1 Mortar shall always be kept damp, protected from sun and rain till used up, covering it by tarpaulin or open sheds.

10.5 Use:

10.5.1. All mortar shall be used as soon as possible after grinding. It should be used on the day on which it is prepared, but in no case mortar made earlier than 36 hours shall be permitted for use.

M-11 Cement Mortar:

11.1. Water shall conform to specification M-1. Cement shall conform to specification M-3. Sand shall conform to M-6. 11.2. Proportion of Mix:

11.2.1: Cement and sand shall be mixed to specified proportion, sand being measured by measuring boxes. The proportion of cement will be by volume on the basis of 50 Kg. / Bag of cement being equal to 0.0342 Cu.m. The mortar may be hand mixed or machine mixed as directed.

11.3. Preparation of mortar:

11.3.1 In hand mixed mortar cement and sand in the specified proportions shall be thoroughly mixed dry on a clean impervious platform by turning over at least 3 times or more till a homogenous mixture of uniform colour is obtained. Mixing platform shall be so arranged that no deleterious extraneous material shall get mixed with mortar or mortar shall flow out. While mixing, the water shall be gradually added and thoroughly mixed to form a stiff plastic mass of uniform colour so that each particle of sand shall be completely covered with a film of wet cement. The water cement ratio shall be adopted as directed.

11.3.2 The mortar so prepared shall be used within 30 minutes of adding water. Only such quantity of mortar shall be prepared as can be used within 30 minutes.

M-12 Stone Coarse Aggregate for Nominal Mix Concrete:

12.1. Coarse aggregate shall be machine crushed stone of black trap or equivalent and be hard, strong, dense, durable, clean and free from skin and coating likely to prevent proper adhesion of mortar.

12.2. The aggregate shall generally be cubical in shape. Unless special stones of particular quarries are mentioned aggregates shall be machine crushed from the best black trap or equivalent hard stone as approved. Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate for plain cement concrete and ordinary reinforced cement concrete shall generally be as per the table given below. However in case of reinforced cement concrete the maximum limit may be restricted to 6 mm. less than the minimum lateral clear distance between bars or 6 mm. less than the cover, whichever is smaller.

TABLE							
I. S. Sieve Designation	Percentage passing for single sized aggregates of Nominal size			I. S. Sieve Designation	Percentage passing for single sized aggregates of Nominal size		
	40 mm	20 mm	40 mm		40 mm	20 mm	40 mm
80 mm.	---	---	---	12.5 mm.	---	---	---
63 mm.	100	---	---	10 mm.	0.5	0.02	0.30
40 mm.	85 – 100	100	---	4.75 mm.	---	0.5	0.5
20 mm.	0 – 20	85 – 100	100	2.35 mm.	---	---	---
16 mm.	---	---	85 – 100				

Note: This percentage may be varied somewhat by Engineer-in-charge when considered necessary for obtaining better density and strength of concrete.

12.3. The grading test shall be taken in the beginning and at the change of source of materials. The necessary test indicated in I.S. 383-1970 and I.S. 456-1978 shall have to be carried out to ensure the acceptability. The aggregates shall be stored separately and handled in such a manner as to prevent the intermixing of different aggregates. If the aggregates are covered with dust, they shall be washed with water to make them clean.

M-13 Black Trap or Equivalent Hard Stone Coarse Aggregate:

13.1. Aggregate For Design Mix Concrete: Coarse aggregate shall be of machine crushed stone of black trap or equivalent hard stone and be hard strong dense- durable clean and free from skin and coating likely to prevent proper adhesion of mortar.

13.2. The aggregates shall generally be cubical in shape. Unless special stones of particular quarries are mentioned, aggregates shall be machine crushed from the best, black trap or equivalent hard stones as approved. Aggregate shall have no deleterious reaction with cement.

13.3. The necessary tests indicated in I.S. 383-1970 and I.S. 456-1978 shall have to be carried out to ensure the acceptability of the material.

13.4. If aggregate is covered with dust it shall be washed with water to make it clean.

M-14 Brick Bats Aggregate:

14.1. Brick bat aggregate shall be broken from well burnt or slightly over burnt and dense brick. It shall be homogeneous in texture roughly cubical in shape, clean and free from dirt of any other foreign material. The brick bats shall be of 40 mm. to 50 mm. size unless otherwise specified in the item. The under burnt or over burnt brick bats shall not be allowed.

14.2. The brick bats shall be measured by volume by suitable boxes or as directed.

M-15 Brick:

15.1. The bricks shall be hand or machine molded and made from suitable soils and kiln-burnt. They shall be free from crack and nodules of free lime. They shall have smooth rectangular faces with sharp corners and shall be of uniform colour.

The bricks shall be molded with a frog of 100 mm. x 40 mm. and 10 mm. to 20 mm. deep on one of its flat sides. The bricks shall not break when thrown on the ground from a height of 600 mm.

15.2. The size of modular bricks shall be 190 mm. x 90 mm. x 90 mm.

15.3. The size of the conventional bricks shall be as under:

(9" x 4 3/8 " x 2 3/4 ") i.e. 225 x 110 x 75 mm.

15.4. Only bricks of one standard size shall be used on one work. The following tolerances shall be permitted in the conventional size adopted in a particular work.

Length $\pm 1/8"$ (3.0 mm) Width $\pm 1/16"$ (1.50 mm) Height $\pm 1/6"$ (1.50 mm.)

15.5. The crushing strength of the bricks shall not be less than 35 Kg./Sq.Cm. The average water absorption shall not be more than 20 percent by weight. Necessary tests for crushing strength and water absorption etc. shall be carried out as per I.S. 3495 (Part-I to IV) 1976.

M-16 Stone:

16.1. The stone shall be of the specified variety such as Granite/Trap Stone/Quartzite or any other type of good hard stones.

The stones shall be obtained only from the approved quarry and shall be hard, sound, durable and free from defects like cavities, cracks, sand holes, flaws, injurious veins, patches of loose or soft materials etc. and weathered portions and other structural defects or imperfections tending to affect their soundness and strength. The stone with round surface shall not be used. The percentage of water absorption shall not be more than 5% of dry weight, when tested in accordance with I.S. 1134- 1974. The minimum crushing strength of the stone shall be 200 Kg. / Sq.Cm unless otherwise specified.

16.2 The samples of the stone to be used shall be got approved before the work is started.

16.3 The Khanki facing stone shall be dressed by chisel as specified in the item for Khanki facing in required shape and size. The face of stone shall be so dressed that the bushing on the exposed face shall not project by more than 40 mm. from the general wall surface and on face to be plastered it shall not project by more than 19 mm. nor shall it have depressions more than 10 mm. from the average wall surface.

M-17 Laterite stone:

17.1. Laterite stone shall be obtained from the approved quarry. It shall be compacted in texture, sound, durable and free from soft patches. It shall have a minimum crushing strength of 100 Kg. /Sq.Cm. in its dry condition. It shall not absorb water more than 20% of its own weight, when immersed for 24 hours in water. After quarrying the stone shall be allowed to weather for some time before using in work.

17.2. The stone shall be dressed into regular rectangular blocks so that all faces are free from waviness and unevenness, edges true and square.

17.3. Those types of stone in which white clay occur, should not be used.

17.4. Special corner stones shall be provided where so directed.

M-18 Mild Steel Bars:

18.1 Mild steel bars reinforcement for R.C.C. work shall conform to I.S. 432 (Part-II) 1966 and shall be of tested quality. It shall also comply with relevant part of I.S. -t56- 1978.

18.2 All the reinforcement shall be clean and free from dirt, paint, grease, mill scale or loose or thick rust at the time of placing.

18.3. For the purpose of payment, the bar shall be measured correct up to 100 mm. length and weight payable worked out at the rate specified below:

1.	6 mm.	0.22 Kg./Rmt.	8.	20 mm	2.47 Kg./Rmt.
2.	8 mm	0.39 Kg./Rmt.	9.	22 mm	2.98 Kg./Rmt.
3.	10 mm	0.62 Kg./Rmt.	10.	25 mm	3.85 Kg./Rmt.
4.	12 mm	0.89 Kg./Rmt.	11.	28 mm	4.83 Kg./Rmt.
5.	14 mm	1.21 Kg./Rmt.	12.	32 mm	6.31 Kg./Rmt.
6.	16 mm	1.58 Kg./Rmt.	13.	36 mm	7.99 Kg./Rmt.
7.	18 mm	2.00 Kg./Rmt.	14.	40 mm	9.86 Kg./Rmt.

M-19 High Yield Strength Steel Deformed Bars:

19.1. High yield strength steel deformed bars be either cold twisted or hot rolled shall conform to I.S. 1739-1966 and I.S. 1139- 1966 respectively.

19.2. Other provision and requirements shall conform to specification No. M-18 for Mild steel bars.

M-20 High Tensile Steel Wires:

20.1. The high tensile wires for the use in pre stressed concrete work shall confirm to I.S. 2090-1962.

20.2. The tensile strength of the high tensile steel bars shall be as specified in the item. In absence of the given strength, the minimum strength shall be taken as per Para 6.1 of I.S. 1785-1962. Testing shall be done as per I.S. requirements. 20.3. The high tensile steel shall be free from loose mill scale, rust oil, grease, or any other harmful matter. Cleaning of steel bars may be carried out by immersion in solvent solution, wire brushing or passing through a pressure box containing carborandum.

20.4. The high tensile wire shall be obtained from manufactures in coil having diameter not less than 350 times the diameter of wire itself so that wire springs back straight on being uncoiled.

M-21 Mild Steel Binding Wires:

21.1. The mild steel wire shall be of 1.63 mm. or 1.22 mm. (16 or 18 gauge) diameter and shall conform to I.S. 280-1972.

21.2. The use of black wire will be permitted for binding reinforcement bars. It shall be free from rust, oil paint, grease, loose mill scale or any other undesirable coating which may prevent adhesion of cement mortar.

M-22 Structural Steel:

22.1 All structural steel shall conform to I.S. 226-1965. The steel shall be free from the defects mentioned in I.S. 226-1975 and shall have a smooth finish. The material shall be free from loose mill scale, rust pits or other defects affecting the strength and durability. Rivet bars shall conform to I.S. 1148-1973.

22.2 When the steel is supplied by the Contractor test certificates of the manufacturers shall be obtained according to I.S. 226-1975 and other relevant Indian Standards.

M-23 Galvanized Iron Sheets:

23.1 The galvanized iron sheets shall be plain or corrugated sheets of specified in item. The G.I. Sheets shall conform to I.S. 277-1977. The sheets shall be undamaged in carriage and handling either by rubbing off of zinc coating or otherwise they shall have clean and bright surface and shall be free from dents, holes, rust or white powdery deposit.

23.2 The length and width of G.I. sheer shall be as directed as per site condition.

M-23 A; G.I. Valleys gutter ridges:

23. A.1 The G.I. ridges and hips shall be of plain galvanized sheets class-3 of the thickness as specified in item. These shall be 600 mm. in width and properly bent up to shape without damage to the sheets in process of bending.

23.A.2. Valleys gutters and flashings shall also be galvanized sheet of thickness as specified in item. Valleys shall be 900 mm. wide overall and fishing shall be 380 mm. wide overall. They shall be bent to the, required shape without damage to the sheet in the process of bending.

M-24 Asbestos Cement Sheets:

24.1 Asbestos cement sheets plain, corrugated or semi corrugated shall conform to I.S. 459-1970. The thickness of the sheets shall be as specified in the item. The shutter shall be free from all defects such as cracks, holes deformities, chipped edges or otherwise damaged.

24.2. Ridges & Hips

24.2.1 Ridges and hips shall be of same thickness as that of A.C. sheets. The types of ridges suitable for the type of sheets and location

24.2.2 Other accessories to be used in roof such as flashing pieces, caves filler pieces, valley gutters, north light and ventilator curves, barge boards etc. shall be standard manufacture and shall be suitable for the type of sheets and location.

M-25 Mangalore Pattern Roof Tiles:

25.1 The Mangalore pattern tiles shall conform to I S. 654-1972 for Class AA or Class 'A' type as specified in item. Samples of the tiles to be provided shall be got approved from the Engineer-in-charge. Necessary tests shall be carried out as directed.

M-26 Shuttering:

26.1. The shuttering shall be either of wooden planking of 30 mm minimum thickness with or without steel lining or of steel plates stiffened by steel angles. The shuttering shall be supported on battens and beams and props of vertical bellies properly cross braced together so as to make the centering rigid. In places of bulged props, brick pillar of adequate section built in mud mortar may be used.

26.2. The form work shall be sufficiently strong and shall have camber, so that it assumes correct shape after deposition of the concrete and shall be able to resist forces caused by vibration of live load of men working over it and other incidental loads associated with it. The shuttering shall have smooth and even surface and its joints shall not permit leakage of cement grout.

26.3. If at any stage of work during or after placing concrete in the structure, the form work sags or bulges out beyond the required shape of the structure, the concrete shall be removed and work redone with fresh concrete

and adequately rigid form work. The complete form work shall be got inspected by and got approved from the Engineer-in-charge, before the reinforcement bars are placed in position.

26.4. The props shall consist of bullies having 100 mm. minimum diameters measured at mid length and 80 mm. at thin end and shall be placed as per design requirement. These shall rest squarely on wooden sole plates 40 mm. thick and minimum bearing area if 0-10 sq. m. lay on sufficiently hard base.

26.5. Double wedges shall further be provided between the sole plate and the wooden props so as to facilitate tightening and easing of shuttering without jerking the concrete.

26.6 The timber used in shuttering shall not be so dry as to absorb water from concrete and swell or bulge nor so green or wet as to shrink after erection. The timber shall be properly sawn and planed on the sides and surface coming in contact with concrete. Wooden form work with metal sheet lining or steel plates stiffened by steel angles shall be permitted.

26.7 As far as practicable, clamps shall be used to hold the forms together and use of nails and spikes avoided.

26.8 The surface of timber shuttering that would come in contact with concrete shall be well wetted and coated with soap solution before, the concreting is done. Alternatively coat of raw linseed oil or oil of approved manufacturer may be applied in place of soap solution. In case of steel shuttering either soap solution or raw linseed oil shall be applied after thoroughly cleaning the surface. Under no circumstances black or burnt oil shall be permitted.

26.9 The shuttering for beams and slabs shall have camber of 4 mm. per metre (1 in 250) or as directed by the Engineer-in-charge so as to offset the subsequent deflection. For cantilevers, the camber at free end shall be 1/50 of the projected length or as directed by the Engineer-in-charge.

M-27 Expansion Joints-Pre-Molded Filler:

27.1 The item provides for expansion joints in R.C.C. frame structures for internal joints, as well as exposed joints, with the use of pre molded bituminous joint filler.

27.2 Pre molded bituminous joint filler, i.e. performed strip of expansion joint filler shall not get deformed or broken by twisting, bending or other handling when exposed to atmospheric condition. Pieces of joint filler that have been damaged shall be rejected.

27.3 Thickness of the pre-molded joint filler shall be 25 mm. unless otherwise specified.

27.4 Pre molded bituminous joint filler shall conform to I.S. 1838-1961

M-44 Paints:

44.1 (A) Oil paints:

44.1.1 Oil paints shall be of the specified colour and shade, and, approved. The ready mixed paint shall only be used. However, if ready mixed paint or specified shade or tint is not available, white ready mixed paint with approved stainer will be allowed. In such a case, the contractor shall ensure that the shade of the paint so allowed shall be uniform.

44.1.2 All the paints shall meet with following general requirements:

(i) Paint shall not show excessive setting in a freshly opened full can and shall easily be redispersed with a paddle to a smooth homogeneous state. The paint shall show no curdling, livering, caking or colour separation and shall be free from lumps and skins.

(ii) The paint as received shall brush easily, possess good levelling properties and show no running or sagging tendencies.

(iii) The paint shall not skin within 48 hours in a three quarters filled closed container.

(iv) The paint shall dry to a smooth uniform finish free from roughness, grit, unevenness and other imperfections.

44.1.3 Ready mixed paint shall be used exactly as received from the manufacturers and generally according to their instructions and without any admixtures whatsoever.

44.2 (B) Enamel Paints:

44.2.1 The enamel paint shall satisfy in general requirements as mentioned in specification of oil paints. Enamel paint shall conform to I.S. 2933 - 1975.

M-49 Polished Kotah Stones:

49.1 Polished Kotah stone shall have the same specifications as per rough Kotah stone except as mentioned below.

49.2 The stones shall have machine polished smooth surface. When brought on site, the stones shall be single polished or double polished depending upon its use. The stones for paving shall generally be single polished. The stones to be used for dado, skirting, platforms, sink, veneering, sills, steps, etc. where machine polishing after the stones are fixed in situ is not possible, shall be double polished.

M-51 Marble Slab:

51.1 Marble slab shall be white or of other colour and of best quality as approved by the Engineer-in-charge.

51.2. Slabs shall be hard, uniform and homogeneous in texture. They shall have even crystalline grain and free from defects and cracks. The surface shall be machine polished to an even and perfectly plane surface and edges machine cut true and square. The rear face shall be rough to provide key for the mortar.

51.3 Marble slabs with natural veins, if selected shall have to be laid as per the pattern given by the Engineer-in-charge. Size of the slab shall be minimum 450 mm x 450 mm. and preferable 600 mm x 600 mm. However, smaller sizes will be allowed to be used to the extent of maintaining required pattern.

51.4 The slab shall not be thinner than the specified thickness at its thinnest part. A few specimen of finished slab to be used shall be deposited by the contractor in the office for reference.

51.5 Except as above, the marble slabs shall conform to I.S. 1130 – 1969.

M-47 Flooring Tiles:

47.1 (A) Plain Cement tiles:

47.1.1 The plain cement tiles shall be general purpose type. These are the tiles in the manufacture of which no pigments are used. Cement used in the manufacture of tiles shall be as per Indian Standards.

47.1.2. The tiles shall be manufactured from a mixture of cement and natural aggregates by pressure process. During manufacture, the tiles shall be subjected to a pressure of not less than 140 Kg/Sq.Cm. The proportion of cement to aggregate in the backing of the tiles shall be not less than 1:3 by weight. The wearing face through the tiles are of plain cement, shall be provided with stone chips of 1 to 2 mm size. The proportions of cement to the marble chips aggregate in the wearing layer of the tiles shall be three parts of cement to one part chips by weight. The minimum thickness of wearing layer shall be 3 mm. The colour and texture of wearing layer shall be uniform throughout its face and thickness. On removal from mould, the tiles shall be kept in moist conditions continuously at least for seven days and subsequently, if necessary; for such long period as would ensure their conformity to requirements of I.S.:1237 - 1980 regarding strength resistance to wear and water absorption.

47.1.3 The wearing face of the tiles shall be plain, free from projections, depressions and cracks and shall be reasonably parallel to the back face of the tile. All angles shall be right and all edges shall be sharp and true.

47.1.4. The size of tiles shall generally be square shape 24.85 Cm. x 24.85 Cm: or 25 Cm. x 25 Cm. The thickness of tiles shall be 20 mm.

47.1.5 Tolerance of length and breadth shall be plus or minus one millimeter. Tolerance on thickness shall be plus 5mm.

47.1.6 The tiles shall satisfy the tests as regards transverse strength, resistance to wear absorption as per I.S. 1237 – 1980.

47.2. (B) Plain Colored Tiles:

47.2.1 These tiles shall have the same specification as per plain cement tiles as per (A) above except that they shall have a plain wearing surface wherein pigments are used. They shall conform to I.S. 1237 – 1980.

47.2.2 The pigment used for colouring cement shall not exceed 10 percent by weight of cement used in the mix. The pigments, synthetic or otherwise, used for colouring tiles shall have permanent colour and shall not contain materials detrimental to concrete.

47.2.3: The colour of the tiles shall be specified in the item or as directed.

47.3. (C) Marble Mosaic Tiles:

47.3.1 These tiles have the same specifications as per plain cement tiles except the requirements as stated below:

47.3.2 The marble mosaic tiles shall conform to I.S. 1237 – 1980. The wearing face of the tiles shall be mechanically ground and filled. The wearing face of tiles shall be free from projections, depressions and, cracks and shall be reasonably parallel to the back face of the tiles. All angles shall be right angles and all edges shall be sharp and true.

47.3.3 Chips used in the tiles be from smallest up to 20 mm size. The minimum thickness of wearing layer of tiles shall of b mm. For pattern of chips to be used on the wearing face, a few samples with or without their full size photographs as directed shall be presented to the Engineer-in-charge for approval.

47.3.4 Any particular samples, if found suitable shall be approved by the Engineer-in-charge, or he may ask for few more samples to be prepared indicating roughly the particular sized chips to be more or less in the, sample presented. The samples have to be made by the contractor till a suitable sample is finally approved for use in the work.

The Contractor shall ensure that the tiles supplied for the work shall be in conformity with the approved sample only, in terms of its dimensions, thickness of backing layer and wearing surface, materials, ingredients, colour shade, Chips, distribution etc. required.

47.3.5 The tiles shall be prepared from cement conforming to Indian Standards or coloured Portland cement generally depending upon the colour of tiles to be used or as directed.

47.4. (D) Chequered Tiles:

47.4.1 Chequered tiles shall be plain cement tiles or marble mosaic tiles. The former shall have the same specification as per (A) above and the latter as per marble mosaic tiles as per (C) except as mentioned below

47.4.2 The tiles shall be of nominal size of 250 mm x 250 mm or as specified. The centre to centre distance of chequered shall not be less than 25 mm and not more than 50mm. The overall thickness of the tile shall be 22 mm.

47.4.3 The grooves in the chequers shall be uniform and straight. The depth of the grooves shall not be less than 3 mm. The chequered shall be plain, coloured or mosaic as specified. The thickness of the upper layer measured from the top of the chequered shall not be less than 6 mm. The tiles shall be given the first grinding with machine before delivery to site.

47.4.4 Tiles shall conform to relevant I.S. 1237 – 1980.

ITEMWISE SPECIFICATION

Item No.1

Excavation for foundation of structures including existing pavement surfaces including dewatering, shoring and strutting as necessary and backfilling the trenches with suitable excavated material in layers of 15 to 20 cms and disposing of remaining unsuitable material with all lifts and lead as directed and preparation of bed for concreting of foundations etc. complete as directed by Engineer and as per specification.

Soils of all types From 0 to 3m depth including ordinary earth, sand dry / wet soil, marine clay, boulders, kankars, soft murrum, hard murrum, etc.

1. The relevant specification for excavation for foundation for open foundation given in MORT&H fifth revision Clause-304 & RDSO specification & IS: 3764 shall be applicable to this item.
2. The measurement shall be in Cum. basis.
3. The rate includes shoring, strutting, dewatering, as necessary and disposing of the excavated stuff as directed.
4. The mode of payment shall be in per cum. basis.

Item No.2

Excavation in hard rock by dry-wet blasting and chiselling including dewatering preparing foundation base by proper benching and stepping and disposing of the excavated stuff as directed.(B) prohibited Blasting. work.

1. The relevant specification for excavation for foundation for open foundation given in MORT&H fifth revision Clause-304 & RDSO specification & IS: 3764 shall be applicable to this item.
2. The measurement shall be in Cum. basis.
3. The rate includes shoring, strutting, dewatering, as necessary and disposing of the excavated stuff as directed.
4. The mode of payment shall be in per cum. basis.

Item No.3

Providing and fixing mild steel dowel bars of 32mm dia. for anchoring by drilling holes in foundation strata including necessary bending, hooking of dowel bars and grouting the holes complete as per detailed drawing and as directed.

Steel shall conform to the requirements of IS:432 and IS: 1786 as relevant. The dowel bars shall conform to IS:432 of Grade I. The steel shall be coated with epoxy paint for protection against corrosion.

The relevant specifications of MORT&H fifth revision clause 602.6.5 shall apply to this item, directed by engineer in charge and as per detailed of item description.

1. The item shall be measured in Running meter.
2. Rate shall be included all materials, labour, equipment etc. required to execute this item.

Rate shall be for unit of one Running meter.

Item No.4

Providing and laying in situ ordinary cement concrete M-15 grade bedding concrete in foundation / below pile cap including dewatering, shuttering, compacting, curing etc. complete true to level and position as directed by Engineer and as per specification.

Ordinary cement concrete of specified Grade shall be carried out in accordance with the following specification.

1. In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportions of cement, fine aggregates and coarse aggregates are specified by volume as given in table below for different grades of concrete designated as ordinary M. 100, M. 150, M.200 and M.250.
2. In the designation of a concrete mix, letter "M" refers to the mix and the number the specified 28 days works cube compressive strength of that mix on 150 mm. cubes expressed in kg/cm².
3. The ordinary concrete mix shall generally be specified by volume. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg. of cement as 0.035 cubic meter in volume. While measuring aggregate by volume, shaking, ramming or hammering shall not be done. Proportioning of sand shall be as per its dry volume. In case it is dump, allowance for "bulking" shall be made as per IS : 2386 (Part-III).
4. Ingredients required for ordinary concrete containing one 50 Kg. bag of cement of different proportions of mix shall be as given in Table below.

TABLE

Grade of Concrete	Mix By Volume	Total Quantity of dry aggregates by volume per 50 Kg. of cement, to be taken as sum of the individual volumes of fine and coarse aggregates max	Proportion of fine aggregate to coarse aggregate	Quantity of water per 50 kg. of cement max.
1	2	3	4	5
(1 Cubic meter = 1000 liters)				
Ordinary	Liters			Liters
M.100	1:3:6	300	General 1:2 for fine aggregate to coarse aggregate by volume but subject to a upper limit of 1:1. ½ & a lower limit of 1:3	34
M.150	1:2:4	220		32
M.200	1:1.1/2:3	160		30
M.250	1:1:2	100		27

NOTE- The proportions of the aggregates shall be adjusted from upper limit to lower limit progressively as the grading of the fine aggregates becomes finer & the maximum size of coarse aggregate becomes larger.

Example- For an average grading of fine aggregate (that is Zone II of IS : 383-1963) the proportions shall be 1: 11/2, 1:2 and 1:3 for maximum size of aggregates 10 mm, 20 mm. and 40 mm. respectively (after carrying out sieve analysis).

Note-2 A mix leaner than M.100 (1:3:6) may be used for non- structural parts, if provided in the contract. In such case grading of aggregates shall be by volume. Other requirements for mixing, placing & curing shall be the same.

5. Following shall be the maximum nominal size of coarse aggregate for the different items of work:

Sr. No.	Item of Construction	Maximum nominal size of Coarse aggregate
(i)	R.C.C. well curb and R.C.C. Piles	40 mm
(ii)	R.C.C. well staining	63 mm
(iii)	Well cap or pile cap; solid type piers, abutment and wing-walls, and their pier caps	40 mm
(iv)	R.C.C. works in cross girders deck slab, wearing coats, kerb, light	20 mm

	posts, blast walls, approach slab etc. and hollow type piers, abutments, wing-walls and their pier caps	
(v)	R.C.C. bearings.	20 mm.
(vi)	For any other item of construction not covered by items (i) to (v)	As specified on the drawing or as desired by the Engineer-In-charge in case it is not specified on drawing.

For heavily reinforced concrete members as in the case of ribs of main beams nominal maximum size of aggregate shall usually be restricted to 5 mm. less than the minimum lateral clear distance between the main bars or 5 mm. less than the minimum cover to the reinforcement, whichever is the smaller.

6. Fine aggregate shall be clean, hard, coarse sand. It shall be free from dust and such other substances. The sand be got approved by the Engineer-in-charge.
7. All materials shall be stored as to prevent their deterioration or intrusion of their quality and fitness for the work. Any material which has deteriorated or has been damaged or is otherwise considered defective by the Engineer-in-charge shall not be used in the works.
8. Cement shall be stored above the ground level in perfectly dry and water tight sheds. Wherever bulk storage containers are used, their capacity should be sufficient to cater to the requirements at site and should be cleaned at least once every 3 to 4 months. The aggregate shall be stored in such a way as to prevent admixture of foreign materials. Different size of fine or coarse aggregate shall be stored in separate stock-piles sufficiently away from the each other to prevent intermixing the materials.
9. The water for mixing shall be potable water to satisfaction of the Engineer-in-charge. The quantity of water shall be just sufficient to produce a dense concrete of required workability for the job.
10. For all work concrete shall be mixed in a mechanical mixer which along with other accessories shall be kept in first class working condition and so maintained throughout the construction. Mixing shall be continued till materials are uniformly distributed and uniform colour of the entire mass is obtained and each individual particle of the coarse aggregate show complete coating of mortar containing its proportionate amount of cement. In no case shall the mixing be done for less than 2 minutes after all ingredients have been put into the mixer.
11. When hand mixing is permitted by the Engineer-in-charge for small jobs or for certain other reasons. It shall be done on a smooth watertight platform large enough to allow efficient turning over of the ingredients of concrete before and after adding water. Mixing platform shall be so arranged that no foreign material shall get mixed with concrete nor does the mixing water flow out. Cement in required number of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregate, which shall also be spread in a layer of uniform thickness on the mixing platform. Dry coarse and fine aggregate and cement shall then be mixed thoroughly by turning over to get a mixture of uniform colour. Enough water shall then be added gradually through a rose can and the mass turned over till a mix of required consistency is obtained. In hand mixing quantity of cement shall be increased by 10 per cent above that specified.
12. Mixers which have been-out of use for more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed to be the Engineer-in-charge, the first batch of concrete from the mixer shall contain only two thirds of normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.
13. The method of transporting and placing concrete shall be approved by the Engineering-in-charge. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes places. All form work and reinforcement contained in it shall be cleaned and made free from standing water, dust, snow or ice immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the Engineer-in-charge has been obtained.
14. If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer-in-charge. Concreting being given, it shall proceed continuously over the area between

construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly design agitators, operating continuously, when this time shall be within 2 hours of the addition of cement to the mix and within 30 minutes of its discharge from the agitator. Except where otherwise agreed to be the Engineer-in-charge, concrete shall be deposited in horizontal layers to a compacted depth of not more than 0.45 meter when internal vibrators are used and not exceeding 0.30 meter in all other cases.

15. Unless otherwise agreed to by the Engineer-in-charge concrete shall not be dropped into place from a height exceeding 1.2 meters. When trucking or chutes are used they shall be kept clean and used in such a way as to avoid segregation. When concreting has to be resumed on a surface which has hardened, it shall be roughened, swept, clean, thoroughly wetted and covered with a 13 mm. thick layer of mortar composed of cement and sand in the same ratio as in the concrete mix itself. This 13 mm. layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgement of any particles of coarse aggregate. The surface shall then be thoroughly wetted, all free water removed and then coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 150 mm. in thickness, and shall be well rammed against old work particular attention being given to corners and close spots.
16. All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrators, unless otherwise permitted by the Engineer-in-charge for exceptional cases, such as concreting under water, where vibrators cannot be used. Sufficient vibrators in serviceable condition shall be kept at site so that spare equipment is always available in the event of break downs.
17. Immediately after compaction, concrete shall be protected against harmful effects of weather, including rain, running water, shocks, vibration, traffic, rapid temperature changes, frost and driving out process. It shall be covered with wet sacking, hessian or other similar absorbent material approved by the Engineer-in-charge soon after the initial set, and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonary work over the foundation concrete may be started after 48 hours of its laying but the curing of concrete shall be continued for a minimum period of 14 days.
18. Form work shall include all temporary or permanent forms required for forming the concrete, together with all temporary construction required for their support. Form work shall however be divided into following two distinct categories:-
 - (1) Shuttering i.e., form work required for forming the concrete.
 - (2) Scaffolding i.e., form-work required for supporting shuttering.Forms for shuttering shall be constructed only in metal suitably lined. Forms for scaffolding shall be constructed of metal or timber. Both shuttering and scaffolding shall be of substantial-rigid construction and shuttering shall be true to shape and dimensions shown on the drawings. All bolts and rivets shall be countersunk and well ground to provide a smooth, plane surface.
19. Forms shall be mortar-tight and shall be made sufficiently rigid by the use of ties and bracings to prevent any displacement or sagging between supports, They shall be strong enough to withstand all pressure, ramming and vibration, without deflection from the prescribed lines occurring during and after placing the concrete. Screw jacks or hard wood wedges where required shall be provided to make up any settlement in the formwork either before or during the placing of concrete. Suitable camber shall be provided in horizontal members of structure, specially in long spans to counteract the effects of any fixed as to provide for such camber. Forms shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections. Unless otherwise specified or directed, chambers or fillets of sizes 25 mm x 25 mm shall be provided at all angles of formwork to avoid sharp corners.
20. The inside surfaces of shuttering shall, except in the case of permanent form work or where otherwise agreed to by the Engineer-in-charge, be coated with an approved material to prevent adhesion of concrete to the form work. Release agents shall be applied strictly in accordance with the manufacturer's

instructions and shall not be allowed to come into contact with any reinforcement or pre-stressing tendons and anchorages. Different release agents shall not be used in form work for concrete which will be visible in the finished works.

21. Special measures shall be taken to ensure that the form work does not hinder the shrinkage of concrete because without these cracking could occur before the form work is removed. Where ever applicable arrangements must be made to ensure that the form work does not restrain the shortening and hogging of the beams or slabs during tensioning of the tendon's. The form work should take due account of the calculated amount of positive or negative camber so as to ensure the correct final shape of the structures having regard to the deformation of a false work, scaffolding or propping and the instantaneous or deferred deformation due to various causes affecting pre-stressed structures. Where there are re-entrant angles in the concrete sections the form work should be removed, at those sections as soon as possible after the concrete has set in order to avoid cracking due to shrinkage of concrete. Form work shall be tight enough to prevent any appreciable loss of cement during vibrations, suitable tolerances should be provided in the form work. Immediately before concreting all forms shall be thoroughly cleaned. Contractor shall give the Engineer-in-charge due notice before pouring any concrete in the forms to permit him to inspect and accept the form work and forms as to their strength alignment and general fitness, but such inspection shall not relieve the contractor of his responsibility for safety of men, machinery, materials and for results obtained.
22. The Engineer-in-charge shall be informed in advance by the contractor of his intention to strike any formwork. While fixing the time for removal of formwork, due consideration shall be given to local conditions, character of the structure, the weather and other conditions that influence the setting of concrete and of the materials used in the mix. Where field operations are controlled by strength tests of concrete, the removal of the load-supporting or soffit forms may commence when concrete has attained strength equal to at least twice the stress to which the concrete will be subjected at the time of striking props including the effect of any further addition of loads. When field operations are not controlled by strength tests of concrete the vertical forms of beams, columns and walls may be removed after 2 days. The props of slabs and beams may be removed after 14 and 21 days respectively. All formwork shall be removed without causing any damage to the concrete. Centering shall be gradually and uniformly lowered in such a manner as to permit the concrete to take stresses due to its own weight uniformly and gradually. Where internal metal ties are permitted, they or their removable parts shall be extracted without causing any damage to the concrete and remaining holes filled with mortar. No permanently embedded metal part shall have less than 25 mm. cover to the finished concrete surface. Where it is intended to reuse the formwork, it shall be cleaned and made good to the satisfaction, of the Engineer-in-charge.
23. Immediately after the removal of forms, all exposed bars or bolts passing through the Cement concrete member and used for shuttering or any other purpose shall be cut inside the cement concrete member to a depth of at least 25 mm. below the surface of the concrete and the resulting holes be filled by cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties and all other holes and depressions, honey comb spots, broken edges or corners and other defects, shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry as consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which have been pointed shall be kept moist for a period of twenty four hours. If rock pockets/honeycombs, in the opinion of the Engineer-in-charge are of such an extent or character as to affect the strength of the structure materially or to endanger the life of the steel reinforcement, he may declare the concrete defective and require the removal and replacement of the portions of the structure affected.
24. In the case of reinforced concrete work workability shall be such that the concrete surrounds and properly grips all reinforcement. The degree of consistency, which shall depend upon the nature of work and methods of vibration of concrete shall be determined by regular slump tests. Following slump shall be adopted for different types of works.

Type of Work		Slumps	
		Where vibrators are used	Where vibrators are not used
1	Mass concrete in RCC foundations, footings and retaining walls	10 mm to 25 mm	80 mm
2	Beams, slabs and columns simply reinforced.	25mm to 40 mm	100 to 120 mm
3	Thin R.C.C. section or section with congested steel	75 mm to 125 mm	125mm to 150mm

25. Works strength tests shall be made in accordance with IS : 516. Each test shall be conducted on ten specimens, five of which shall be tested at seven days and the remaining five at 28 days The samples of concrete shall be taken on each day of concreting and cubes shall be made at the rate of one for every 5 cubic meter of concrete or a part thereof. However, if concreting done in a day is less than 15 cubic meter, the minimum number of cubes can be reduced to 6 with the specific permission of the Engineer-in-charge. Similar works tests shall be carried out whenever the quality and grading of materials is charged irrespective of the quantity of concrete poured. The number of specimens may be suitably increased as deemed necessary by the Engineer-in-charge when procedure of tests given above reveal a poor quality of concrete and in other special cases.
26. The average strength of the group of cubes cast for each day shall not be less than the specified works cube-strength.
27. R.C.C. work shall have exposed concrete surface. Centering design and its erection shall be approved by the Engineer-in-charge. One carpenter with helper will invariably be kept present throughout the period of concreting. Movement of labour and other persons shall be totally prohibited over reinforcement laid in position. For access to different parts, suitable mobile platforms shall be provided so that steel reinforcement in position is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, kapchi or metal pieces shall not be used for this purpose. Concreting of important structural members shall always be done in the presence and under the supervision of departmental person not below the rank of Asstt. Engineer/ Addl. Asstt. Engineer, Overseer or as instructed by the Engineer-in-charge. After removal of form work checks that concrete produced is of good quality plastering shall not be allowed to the exposed faces of concrete.
28. In reinforced concrete the volume occupied by reinforcement shall not be deducted. The slab shall be measured as running continuously through and the beam as the portion below the slab.
29. All necessary labour, materials, equipment, etc., for sampling, preparing test cubes, curing etc., shall be provided by the Contractor. Testing of the materials and concrete may be arranged by the Engineer-in-charge in an approved laboratory at the cost of the contractor.
30. The payment will be made on **Cu.m.** basis of the finished work.
31. The unit rate for concrete shall include the cost of all materials, labour, tools and plan required for mixing, placing in position, vibrating and compacting finishing as-per directions of the Engineer-in-charge, curing and all other incidental expenses for producing concrete of specified strength to complete the structure or its components as show on the drawings and according to these specifications. The rate shall also include the cost of making/fixing and removing of all centers and forms required for the work.

Rate shall be for unit of one Cubic Meter.

Item No.5

Providing and laying controlled cement concrete M-40 and curing complete for Open Foundation including the cost of formwork but excluding the cost of reinforcement for reinforced concrete work in (A) Foundations, footings and Mass concrete.

This work shall consist of Providing and laying in-situ machine mixed RCC M-40 grade Controlled Cement Concrete in open foundation.

Open foundation shall be of reinforced concrete. A minimum offset of 150 mm shall be provided beyond the outer faces of the foundation. If the open foundation is in contact with earth at the bottom, a levelling course of minimum thickness of M 15 nominal mix concrete shall be provided.

Concreting of the open foundation shall be carried out in dry conditions. The bottom of the foundation shall be laid preferably as low as possible taking account of the water level prevalent at the time of casting.

However, detailed specification for this item shall be as per General technical specifications for Bridge works booklet Item no. 13, Page no. 30.

Permissible Tolerances for Pile Caps

(a) Variation in dimension	: +50 mm, -10mm
(b) Misplacement from specified position in plan	: 15 mm
(c) Surface irregularities measured with 3 m straight edge	: 5mm
(d) Variation of levels at the top	: \pm 25 mm

The item shall be measured & paid as finished work in Cubic meter.

Item No.6

Providing and filling in foundation trench with ordinary cement concrete M-15 mix and providing necessary vertical pin headers including formwork, vibrating, ramming and curing complete.

1. The relevant specifications given for machine mixed plain cement concrete M15 grade as per Section -1500 & 1700 of MORT&H fifth revision specification & as per relevant RDSO specification.
2. The measurement shall be per Cum basis.
3. The rate includes tamping, vibrating, leveling and curing complete with all necessary formwork, dewatering wherever required including all materials, labours, plants, machineries & tools, all leads and lifts, etc. complete as per specification.

Rate shall be for unit of one Cubic Meter.

Item No.7

Providing and laying machine mixed M-40 grade ordinary cement concrete for cast-in-situ piers, abutments, side wall at any height or depth as per approved design and drawings, with necessary centering, shuttering, scaffolding, transporting, placing, compacting by mechanical vibrators, finishing, curing and casting as per drawing etc. complete excluding reinforcement as directed by Engineer and as per specification.

1. The relevant specifications given for cement concrete M40 grade as per Section -1500, 1700, 2100 & 2200 of MORT&H fifth revision specification.
2. The measurement shall be per cum basis.
3. The rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required
4. The mode of payment shall be in per cum. Basis.

Item No.8

Providing and laying in situ machine mixed controlled M-40 grade cement concrete for Pier cap, Abutment cap, dirt wall etc. including M:45 pedestals over piers and abutments including necessary scaffolding formwork, centering, transporting, placing, compacting by mechanical vibrators, finishing and curing and casting, finishing at any height or depth as per drawing etc. complete excluding reinforcement, as directed by Engineer and as per specification.

Pier Cap & Dirt Wall in M:40 & Pedestals & Seismic Restrainer in M:45

1. The relevant specifications given for cement concrete M40 grade for Pier Cap & Dirt Wall and M45 for Pedestals & Seismic Restrainer as per Section -1500, 1700, 2100 & 2200 of MORT&H fifth revision specification.
2. The measurement shall be per cum basis.
3. The rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required
4. The mode of payment shall be in per cum. Basis.

Item No.9

Providing & fixing in position (Thermo mechanically treated bars) TMT Fe550 D steel bars of various diameters for all RCC works in Open Foundation / Footing & Staircase and foundations as per detailed design & drawings and schedule including cutting, bending, hooking the bars, binding with 18 SWG GI wires or tack welding (only for piles) and supporting as required with all lifts and leads etc. complete including cost of all labour, materials, tools, plants, equipments etc. all complete as directed by Engineer and as per specification.

1. The relevant specifications as per IS 1786 Specification & as per relevant MORT&H fifth revision section 1600 shall apply to this item & section 1009.3.2.1 shall apply for Providing anti-corrosive treatment to TMT reinforcement with Fusion Bonded Epoxy Coating (FBEC) Confirming to IS 13620:1993.
2. The item shall be measured in length including hooks, if any, separately for different diameters as actually used in work, excluding overlaps. From the so measured, the weight of reinforcement shall be calculated in MT on the basis of IS: 1732,
3. The rate includes for supply, loading, unloading, transporting to site, cutting, bending, hooking, placing, tying in position with contractor's own GI annealed binding wire, welding it in position in open foundation etc. Welding and supporting in position to ensure lines and levels during concreting, maintaining proper cover / spacing, all leads & lifts, etc. including contractor's own equipment, labour, supervisor, taxes, machineries, etc. complete as per drawings and specification.
4. The mode of payment shall be in per Metric Tone Basis.

Item No.10

Providing & fixing in position (Thermo mechanically treated bars) TMT Fe550 D steel bars of various diameters for all RCC works in Pier, Abutment wall, box wall, Piercap, Abt.cap, Dirt wall, sidewall, Retaining wall, Pedestals as per detailed design & drawings and schedule including cutting, bending, hooking the bars, binding with 18 SWG GI wires and supporting as required with all lifts and leads etc. complete including cost of all labour, materials, tools, plants, equipments etc. all complete as directed by Engineer and as per specifications. Piers, Pier Cap, Pedestals & Seismic Restrainer

1. The relevant specifications as per IS 1786 Specification & as per relevant MORT&H fifth revision section 1600 shall apply to this item & section 1009.3.2.1 shall apply for Providing anti-corrosive treatment to TMT reinforcement with Fusion Bonded Epoxy Coating (FBEC) Confirming to IS 13620:1993.

2. The item shall be measured in length including hooks, if any, separately for different diameters as actually used in work, excluding overlaps. From the so measured, the weight of reinforcement shall be calculated in MT on the basis of IS: 1732,
3. The rate includes for supply, loading, unloading, transporting to site, cutting, bending, hooking, placing, tying in position with contractor's own GI annealed binding wire, welding it in position in Pier, RCC caps, Dirt wall Pedestals & Seismic restrainer etc. Welding and supporting in position to ensure lines and levels during concreting, maintaining proper cover / spacing, all leads & lifts, etc. including contractor's own equipment, labour, supervisor, taxes, machineries, etc. complete as per drawings and specification.
4. The mode of payment shall be in per Metric Tone Basis.

Item No.11

Providing and applying Coal Tar Epoxy protective paint for Open Foundation in two coats of DFT 210 microns for foundations /concrete surfaces in contact with soil complete as per Specifications and as directed by the Engineer including all leads and lifts etc. complete.

GENERAL INTENT

This Section covers the work of chemically resistant coating to the surfaces of the Pile cap.

APPLICATOR

Ensure that all Work is done by a competent applicator licensed and/or approved by the chemically resistant coating material manufacturer. Submit the manufacturer's certification of this approval.

GUARANTEE

Furnish a written guarantee covering the materials and workmanship for a period of 5 years from the date of acceptance of the Work, and be responsible for making good, at your expense, any and all defects due to the failure of the coating materials or workmanship.

Provide completely corrosion resistant work with no leakage through or around the coating.

SUBMITTALS

Submit the proposed materials, schedule of applications and the manufacturer's literature for the materials and the recommended methods of application.

Submit sketches showing standard and special details for the corrosion protection. Submit the manufacturer's approval of the applicator.

Immediately prior to commencing Work in each Area, submit a letter of acceptance for the wall surfaces to be coated, signed by the applicator's authorized representative.

Upon acceptance, submit a written guarantee.

2. PRODUCT

Coating for Application on RCC Retaining wall/ pier surface System Design Epoxy Tar Based Coating

The coating shall be corrosion resistant coal tar epoxy coating with minimum of 50% solids content. The dry film thickness shall not be less than 200 microns per coat and should be applied in minimum two (2) coats. The cured film shall be tough and abrasion resistant.

The Contractor must follow the manufacturer's guidelines for the preparation of surfaces, for mixing and application of coating.

3. EXECUTION

a. General

Deliver materials to job site in factory sealed containers with manufacturer's identification on each package.

The Contractor shall store the materials to protect them from damage.

b. Surface Preparation and Inspection

Clean surfaces of deleterious material in accordance with the manufacturer's recommended practice.

Prepare surfaces to be coated in accordance with manufacturer's instructions.

Verify the surfaces are dry. (ASTM D4263)

Have the coating manufacturer's authorized agent inspect surfaces to be coated and certify in writing to the Engineer-in-Charge that the surfaces are acceptable for the application of the coating. Do not apply the coating until written certification is received by the Engineer-in-Charge.

c. Concrete Repair

Chip out damaged concrete to sound concrete.

Repair rebar if damaged.

Clean concrete surfaces, dampen and hand place patching concrete in accordance with the pipe manufacturer's recommended practice. Wet cure immediately and as recommended by the manufacturer.

d. Application of Coating

Confirm to the coating manufacturer's instructions for application.

Schedule the Work to allow application to be performed in a manner that it conforms to the Manufacturer's recommendations.

Apply coating only when atmospheric conditions are suitable and as recommended by the Manufacturer.

e. Protection of coating

Protect the coating from damage.

Allow to cure before further work or putting the coating into service.

f. Clean-up

Promptly, as the Work proceeds and upon completion, clean up and remove from the site, rubbish and surplus material resulting from the Work of this Section.

1. RATE

The measurement shall in sq.mt basis.

The rate includes labour, material, equipment as per specification and as directed by the engineer including all lead and lifts etc. complete.

The mode of payment shall be in per Square Meter basis.

Item No.12

Providing and Casting in situ controlled cement concrete M-45 for R.C.C. Deck Slab including centering, scaffolding, curing and finishing complete.

1. The relevant specifications given for cement concrete M35 grade as per Section -1500, 1700, 2100 & 2200 of MORT&H fifth revision specification.
2. The measurement shall be per cum basis.
3. The rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required
4. The mode of payment shall be in per cum. Basis.

Item No.13

Providing, fabricating and fixing in position Deck sheet for the deck slab of Composite super structure and other Structural steel sections such as plate. The rate to be inclusive of all charges such as loading, unloading, transporting, cost of fabrication, erection, all accessories to be used for connection, anticorrosive primer and paint of approved make/ shade and cleaning works, inclusive of all taxes.

1. MORT&H specification in section no. 1900 shall be followed in connection with this item. All relevant provisions have been included in the respective IRC and IS specifications are also applicable.
2. The measurement shall be on the basis of Metric Tonne.
3. The rate includes all required materials, labour, equipments, bolting, joint, welding, etc. required to carry out this item including transporting, launching, shifting, placing in exact position etc. complete above the running railway track/Junction with live H.T. electric overhead line as directed by Engineer-in-charge.
4. The mode of payment shall be in per M.T. basis.

Item No.14

Supplying, fabrication, assembling of all types of steel girders of specified spans with structural steel conforming to Quality "B0" Grade Designation E250 GR conforming to IS:2062-2011, erection / slewing / end launching of steel girders with cranes or any other approved launching methods as per site conditions (not requiring traffic block) on substructure including provision of trolley refuges etc., complete as per approved QAP and drawings conforming to IRS-B1-2001 and other relevant codes and specifications.

Note:

1. Detailed fabrication and erection drawings & launching methodology will be prepared by the contractor and got approved from Railway.
2. The rate is all inclusive including launching in position, complete in all respect except cost of (i) Painting / Metalising; (ii) Bearings & (iii) HSFG bolts which shall be paid extra under relevant item.
3. The payment shall be made on the theoretical weight of main components and gusset plates only.
4. Payment Schedule:
 - (i) Receipt of material at site: 40%
 - (ii) Fabrication of girders: 20%
 - (iii) Erection/Launching: 20%
 - (iv) Completion in all respects: 20%

Plate Girder/Semi Through Girder/Composite Girder (Steel Work)

The rate is inclusive of transportation of fabricated Steel Girder parts to site by contractor's own means at his cost. The rate shall also be inclusive of cold straightening of deformed and bent girder parts before their assembly. The structural steel to be used shall be procured from the Railway/RDSO approved manufacturer only. Work has to be done as per drawings and specifications approved by Railway.

- 1) The fabricated steel girder must be got done from RDSO approved firms only.
- 2) For payment purpose, nominal weight of the fabricated steel Girder as per drawing will only be considered.

1. The relevant specifications as per relevant RDSO specification & as per relevant MORTH specification Section 1900.
2. The measurement shall be in MT. basis.
3. The rate includes for supply, loading, unloading, transporting to site. Welding and supporting in position to ensure lines and levels including contractor's own equipment, labour, supervisor, taxes, machineries, etc. complete as per drawings and specification.

Rate shall be for unit of MT. basis.

Item No.15

Extra for using steel conforming to Grade Designation E350 instead of Grade Designation E250 of Quality "B0" as per IS: 2062

1. The relevant specifications as per relevant MoRTH specification Cl. No. 1900, Pg. No. 585 & As per IRC-24, And Approved Design, Drawing & As per Railway Department Specification
2. The rate includes for supply, loading, unloading, transporting to site. Welding and supporting in position to ensure lines and levels including contractor's own equipment, labour, supervisor, taxes, machineries, etc. complete as per drawings and specification.

Rate shall be for unit of MT. basis.

Item No.16

Supplying and fixing HSFG bolts of any dia and any length with suitable nuts including DTI washers conforming to IRS-B1-2001 for bridges and steel structures with contractors labour, tools and plants and lead and lift etc., complete.

1. MORT&H specification in section no. 1900 shall be followed in connection with this item. All relevant provisions have been included in the respective IRC and IS specifications are also applicable.
2. The measurement shall be on the basis of Kg.
3. The rate includes all required materials, labour, equipments, bolting, joint, welding, etc. required to carry out this item including transporting, launching, shifting, placing in exact position etc. complete above the running railway track/Junction with live H.T. electric overhead line as directed by Engineer-in-charge.
4. The mode of payment shall be in per Kg. basis.

Rate shall be for unit of Kg. basis.

Item No.17

Metallizing of steel work of girders with sprayed aluminium after surface preparation by Sand/grit blasting, followed by one coat of etch primer (IS:5666) & one coat of Zinc Chrome primer (IS:104) and two coats of aluminium paint (IS:2339) with all labour, T&P and material as a complete job duly conforming to all relevant specifications and process given under Clause 39 of IRS-B1-2001.

Note: Nominal Thickness of sprayed Aluminium coating shall be 150 microns. DFT of Zinc chrome primer shall be 25-30 microns and DFT of each coat of Aluminium paint shall be 12-14 microns.

On new girder during fabrication

1. MORT&H specification in section no. 1900 shall be followed in connection with this item. All relevant provisions have been included in the respective IRC and IS specifications are also applicable.
2. The measurement shall be on the basis of Sqm.
3. The rate includes all required materials, labour, equipments, bolting, joint, welding, etc. required to carry out this item including transporting, launching, shifting, placing in exact position etc. complete above the running railway track/Junction with live H.T. electric overhead line as directed by Engineer-in-charge.
4. The mode of payment shall be in per Square meter basis.

Item No.18

Providing & fixing in position (Thermo mechanically treated bars) TMT Fe550D steel bars of various diameters for all RCC works in super structure as per detailed design & drawings and schedule including cutting, bending, hooking the bars, binding with 18 SWG GI wires and supporting as required with all lifts and leads etc. complete including cost of all labour, materials, tools, plants, equipments etc. all complete as directed by Engineer and as per specifications.

For PSC Girder, Cross Girder, Deck Slab & Solid Slab

1. The relevant specifications as per IS 1786 Specification & as per relevant MORT&H fifth revision section 1600 shall apply to this item & section 1009.3.2.1 shall apply for Providing anti-corrosive treatment to TMT reinforcement with Fusion Bonded Epoxy Coating (FBEC) Confirming to IS 13620:1993.
2. The item shall be measured in length including hooks, if any, separately for different diameters as actually used in work, excluding overlaps. From the so measured, the weight of reinforcement shall be calculated in MT on the basis of IS: 1732,
3. The rate includes for supply, loading, unloading, transporting to site, cutting, bending, hooking, placing, tying in position with contractor's own GI annealed binding wire, welding it in position in PSC Girder, Cross Girder, Deck Slab & Solid Slab etc. Welding and supporting in position to ensure lines and levels during concreting, maintaining proper cover / spacing, all leads & lifts, etc. including contractor's own equipment, labour, supervisor, taxes, machineries, etc. complete as per drawings and specification.
4. The mode of payment shall be in per Metric Tone Basis.

Item No.19

Design, supply, fitting and fixing in position true to line and level POT-PTFE bearing of 300MT Capacity, consisting of a metal piston supported by a disc or un reinforced elastomer confined within a metal cylinder, sealing rings, dust seals, PTFE surface sliding against stainless steel mating surface, complete assembly to be of cast steel / fabricated structural steel, metal and elastomer elements complete as per IS:2062, IS:1030, AISI:304, AISI:316, IS:6911, BS:3784, IS:3400, IS:226, BS-5400, Bridge Code and as per approved drawing and Technical Specifications. The design of the bearings shall be submitted by the manufacturers / contractor and got approved from Railway before fixing.

(a) POT-cum -PTFE Bearing (Free end)

(b) POT Bearing-Fixed Type

(c) POT-cum -PTFE Guided (L)Bearing

(d) POT-cum -PTFE Guided (T)Bearing

1. The relevant specifications as per relevant MoRTH specification Cl. No. 2000, Pg. No. 623 and Approved Design & Drawing.
2. The rate includes for supply, fitting and fixing in position true to line and level, loading, unloading, transporting to site. Supporting in position to ensure lines and levels including contractor's own equipment, labour, supervisor, taxes, machineries, etc. complete as per drawings and specification.

Rate shall be for unit of Each basis.

Item No.20

Providing and laying of a strip seal expansion joint catering to maximum horizontal movement upto 70 mm, complete as per approved drawings and standard specifications to be installed by the manufacturer/supplier or their authorized representative ensuring compliance to the manufacturer's instructions for installation

1. The relevant specifications given in tender as per clause 2600 of MORT&H fifth revision as per relevant RDSO specification shall apply to this item.
2. The measurement shall be in Rmt. basis.
3. The rate is inclusive of supplying, fixing with contractor's own materials, equipments, machineries, labour, transport, testing, bolts, socket tubes, neoprene sheet/cap etc. complete. The rate is finished item complete and will be paid after fixing in all, respect. The Contractor shall procure Expansion Joint, confining to relevant MORTH specification from approved MORTH vendor with prior approval of Engineer in- charge

Rate shall be for a unit of one Running Meter.

Item No.21

Providing and casting RCC in M-40 controlled concrete Crash Barriers Crash Barriers and Friction slab as per detailed drawings including necessary scaffolding, centering, formwork, mixing in machine, transporting, placing, compacting, finishing, curing, etc. complete including providing and fixing of inserts if any with all leads and lifts as per drawing & specification and as directed by Engineer, excluding reinforcement.

1. The relevant specifications given for machine mixed plain cement concrete M40 grade as per Section - 1500, 1700 & 2300 of MORT&H fifth revision specification & as per relevant RDSO specification.
2. The measurement shall be per Cum basis.
3. The rate is inclusive of all materials, including necessary mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, scaffolding, staging, shuttering, formworks, de shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required, with F3 type exposed concrete finish and form mark. Any honeycombing/ undulation found shall be rectify to match F3 class finish.

Note:- Rates in items shall include cost of providing grooves, chamfers, moulding, cut-out etc. in formwork. The work will include placing in position of necessary fixtures, sleeves for various purposes, etc. complete as per drawings, specifications and as directed by the Engineer in charge. The rate shall also include preparation of construction joints as per specifications and provide approved wire mesh/weld mesh at such location as approved by the Engineer-in-charge or as shown in drawings.

Rate shall be for a unit of one Cubic Meter.

Item No.22

Providing and laying precast RCC footpath slab in controlled cement concrete of M-25 grade (7 cm thickness including necessary reinf.) and providing and setting cement chequered tiles in C.M. 1:5 as per drawing including necessary formwork, cutting and finishing complete.

1. The relevant specifications given for cement concrete M25 grade as per Section -1500, 1700, 2100 & 2200 of MORT&H fifth revision specification.
2. The measurement shall be per cum basis.
3. The rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required
4. The mode of payment shall be in per cum. Basis.

Item No.23

Providing and fixing in position (Thermo mechanically Treated bars) TMT Fe550 D reinforcing bars of various diameters for the above all RCC works as per detailed designs and drawings and schedule including cutting, bending, hooking the bars, binding with 18 SWG GI wires with cost of all labour, materials, tools, plants, equipments, supporting as required with all lifts and leads etc. all complete as per specification and as directed by Engineer.

For Approach Slab, Crash Barrier, Retaining wall, Parapet, Friction slab & Coping

1. The relevant specifications as per IS 1786 Specification & as per relevant MORT&H fifth revision section 1600 shall apply to this item & section 1009.3.2.1 shall apply for Providing anti-corrosive treatment to TMT

reinforcement with Fusion Bonded Epoxy Coating (FBEC) Confirming to IS 13620:1993.

2. The item shall be measured in length including hooks, if any, separately for different diameters as actually used in work, excluding overlaps. From the so measured, the weight of reinforcement shall be calculated in MT on the basis of IS: 1732,
3. The rate includes for supply, loading, unloading, transporting to site, cutting, bending, hooking, placing, tying in position with contractor's own GI annealed binding wire, welding it in position for Approach Slab, Crash Barrier, Retaining wall, Parapet, Friction slab & Coping etc. Welding and supporting in position to ensure lines and levels during concreting, maintaining proper cover / spacing, all leads & lifts, etc. including contractor's own equipment, labour, supervisor, taxes, machineries, etc. complete as per drawings and specification.
4. The mode of payment shall be in per Metric Tone Basis.

Item No.24

Providing fusion bonded Epoxy coating not less than 175-micron thickness and up to 300 micron to reinforcement bars as per IS-13620- 1993/ASTM-775 M including testing of coating at plant and all taxes (A) 10mm to 16mm dia bar

1009.3.2.1 Fusion Bonded Epoxy Coated Reinforcement

Fusion bonded epoxy coated reinforcement shall conform to IS:13620 or other international standards as approved by Engineer. The location of the source of supply of the coated bars shall be such as to ensure that the bars are not transported for a distance of more than 300 Km.

Additional requirements for the use of such reinforcement bars are given below:

- a) Patch up materials shall be procured in sealed containers with certificates from the agency who has supplied the fusion bonded epoxy bars.
- b) PVC coated G.I. binding wires of 18G shall only be used in conjunction with fusion bonded epoxy bars.
- c) Chairs for supporting the reinforcement shall also be of fusion bonded epoxy coated bars.
- d) The cut ends and damaged portions shall be touched up with repair patch up material.
- e) The bars shall be cut by saw-cutting and not by flame cutting.
- f) While bending the bars, the pins of work benches shall be provided with PVC or plastic sleeves.
- g) The coated steel shall not be directly exposed to sun rays or rains and shall be protected with opaque polyethylene sheets or such other approved materials.
- h) While concreting, the workmen or trolley shall not move directly on coated bars but shall move only on wooden planks placed on the bars.

Item Description shall apply to this item. The measurement shall be per MT basis.

Rate shall be for unit of one MT basis.

Item No.25

Providing fusion bonded Epoxy coating not less than 175 micron thickness and up to 300 micron to reinforcement bars as per IS-13620- 1993/ASTM-775 M including testing of coating at plant and all taxes (B) 20mm to 32 mm dia bar

1009.3.2.1 Fusion Bonded Epoxy Coated Reinforcement

Fusion bonded epoxy coated reinforcement shall conform to IS:13620 or other international standards as approved by Engineer. The location of the source of supply of the coated bars shall be such as to ensure that the bars are not transported for a distance of more than 300 Km.

Additional requirements for the use of such reinforcement bars are given below:

- a) Patch up materials shall be procured in sealed containers with certificates from the agency who has supplied the fusion bonded epoxy bars.

- b) PVC coated G.I. binding wires of 18G shall only be used in conjunction with fusion bonded epoxy bars.
- c) Chairs for supporting the reinforcement shall also be of fusion bonded epoxy coated bars.
- d) The cut ends and damaged portions shall be touched up with repair patch up material.
- e) The bars shall be cut by saw-cutting and not by flame cutting.
- f) While bending the bars, the pins of work benches shall be provided with PVC or plastic sleeves.
- g) The coated steel shall not be directly exposed to sun rays or rains and shall be protected with opaque polyethylene sheets or such other approved materials.
- h) While concreting, the workmen or trolley shall not move directly on coated bars but shall move only on wooden planks placed on the bars.

Item Description shall apply to this item. The measurement shall be per MT basis.

Rate shall be for unit of one MT basis.

Item No.26

Providing and laying Double Walled Corrugated Pipes (DWC) of Polyethylene (conforming to IS:14930-II) of 50mm O.D. / 38mm I.D. with fittings and necessary connecting accessories of same material at required depth for laying cable below footpath slab etc. complete as per specification and as directed by Engineer.

- 1. The relevant specifications as per IS 4985 Specification
- 2. Relevant specifications given for above work as described shall be applicable to this item.
- 3. The measurement shall be in Rmt.
- 4. The rate for this item includes all materials, labour, and everything required to execute this item etc. complete and as directed by engineer in charge.
- 5. The mode of payment shall be in per Running Meter basis.

Item No.27

Providing and fixing 100 mm dia. G.I. Drainage spouts, as per MOST Drg. Nos SD/303 including grating with suitable clean out fixtures including all leads and lifts etc. complete as per specification, design & drawings and as directed by Engineer.

- 1. The relevant specifications as per IS 4985 Specification
- 2. Relevant specifications given for above work as described shall be applicable to this item.
- 3. The measurement shall be in Rmt.
- 4. The rate for this item includes all materials, labour, and everything required to execute this item etc. complete and as directed by engineer in charge.
- 5. The mode of payment shall be in per Running Meter basis.

Item No.28

Providing, laying and jointing in true line and level 110 diameter U.P.V.C (Type B) conforming to IS 13592-1992 with one end plain and other end socketed with rubber ring, & fittings conforming to ISI 14735-1999 of approved make for drainage system pipe line, pipe shall be jointed with each other with rubber lubricant, pipe shall be fixed on wall using of PVC clamp of the size 110 mm diameter x 149 mm length x 145 mm height at every 2000 mm center to center or shall be concealed in walls as directed including necessary fittings such as bends, shoes etc. including testing of pipes and joints and jointed with adhesive solvent cement including cost of all materials.

- 1. The relevant specifications as per MORT&H fifth revision section 2700 shall apply to this item.
- 2. Relevant specifications given for above work as described shall be applicable to this item.
- 3. The measurement shall be in Rmt.

4. The rate for this item includes all materials, labour, and everything required to execute this item etc. complete and as directed by engineer in charge.
5. The mode of payment shall be in per Running Meter basis.

Item No.29

Fabricating, supply and erecting in position Standard Structural steel sections conforming to IS 2062 for railing or other works using ISMB, ISA, ISMC, MS plate, flat, square bars, pipe, square pipe, etc. including welding, cutting, wastage, etc. complete. The rate is inclusive of welding rod, supply & fixing of correct size nut, bolts, washers, including one primer coat of red lead paint conforming IS:102 Zinc chromate paint conforming to IS:104 followed by two coat of aluminium paint as per IS:2339 with all contractor's materials, labour, tools & plants, in bolted/welded construction as directed by Engineer-in Charge. The waste cut pieces shall Nost be included in the paying quantity. The work shall be done as per drawing and specification. The work shall be carried out as per IS:800, IS:816. For Staircase and Inspection Platform

1. The relevant specifications as of MORTH fifth revision section 1100, 1900 & RDSO specification shall apply to this item.
2. The measurement shall be in MT. basis.
3. The rate includes all operation such as straightening, cutting, bending to shape, welding, fabricating, driving, placing in position, applying protective coating, etc. complete as per specification excluding temporary liner if provided. Depth & thickness of liner shall be decided by Engineer-in-charge as per site condition.
4. The mode of payment shall be in per MT. basis.

Item No.30

Providing and laying 50 mm thick Dense Graded Bituminous Macadam in two layer (single layer not more than 70 mm) using BT stone chips as per MoRTH gradation and specification with Bitumen Grade (VG 30) for mixing @ 45.00 Kg /MT of total Wt. of mix i.e (4.50 % of total weight mix)including tack coat @ 2.5 kg/10 smt with Bitumen Emulsion (Rapid setting) and mixing aggregate & asphalt by batch mix plant and spreading the same by sensor paver finisher including rolling & consolidation with 10-12 tonne vibratory roller & providing all materials equipment's tools & plants, fire wood, oil , kerosene,labour charges , using contractor 's own machinery etc Complete as directed by engineer in charge as per MoRTH Specification

Details specification for this item shall be as per MoRTH specification No. 503 & 504
The mode of payment shall be in per Metric Tone basis.

Item No.31

Providing and laying 25 mm thick of compacted Bituminous concrete using BT aggregate as per MORTH gradation ,specification and asphalt Grade VG 30 mixing @52.00 Kg /MT of total Wt. of mix i.e. (5.20% of total weight mix) including heating and mixing aggregate & asphalt by batch mix plant spreading the same by sensor paver finisher including rolling & consolidation with 10-12 tonne vibratory roller, Tandem Roller ,PTR & providing all materials equipment's tools & plants, fire wood, oil , kerosene, labour charges , using contractor 's own machinery etc Complete as directed by engineer in charge as per MoRTH Specification

Details specification for this item shall be as per MoRTH specification No. 503 & 507
The mode of payment shall be in per Metric Tone basis.

Item No.32

Providing and applying tack coat with Emulsion RS1 using bitumen pressure distributor at the rate of 0.30 kg/sqm on the existing bituminous surface cleaned with Air Compressor.

Details specification for this item shall be as per MoRTH specification No. 502 & 503
The mode of payment shall be in per Square Meter.

Item No.33

Road marking with Hot applied thermoplastic paint with refletririzing glass beads on bitumen surface. Providing and laying of Hot applied Thermoplastic compound 2.5 mm thick including Reflectorising Glass Beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC : 35 & finished surface to be level, uniform and free from streaks and holes. Zebra patta / Bump patta lane / center line / edge line /cut patta. The white colour marking should provide liminance cooficient on cement road shall be minimum 130 mcd/M2 / LUX and asphalt road shall be min. 100 mcd/M2/ LUX during the service life during the day time. The marking should meet the performance criteria for night time reflectivity, wet reflectivity and skid resistance as mentioned in the section 15 of IRC 35:2015 Warranties for retroreflective shall be 2 years.

The relevant specifications as per relevant MORT&H fifth revision section 803 & also as per Item Description shall apply to this item.

Rate shall be for unit of one Square Meter.

Item No.34

Supplying and fixing cat eye (Stimsonite) made out from Acrilo beaultile sterine injuction high compressed molding with reflector made of MMC (prismatic type of size 12cm x 6cm x 2.5cm) provided with bituminous adhesive 100g. with each unit for fixing. (High Intensity grade)

The relevant specifications as per relevant MORT&H fifth revision section 804 & also as per Item Description shall apply to this item.

Rate shall be for unit of one Nos.

Item No.35

Providing and applying one coat Epoxy PheNoslic primer of DFT 50 micron and two coats of Epoxy PheNoslic coating of DFT 100 microns each or any other equivalent epoxy coating system to all concrete surfaces exposed to atmosphere in substructure and superstructure including cost of material, labour, transportation, scaffolding and preparing the surfaces by cleaning, washing, brushing, sand / grit blasting etc. complete and as directed by Engineer and as per specification. (Paint shall be got approved from Engineer and tested from approved laboratory).

1. The relevant specifications for applying epoxy coating of approved shade, brand and manufacture on new concrete work is given in item shall apply to this item.
2. The measurement shall be in Sq.mt basis.
3. The rate includes all labour, material, equipments etc. complete as per direction of engineer in charge.
4. The mode of payment shall be in per sqm. Basis

Rate shall be for unit of one Square Meter.

Item No.36

Painting Two Coats on New Concrete Surfaces (Painting two coats after filling the surface with synthetic enamel paint in all shades on new plastered concrete surfaces) - For inner face of crash barrier & Kerb of Protection to R.E. wall (Black & Yellow Strips)

1. Relevant specification shall be followed-as per item description and as directed by engineer in charge
The measurement shall be in Sqm. basis.
2. The mode of payment shall be in per Sqm., basis.
3. The rate includes all material, paints, scaffolding, cleaning all dust, dirt and other foreign matters with all material labour equipments with all leads and lifts etc. complete

Rate shall be for unit of one Square Meter.

Item No.37

Clearing and grubbing site/road/land including uprooting all vegetation, grass, bush shrubs, saplings and trees with girth, removal of stumps of trees of girth of all sizes including removing stumps of trees cut earlier and disposal of unserviceable materials and stacking of serviceable materials as directed by Engineer with all leads and lifts etc. complete as per specification. before commencement and after completion of the work. (C) By mechanical means in area of light jungle

1. The relevant specifications of MORT&H fifth revision clause 201 shall apply to this item.
2. The item shall be measured in Hector.
3. Rate shall be included all materials, labour, equipment etc. required to execute this item.

Rate shall be for unit of one Hectare.

Item No.38

Demarkation of road alignment including marking out road line by providing and fixing wooden pegs or steel rod of required size at every 25 M to 50 M including excavating trenches ion both sides of 0.30 m x 0.30m including supplying of labours and all materials for every work etc complete.

1. The center line axis of the dual two lane bridge is to be done for bridge and also for approaches / retaining walls in both ends shall be surveyed along their lengths. Center line pegs for each two lane bridge, ramps including foundation pegs at each location and at suitable distance of 3.0 m c/c along the approach on each side shall be fixed.
2. All deviation angles of the central line axis for both the two lane bridge including tangent distances shall be demarcated with pegs fixed in to the ground.
3. The rate on Lump sum basis shall include all equipment, survey instruments, necessary survey party, supply and fixing of pegs including, fixing of pillars for intermediate stations established GTS bench mark at every 200 m distance, labour, materials required in completing the job as required, as per direction of Engineer-in-charge.
4. Contractor has to carry out full topographical survey including working of center line with total station instrument.

Rate shall be for unit of one Kilometer.

Item No.39

Dismantling of the existing road, Flexible Pavement / Asphaltic road, crust in approach portion including demolishing asphalt carpet with soling, metal etc. with stacking the same as directed by Engineer-in-charge.

202 DISMANTLING CULVERTS, BRIDGES AND OTHER STRUCTURES/ PAVEMENTS

202.1 Scope

This work shall consist of dismantling and removing existing culverts, bridges, pavements, kerbs and other structures like guard-rails, fences, utility services, manholes, catch basins, inlets, etc., from the right of way which in the opinion of the Engineer interfere with the construction of road or are not suitable to remain in

place, disposing of the surplus/unsuitable materials and backfilling to after the required compaction as directed by the Engineer.

Existing culverts, bridges, pavements and other structures which are within the highway and which are designated for removal, shall be removed upto the limit and extent specified in the drawings or as indicated by the Engineer.

Dismantling and removal operations shall be carried out with such equipment and in such a manner as to leave undisturbed, adjacent pavement, structures and any other work to be left in place.

All operations necessary for the removal of any existing structure which might endanger new construction shall be completed prior to the start of new work.

202.2 Dismantling Culverts and Bridges

The structures shall be dismantled carefully and the resulting materials so removed as not to cause any damage to the part of the structure to be retained and any other properties or structures nearby:

Unless otherwise specified, the superstructure portion of culverts/bridges shall be entirely removed and other parts removed up to at least 600 mm below the sub-grade, slope face or original ground level whichever is the lowest or as necessary depending upon the interference they cause to the new construction. Removal of overlying or adjacent material, if required in connection with the dismantling of the structures, shall be incidental to this item.

Where existing culverts/bridges are to be extended or otherwise incorporated in the new work, only such part or parts of the existing structure shall be removed as are necessary and directed by the Engineer to provide a proper connection with the new work. The connecting edges shall be cut, chipped and trimmed to the required lines and grades without weakening or damaging any part of the structure to be retained. Due care should be taken to ensure that reinforcing bars which are to be left in place so as to project into the new work as dowels or ties are not injured during removal of concrete.

Pipe culverts shall be carefully removed in such a manner as to avoid damage to the pipes. Steel structures shall, unless otherwise provided, be carefully dismantled in such a manner as to avoid damage to members thereof. If specified in the drawings or directed by the Engineer that the structure is to be removed in a condition suitable for re-erection, all members shall be match-marked by the Contractor with white lead paint before dismantling; end pins, nuts, loose plates, etc. shall be similarly marked to indicate their proper location; all pins, pin holes machined surfaces shall be painted with a mixture of white lead and tallow and all loose s shall be securely wired to adjacent members or packed in boxes.

Timber structures shall be removed in such a manner as to avoid damage to such timber or lumber having salvage value as is designated by the Engineer.

202.3 Dismantling Pavements and Other Structures

In removing pavements, kerbs, gutters, and other structures like guard-rails, fences, holes, catch basins, inlets, etc., where portions of the existing construction are to be left e finished work, the same shall be removed to an existing joint or cut and chipped to a line with a face perpendicular to the surface of the existing structure. Sufficient removal shall be made to provide for proper grades and connections with the new work as directed by the Engineer.

All concrete pavements, base courses in carriageway and shoulders etc., designated for oval shall be broken to pieces whose volume shall not exceed 0.02 cum. and used with approval of the Engineer or disposed of.

202.4 Back-filing

Holes and depressions caused by dismantling operations shall be backfilled with excavated her approved materials and compacted to required density as directed by the Engineer.

202.5 Disposal of Materials

All Surplus materials shall be taken over by the Contractor which may either be re-used with approval of the Engineer or disposed of with all leads and lifts.

202.6 Measurements for Payment

The work of dismantling shall be paid for in units indicated below by taking measurements re and after, as applicable:

i)	Dismantling brick/stone masonry/ concrete (plain and reinforced)	cu.m
ii)	Dismantling flexible and cement concrete pavement	cu.m
iii)	Dismantling steel structures	Kg.
iv)	Dismantling timber structures	cu.m
v)	Dismantling pipes, guard rails, kerbs, gutters and fencing	linear m
vi)	Utility services	No.

202.7 Rates

The Contract unit rates for the various items of dismantling shall be paid in full for carrying out the required operations including full compensation for all labour, materials, tools, equipment, safeguards and incidentals necessary to complete the work. The rates will include excavation and backfilling to the required compaction and for handling, giving credit towards salvage value disposing of dismantled materials with all lifts and leads.

Rate shall be for unit of one Cubic Meter.

Item No.40

Dismantling the existing structure including removing and stacking the dismantled materials as and where directed. (A) R.C.C. Work.

Details specification for this item shall be as per General technical specifications for Road works booklet Item no.25, Page no. 51, as per above item no. 39 and as per directed by engineer-in-charge.

Rate shall be for unit of one Cubic Meter.

Item No.41

Carting of excavated material such as murrum, earth, kapachi, gravel, brickbats, kankar, debris, sand, dismantled material, including loading, unloading, stacking etc. complete at non objectional place as directed by engineer in charge.

(a) Lead up to 3 Km

(b) Additional rate for lead above 3 and upto 5 km

(c) Additional rate for lead above 5 and upto 10 km

Details specification for this item shall be as per MoRTH specification Cl. No. 304, Pg. no. 59 and as per directed by engineer-in-charge.

Rate shall be for unit of one Cubic Meter.

Item No.42

Providing and fixing in position fully moulded restrained elastomeric bearings as per detailed drawings.

Details specification for this item shall be as per MoRTH specification No. 2000 & as below.

1. The term 'bearings' in this case shall refer to an elastomeric bearing consisting of one or more elastomer slabs bonded to metal plates during manufacture so as to form a sandwich arrangement, while 'Bearings Pads' shall, denote single unreinforced elastomer slabs.
2. The elastomer to be used for bearings shall be made from natural or synthetic rubber and satisfy the physical properties given below. The test pieces required for the tests shall be selected from the centre layer of the bearings while making up the selection.

	Items	ASTM Designation	Requirement
(i)	Durometer Hardness	D-2240	55 to 70 (# 5 points for the nominated value)
(ii)	Ultimate Tensile Strain percent	D-412	450 for 55 grade 400 for 60 grade 300 for 70 grade 175 minimum
(iii)	Tensile Strength Kg/cm ²	D-412	135 minimum for natural rubber of hardness greater than 65.
(iv)	Adhesion to Metal Kg/cm.	D-429 (Method-B)	9
(v)	Tear Resistance Kg/c.	D-624 40 (DIEC)	25 maximum
(vi)	Compression set 22 hrs. at 70°C%	D-395 (Method-B)	No cracks.
(vii)	Ozone resistance 22% strain 100 hrs. at 380°C ± 10 °C (1 part per million in air by volume)	D-1149	10 points
(viii)	Accelerated ageing 70 hours 1000C	D-573	15% of original 25% of original
(ix)	Hardness increase Tensile strength reduction, Elongation at break reduction Low temperature stiffness young's Modulus-40 °C Kg/cm ²	D-797	700 maximum

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3. Adhesive used in bearing location attachment to bridge decks shall be subject to the approval by the Engineer-in-charge. It shall be of high viscosity resins, which are cold setting and free of solvent. Adhesive shall not be used to bond layers of cured elastomer. Mild steel used for plate reinforcement shall comply with the requirements of relevant IS. The Contractor shall furnish to the Engineer-in-charge a certificate by the Manufacturer that the elastomer and fabric (if used) in the elastomeric bearing conforms to all the above requirements. The certification shall be supported by a certified copy of the results of tests, performed by the Manufacturer upon samples of the elastomer and fabric to be used in the bearings.

The contractor shall, whenever required, during the course of manufacture arrange and offer all facilities for the purpose of inspection and test of all or any of the material used therein, to any officer as directed by the Engineer-in-charge and the bearings and similar parts shall be used in the superstructure except on the production of certificate of acceptance thereof from the Directorate of Inspection whenever necessary. All the inspection charges shall be payable by the contractor.

4. The thickness of a single layer bearing shall not exceed 20 per cent of the least plan dimension. The total thickness of a laminated bearing shall not exceed 40 per cent of the least plan dimension. The thickness of any internal layer of elastomer shall not be less than 6 mm nor greater than 12 mm. The thickness of outer plates shall be not less than 3 mm. and that of inner plate not less than 1.5 mm. Metal plates in which dowels are located shall be, in general, not less than 6 mm. thick. The edges of all plates shall be lightly rounded to approximately 5 mm. radius. The metal plates referred above should not be composed of thinner plates joined together. Laminated Bearings shall have side cover of elastomer of minimum thickness of 6 mm, to protect the ends of the steel plates and to give a reduced surface strain to that occurring at the edge of the bonded plate shall not be considered in evaluation of deformations. The cover of elastomer at the top and bottom surfaces shall not be less than 3 mm. or more than half the thickness of internal layer. The outer cover at top and bottom surfaces having thickness less than half that of a single, internal layer and not exceeding 3 mm. may be considered as a simple protection and need not therefore be considered in calculating deflections. Where above elastomer covers are provided, there is no objection to keeping the thickness of top most and bottom most plates same as that of inner plates.
5. Bearing shall be set back from the edge of a bearing surface a distance not less than the thickness of the layer of elastomer in contact with bearing surface to allow for spreading of the elastomer under load. Bearings may be located in position by means of dowels or studs or other devices, or bonded to the structure with approved adhesives which shall generally be of the high viscosity resin type cold setting and free from solvent. For spans on an inclined grade and without hinge bearings the sole plates shall be provided and the same beveled so that masonry surfaces and the bearing shall be kept horizontal. To facilitate maintenance, the ends of trusses and plate girders shall preferably be supported on plates or pedestals so that there is at least 15 centimeters clearance between the bottom chord or flange and the substructure. The plan dimensions of the bearings to be finally adopted shall preferably be selected from series 'R' 20 of IS: 1076. The arrangement of placing only one bearing under a girder shall be permitted. Further, bearings of different sizes must not be placed next to each other to support a span. The bearings shall be fully moulded when metal laminations are used. These laminated elastomeric bearings shall consist of one or more elastomer slabs bonded to metal plates so as to form a sandwich arrangement. Such fully moulded bearings shall be manufactured to required size. The bond between elastomers and metal or fabric shall be such that, when a sample is tested for separation, failure shall occur within the elastomers and not between the elastomer and metal.
6. The contractor shall get the bearings tested for the physical properties and performance of bearings. The test pieces required for the test shall be selected from the Central layer of bearing making up the selection. For the Size of test pieces and method of tests etc. the relevant I.S.T.M. Standard shall be followed: The tests shall be carried out in a recognized laboratory acceptable to the department for all the necessary tests required by the Department. The specimen for tests as may be required shall be supplied by the contractor at his own cost and the testing charges shall also be fully borne by the contractor. Only those Bearings which pass the tests satisfactorily

will be accepted and will be permitted to be used. The Department shall not accept any responsibility for the cost of bearings rejected.

- 7.(i) Tolerances on length and width 0, +5 mm.
 - (ii) Tolerances on thickness for single layer pad. ± 0.5 mm.
 - (iii) Tolerance on total thickness 'h' of finished bearings.

10 < h \leq 30mm	:	± 0.5 mm
30 < h \leq 50mm	:	± 0.8 mm
50 < h \leq 80mm	:	± 0.9 mm
80 < h \leq 120mm	:	± 1.1 mm
 - (iv) The parallelism of the individual elastomer laminations for a finished bearing, shall not exceed the tolerances specified at (ii) above when measured at the extremities of the laminations.
8. Proper arrangement shall be made to avoid corrosion of metal plates or deteriorating of adhesive by encasing the bearings totally in elastomer or by some other method approved by the Engineer-in-charge.
- 9.(i) When bearing assemblies on plates are shown on the drawing to be placed (not embedded) directly on concrete, the concrete bearing area shall be constructed slightly above grade and shall be finished by grinding.
- (ii) It shall be ensured that bearings are set truly level and in exact position as indicated on the drawings so as to have full and even bearing on the seats. Thin mortar pads (not exceeding 12 mm.) may be made to meet with this requirement.
 - (iii) It shall be ensured that the bottoms of the girders to be received on the bearings are plane at the location of these bearings and care shall be taken that the bearings are *not* replaced while placing the girders.
 - (iv) Before fixing the elastomeric bearings the concrete surface on which the bearings are to be placed shall be wood float finished to a level plane which shall not vary more than 1.5 mm. from a straight edge placed in any direction across the areas.
 - (v) The position of the bearings shall be accurately marked on the pier abutment cap and the area where the bearings are to be located levelled accurately.
 - (vi) The concrete surface shall be free from any loose material and cleared of grease oil, paint etc. and it shall be dry at the time of fixing.
 - (vii) The surface of elastomer shall be free of any foreign material.
 - (viii) Once prepared, the concrete or elastomer shall not be touched with bare hand.
 - (ix) The bearings shall be covered with canvas or a suitable covering material to protect from direct sunlight and weather until the concrete on superstructure is cast.
 - (x) The bearings shall be fixed in position with epoxy resin adhesive of approved quality.
 - (xi) The concreting of superstructure shall be taken up only after ensuring that the adhesive for fixing the bearings or pier/abutment cap has set.
 - (xii) Unit rate shall be cubical contents of the bearing measured in Cu.cm.
 - (xiii) The rate for each type of bearings shall include the cost of supplying and fixing bearings in position complete. The rate shall also include the cost of samples and their testing as desired by the Engineer-in-charge. The rate shall also include the cost of adhesives for fixing

Rate shall be for a unit of one Cubic Centimeter.

Item No.43

Providing and casting in situ or precast controlled Cement Concrete M-50 for prestressed concrete work in Super structure including centering, shuttering, curing, scaffolding, ramming, vibrating, finishing, launching or shifting complete. (II) Deck Slab, (III) Main Girders. (IV) Diaphragm or Cross Girder

Details specification for this item shall be as per MoRTH specification No. 1700 pg. no. 535

Rate shall be for a unit of one Cubic meter.

Item No.44

Providing and Casting in situ controlled cement concrete M-40 for R.C.C. Solid Slab including centering, scaffolding, curing and finishing complete.

Details specification for this item shall be as per MoRTH specification No. 1700 pg. no. 535

Rate shall be for a unit of one Cubic meter.

Item No.45

Providing and fixing in position to exact profile high tensile steel wires of required ultimate strength including bending, cutting, tying providing necessary standard and anchorages, sheathing, stressing, grouting, ducts as per detailed drawing including necessary plant and machinery complete.

Details specification for this item shall be as per MoRTH specification No. 1700 pg. no. 535

Rate shall be for a unit of one Cubic meter.

Item No.46

Providing and carrying out load test on bridge deck with simulated loading including provision, placing and removal of loading, supplying, fixing and removing deflection measuring instruments etc. complete with platforms for fixing the instruments etc. complete as per the details supplied and specification and as directed by Engineer and including submission of required results in triplicate after satisfactory completion of the load test.

1. The item shall be executed in as per relevant IRC specification, drawing and directed by engineer in charge.
2. The measurement shall be in MT. basis.
3. The rate shall include all materials, machinery, labour, plant etc. required to execute the above item.

Rate shall be for unit of one Metric Tonne.

Item No.47

Providing and casting insitu controlled cement concrete M-35 in RCC Gap Slab and Approach Slab including formwork, curing and finishing complete.

Details specification for this item shall be as per MoRTH specification No. 1700 pg. no. 535

Rate shall be for a unit of one Cubic meter.

Item No.48

Providing and fixing RCC M:25 architectural pylons at end of approach structures including all materials, labour, ramming, curing etc. complete as per detailed working drawing.

(a) Concrete

Details specification for this item shall be as per MoRTH specification No. 1700 pg. no. 535

Rate shall be for a unit of one Cubic meter.

Item No.49

Providing and fixing the Continuity arrangement in deck slab as per the detailed drawing with fixtures, components, filler etc. complete as directed by Engineer in charge.

All relevant provisions as have been included in the respective IRC and IS specifications are also applicable.

Continuity arrangement in deck slab as per the detailed drawing shall be provided as per the design and drawings.

Rate shall be for a unit of one Running Meter.

Item No.50

Providing and laying, Spreading & Compacting Coarse Clean Sharp Sand behind Abutments and returns and C.B.R. not less than 10% below sub base course, C=0 & $\phi=30^\circ$ including carriage of material, spreading in uniform layer on prepare base watering & compacting with vibratory roller at OMC incl. all labour etc. complete

1.1. DESCRIPTION:

This shall consist of supplying and providing sand of required gradation in accordance with the requirement of these specifications and as mentioned in items of bill of quantity as a top part of the sub grade.

1.2 MATERIALS:

The material to be used for the work shall be natural sand having soaked C.B.R. not less than 10%. The sand shall be free from organic or other deleterious constituents and conform to grading given in following table or as directed by the Engineer-in-charge.

Grading for sub-grade /sand/) Table No. 400.8 of MOST SPECIFICATION

FOR ROAD AND BRIDGE WORK (FOURTH REVISION).

GRADING

Grading Classification	Size of Screenings	IS Sieve Designation	Per cent by weight passing the IS Sieve
B	11.2 mm	11.2 mm	100
		5.6 mm	90-100
		180 micron	15-35

1.2.1 PHYSICAL REQUIREMENTS:

The material shall be coarse sand confirming to

(1) Grain size is as per table above.

(2) Soaked CBR >10%

1.3 PREPARATION AND SURFACE TREATMENT OF FORMATION.

Preparation and surface treatment of the formation, i.e. top of the sub grade, shall be carried out only after the completion of any specified sub grade drainage and unless otherwise agree by the Engineer, immediately prior to laying the sub base or the road base where no sub base is required. The sequence of operation shall be as follows:

- All surfaces below carriageway, lay byes, footways and hard shoulder shall, after reinstatement of any soft areas to the required specification be well cleaned and freed of mud and slurry.
- The surface shall be compacted by four passes of smooth vibratory wheeled roller of 80-100 KN weight after spraying requisite amount of water, if required, before the commencement of rolling.
- The formation shall, where necessary, be regulated and trimmed to the requirement of the clause 305.3.9 with motor grader.

- (d) The trimmed formation shall be rolled by the one pass of the smooth wheeled vibratory roller of 80-100 KN weight after spraying requisite water, if required, before the commencement of rolling.

Where the completed formation is not immediately covered with sub base or road base material, its moisture content shall be maintained to prevent cracking in the formation by suitable measures as approved by the Engineer. The entire work of surface treatment of formation shall be deemed as incidental to the work of sub base/ base course to be provided on the sub grade and as such no extra payment shall be made for the same.

SURFACE FINISH AND QUALITY CONTROL OF WORKS:

The surface finish of construction shall confirm to the requirement of clause (MOST SPECIFICATION FOR ROAD AND BRIDGE WORK (FOURTH REVISION) 902. Control on quality of materials shall be exercised by the Engineer-in-Charge in accordance with M.O.S.T. SPECIFICATION FOR ROAD AND BRIDGE WORK (FOURTH REVISION) clause – 900.

1.5 PREPARATION OF SUB – GRADE:

Immediately prior to the laying of sub-base, the sub-grade finished to section 301 to 305 of MOST SPECIFICATION FOR ROAD AND BRIDGE WORK (FOURTH REVISION) as applicable shall be prepared by removing all vegetation and other extraneous material, lightly sprinkled with water if necessary and rolled with vibratory roller as directed by Engineer-in-Charge.

1.6 INVERTED CHOKE:

If water bound macadam is to be laid directly over the sub-grade, without any other intervening pavement course, a 100mm insulating layer of screening or coarse sand on top of the fine grained soil, the gradation of which will be as per table no. 1000.2 (MOST SPECIFICATION FOR ROAD AND BRIDGE WORK- FOURTH REVISION) as stated above.

1.7 SPREADING:

The sub-grade material of grading specified in the contract shall be spread on the prepared sub-grade with manual labourers using templates etc. and maintained the required slope and grade during the operation or other means as approved by the Engineer.

The thickness of loose layers shall be so regulated that the maximum thickness of the layer after consolidation does not exceed 100-mm.

1.8 COMPACTION OF SAND SUB-GRADE:

1.8.1 ROLLING: Relevant specification as per MOSRT&H specification para no. 404.3.4 shall be applicable.

1.9 MOST Clause 112 (MOST SPECIFICATION FOR ROAD & BRIDGE WORK (FOURTH REVISION))

112. -ARRANGEMENT FOR TRAFFIC DURING CONSTRUCTION

112.1 General

The Contractor shall at all-time carry out work on the highway in a manner creating least interference to the flow of traffic while consistent with the satisfactory execution of the same. For all works involving improvements to the existing highway, the Contractor shall, in accordance with the directives of the Engineer, provide and maintain, during execution of the work a passage for traffic either along a part of the existing carriageway under improvement, or along a temporary diversion constructed close to the highway. The Contractor shall take prior approval of the Engineer regarding traffic arrangements during construction.

112.2 Passage of Traffic along a part of the existing Carriageway under Improvement.

For widening / strengthening existing carriageway or constructing service road parallel to existing road is proposed to be used for passage of traffic, treated shoulders shall be provided on the side on which work is not in progress. The treatment to be shoulder shall consist of providing at least 150 mm thick granular base course covered with bituminous surface dressing in a width of at least 1.5 m and the surface shall be maintained throughout the period during which traffic uses the same to the satisfaction of the Engineer. The continuous length, in which such work shall be carried out, would be limited normally to 500 m at a place. However, where work is allowed by the Engineer in longer stretches passing places at least 20 m long with additional paved width of 2.5 m shall be provided at every 0.5 km interval.

After obtaining permission of the Engineer, the treated shoulder shall be dismantled, the debris disposed of the area cleared as per the direction of the Engineer.

112.3 Passage of traffic along a Temporary Diversion

In stretches where it is not possible to pass the traffic on part width of carriageway, a temporary diversion shall be constructed with 7 m carriageway and 2.5 m earthen shoulders on each side (total width of roadway 12 m) with the following provision for road crust in the 7 m width:

- (i) 200 mm (compacted) granular sub-base;
- (ii) 225 mm (compacted) granular base course; and
- (iii) Premix carpet with Seal Coat / Mix Seal Surfacing.

The alignment and longitudinal section of diversion including junctions and temporary cross drainage provision shall be as approved by the Engineer.

112.4 Traffic Safety and Control

The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic approaching or passing through the section of the highway under improvement. Before taking up any construction, an agreed phased Programme for the diversion of traffic on the highway shall be drawn up in consultation with the Engineer.

The barricades erected on either side of the carriageway / portion of the carriageway closed to traffic, shall be strong design to resist violation, and painted with alternate black and white strips. Red lanterns or warning lights of similar type shall be mounted on the barricades at night and kept lit throughout from sunset to sunrise.

At points where traffic is to deviate from its normal path (whether on temporary diversion of part width of the carriageway) the channel for traffic shall be clearly marked with the aid of pavement markings, painted drums or a similar device to the directions of the Engineer. At night, the passage shall be delineated with lanterns or other suitable light source.

One-way traffic operation shall be established whenever the traffic is to be passed over part of the carriageway inadequate for two-lane traffic. This shall be done with the help of temporary traffic signals or flagmen kept positioned on opposite sides during all hours. For regulation of traffic, the flagmen shall be equipped with red and green flags and lanterns / lights.

On both sides, suitable / warning signs as approved by the Engineer shall be installed for the guidance of road users. On each approach, at least two signs shall be put up, one close to the point where transition of carriageway begins and the other 120 m away. The signs shall be approved design of the reflectory type, if so directed by the Engineer.

112.5 Maintenance of Diversions and Traffic Control Devices Signs, lights, barriers and other traffic control devices, as well as the riding surface of diversions shall be maintained in a satisfactory condition till such time they are required as directed by the Engineer. The temporary travelled way shall be kept free of dust by frequent applications of water, if necessary.

1.10 Measurement for Payment.

Work shall be measured as finished work in position in cubic metre.

1.11Rate

The contract unit rate for sand sub grade shall be paid in full for carrying out the required operations including full compensation for:

- (i) Making arrangements for traffic to Clause 112 (MOST SPECIFICATION FOR ROAD & BRIDGE WORK (FOURTH REVISION) except for initial treatment to verges, shoulders and construction of diversions;
- (ii) Furnishing all materials to be incorporated in the work including all royalties, fees, rents where necessary and all leads and lifts;
- (iii) All labour, tools, equipment and incidentals to complete the work to the Specifications;
- (iv) Carrying out the work in part widths of road where directed; and Carrying out the required tests for quality control.

Rate shall be for unit of Cubic Meter.

Item No.51

Providing and casting in situ controlled cement concrete M-35 for R.C.C. Retaining wall as per drawings including centering, shuttering, scaffolding where necessary, laying, vibrating, curing and finishing complete.

Details specification for this item shall be as per MoRTH specification No. 1500, 1700 & 2100

The mode of payment shall be in per Cubic Meter.

Item No.52

Providing and laying weep holes in abutments and returns ny using A.C. pipe of 100mm including laying in proper grade and joint in complete as per detailed specification.

1. WEEP HOLE

Weep holes shall be provided in solid plain concrete/reinforced concrete, brick/stone masonry, abutment, wing wall and return walls as shown on the drawing or directed by the Engineer to drive moisture from the back filling. Weep holes shall be provided with 100 mm dia using PVC/Polysil pipes structures in plain/reinforced concrete or brick masonry. In case of stone masonry, weep holes shall be 80 mm wide, 150 mm high or circular with 150 mm diameter. Weep holes shall extend through the full width of concrete/masonry with slope of about 1 vertical: 20 horizontal towards the draining face. The spacing of weep holes shall generally be 1 m in either direction or as shown in the drawing with the lowest at about 150 mm above the low water level or ground level which is higher or as directed by the Engineer. Approved makes for PVC weep holes is Supreme and Finolex.

2. Measurements shall be given on number of weep holes provided.
3. The rate includes all materials, labors, equipments and plants etc. required for executing this item.
Rate shall be for unit of one Nos.

Item No. 53

Providing and laying - 600mm thick Filter media directed at the back of abutments, returns and wing walls as per detailed specifications.

1. Well graded pebbles or metal of 40 mm to 63 mm size shall be used. The grading and tolerance of metal of pebbles should be as under.
- 2.

Sr. No.	No. of Size range	Sieve designation	Percentage by weight passing through the sieve
1.	63 mm to 40 mm	90 mm	100-50
		63 mm	85-100
		50 mm	35-70
		40 mm	00-15
		20 mm	00-05

The size shall be 40 mm to 63 mm wherein, tolerance limit for oversize shall be upto 15% and that for lower size should be upto 15%. below 20 mm. It shall be tightly placed to a thickness not less than 600 mm and provided over the entire surface behind abutments wings or return walls to the full height.

3. Materials shall be first stacked in boxes of 2 m x 1.5 m x 0.5 m size on fairly level ground and measured.
3. The measurement for payment shall be made on square meter basis.
4. The unit rate includes the cost of materials, scaffolding, labour and tools to complete the work.

Rate shall be for unit of Square meter basis.

Item No.54

Box cutting the road surface to proper slope and camber for making a base for road work including removing the excavated stuff and depositing on the road side slope as directed upto 50m lead.

The relevant specifications as per relevant MORTH specification Section 301.

The measurement & Payment shall be per Cubic Meter basis.

Item No.55

Construction of granular sub-base (Grade I) 200mm thick by providing coarse graded material BTMC 53 mm to 26.5 mm, BTMC 26.5 mm to 4.75 mm & Coarse sand, spreading in uniform layers with motor grader on prepared surface, mixing by mechanical mix plant method with rotavator at OMC, and compacting with vibratory roller to achieve the desired density, complete as per MORTH clause

Scope

This work shall consist of laying and compacting well-graded material on prepared sub grade in accordance with the requirements of these Specifications. The material shall be laid in one or more layers as sub-base or lower sub-base and upper sub-base (termed as sub case hereinafter) as necessary according to lines, grades and cross-sections shown on the drawings or as directed by the Engineer.

Materials

The material to be used for the work shall be natural sand, crushed gravel, crushed stone, crushed slag, or combination thereof depending upon the grading required. Use of materials like brick metal, Kankar and crushed concrete shall be permitted in the lower sub-base. The material shall be free from organic or other deleterious constituents and shall conform to the grading given in Table 400-1 and physical requirements given in Table 400-2. Grading III and IV shall preferably be used in lower sub-base. Grading V and VI shall be used as a sub-base-cum-drainage layer. The grading to be adopted for a project shall be as specified in the Contract. Where the sub-base is laid in two layers as upper sub-base and lower sub-base, the thickness of each layer shall not be less than 150 mm.

If the water absorption of the aggregates determined as per IS:2386 (Part 3) is greater than 2 percent, the aggregates shall be tested for Wet Aggregate Impact Value (AIV) (IS:5640). Soft aggregates like Kankar, brick ballast and laterite shall also be tested for Wet AIV (IS:5640).

Table: Grading for Granular Sub-base Materials

IS Sieve	Percent by Weight Passing the IS Sieve					
Designation	Grading I	Grading II	Grading III	Grading IV	Grading V	Grading VI
75.0 mm	100		-	-	100	-
53.0 mm	80-100	100	100	100	80-100	100
26.5 mm	55-90	70-100	55-75	50-80	55-90	75-100
9.50 mm	35-65	50-80	-	-	35-65	55-75
4.75 mm	25-55	40-65	10-30	15-35	25-50	30-55
2.36 mm	20-40	30-50	-	-	10-20	10-25

IS Sieve	Percent by Weight Passing the IS Sieve					
Designation	Grading I	Grading II	Grading III	Grading IV	Grading V	Grading VI
0.85 mm	-		-	-	2-10	-
0.425 mm	10-15	10- 15	-	-	0-5	0-8
0.075 mm	<5		<5	<5	-	0-3

Table: Physical Requirements for Materials for Granular Sub-base

Aggregate Impact Value (AIV)	IS:2386(Part4) or IS:5640	40 maximum
Liquid Limit	IS:2720 (Part 5)	Maximum 25
Plasticity Index	IS:2720 (Part 5)	Maximum 6
CBR at 98% dry density (at IS:2720-Part 8)	IS:2720 (Part 5)	Minimum 30 unless otherwise specified in the Contract

Preparation of Sub-grade

Immediately prior to the laying of sub-base, the sub grade already finished to Clause 301 or 305 as applicable shall be prepared by removing all vegetation and other extraneous matter, lightly sprinkled with water, if necessary and rolled with two passes of 80-100 KN smooth wheeled roller.

Spreading and Compacting

The sub-base material of the grading specified in the Contract and water shall be mixed mechanically by a suitable mixer equipped with provision for controlled addition of water and mechanical mixing. So as to ensure homogenous and uniform mix. The required water content shall be determined in accordance with IS:2720 (Part 8). The mix shall be spread on the prepared sub grade with the help of a motor grader of adequate capacity, its blade having hydraulic controls suitable for initial adjustment and for maintaining the required slope and grade during the operation, or other means as approved by the Engineer.

Moisture content of the mix shall be checked in accordance with IS:2720 (Part 2) and suitably adjusted so that, at

the time of compaction, it is from 1 to 2 percent below the optimum moisture content.

Immediately after spreading the mix, rolling shall be done by an approved roller. If the thickness of the compacted layer does not exceed 100 mm, a smooth wheeled roller of 80 to 100 KN weight may be used. For a compacted single layer up to 200 mm the compaction shall be done with the help of a vibratory roller of minimum 80 to 100 KN static weight capable of achieving the required compaction. Rolling shall commence at the lower edge and proceed towards the upper edge longitudinally for portions having unidirectional cross fall or on super elevation. For carriageway having cross fall on both sides, rolling shall commence at the edges and progress towards the crown.

Each pass of the roller shall uniformly overlap not less than one-third of the track made in the preceding pass. During rolling, the grade and cross fall (camber) shall be checked and any high spots or depressions which become apparent, corrected by removing or adding fresh material. The speed of the roller shall not exceed 5 km per hour.

Rolling shall be continued till the density achieved is at least 98 percent of the maximum dry density for the material determined as per IS:2720 (Part 8). The surface of any layer of material on completion of compaction shall be well closed, free from movement under compaction equipment and from compaction planes, ridges, cracks or loose material. All loose, segregated or otherwise defective areas shall be made good to the full thickness of layer and re-compacted.

Surface Finish and Quality Control of Work

The surface finish of construction shall conform to the requirements of Clause 902. Control on the quality of materials and works shall be exercised by the Engineer in accordance with Section 900.

Arrangements for Traffic

During the period of construction, arrangements for the traffic shall be provided and maintained in accordance with Clause 112.

Measurements for Payment

Granular sub-base shall be measured as finished work in position in cubic metres. The protection of edges of granular sub-base extended over the full formation as shown in the drawing shall be considered incidental to the work of providing granular sub-base and as such no extra payment shall be made for the same.

Rate

The Contract unit rate for granular sub-base shall be payment in full for carrying out the required operations including full compensation for:

- i) making arrangements for traffic to Clause 112 except for initial treatment to verges, shoulders and construction of diversions;
- ii) supplying all materials to be incorporated in the work including all royalties, fees, rents where applicable with all leads and lifts;
- iii) all labour, tools, equipment and incidentals to complete the work to the Specifications;
- iv) carrying out the work in part widths of road where directed; and
- v) carrying out the required tests for quality control.

The mode of payment shall be in per Cubic Meter basis.

Item No.56

Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam 250mm thick in layers as per specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.

- 1 The relevant specifications given in Section –501 & 502 of MORT&H fifth revision specification shall apply to this item.
- 2 The mode of payment & measurement shall be per Cubic Meter basis.

Item No.57

Providing and laying Prime coat Emulsion SS1 asphalt binder @ rate of 7.5 Kg./10 sq.m. of road surface using Emulsion pressure sprayer etc. complete including cost of Emulsion asphalt.

Details specification for this item shall be as per MoRTH specification No. 502 & 503

The mode of payment shall be in per Square Meter.

Item No.58

Providing and laying 75 mm thick Dense Graded Bituminous Macadam in two layer (single layer not more than 70 mm) using BT stone chips as per MoRTH gradation and specification with Bitumen Grade (VG 30) for mixing @ 45.00 Kg /MT of total Wt. of mix i.e (4.50 % of total weight mix)including tack coat @ 2.5 kg/10 smt with Bitumen Emulsion (Rapid setting) and mixing aggregate & asphalt by batch mix plant and spreading the same by sensor paver finisher including rolling & consolidation with 10-12 tonne vibratory roller & providing all materials equipment's tools & plants, fire wood, oil , kerosene,labour charges , using contractor 's own machinery etc Complete as directed by engineer in charge as per MoRTH Specification

Details specification for this item shall be as per MoRTH specification No. 503 & 504

The mode of payment shall be in per Metric Tone basis.

Item No.59

Providing and laying 50 mm thick of compacted Bituminous concrete using BT aggregate as per MORTH gradation ,specification and asphalt Grade VG 30 mixing @52.00 Kg /MT of total Wt. of mix i.e. (5.20% of total weight mix) including heating and mixing aggregate & asphalt by batch mix plant spreading the same by sensor paver finisher including rolling & consolidation with 10-12 tonne vibratory roller,Tandem Roller ,PTR & providing all materials equipment's tools & plants, fire wood, oil , kerosene,labour charges , using contractor 's own machinery etc Complete as directed by engineer in charge as per MoRTH Specification

Details specification for this item shall be as per MoRTH specification No. 503 & 507

The mode of payment shall be in per Metric Tone basis.

Item No.60

Providing and laying 60 mm thick Dense Graded Bituminous Macadam using BT stone chips as per MoRTH gradation and specification with Bitumen Grade (VG 30) for mixing @ 45.00 Kg /MT of total Wt. of mix i.e (4.50 % of total weight mix)including tack coat @ 2.5 kg/10 smt with Bitumen Emulsion (Rapid setting) and mixing aggregate & asphalt by batch mix plant and spreading the same by sensor paver finisher including rolling & consolidation with 10-12 tonne vibratory roller & providing all materials equipment's tools & plants, fire wood, oil , kerosene,labour charges , using contractor 's own machinery etc Complete as directed by engineer in charge as per MoRTH Specification

Details specification for this item shall be as per MoRTH specification No. 503 & 504

The mode of payment shall be in per Metric Tone basis.

Item No.61

Providing and laying 40 mm thick of compacted Bituminous concrete using BT aggregate as per MORTH gradation ,specification and asphalt Grade VG 30 mixing @52.00 Kg /MT of total Wt. of mix i.e. (5.20% of total weight mix) including heating and mixing aggregate & asphalt by batch mix plant spreading the same by sensor paver finisher including rolling & consolidation with 10-12 tonne vibratory roller,Tandem Roller ,PTR & providing all materials equipment's tools & plants, fire wood, oil , kerosene,labour charges , using contractor 's own machinery etc Complete as directed by engineer in charge as per MORTH Specification

Details specification for this item shall be as per MoRTH specification No. 503 & 507

The mode of payment shall be in per Metric Tone basis.

Item No.62

Providing and laying in position M-15 grade concrete for cement concrete work, using content as per approved Mix manufactured in fully automatic batching plant and transported to site of work in transit mixer for a lead upto 10 kms having continuous agitated mixer, manufactured as per mix design of specified grade, including the cost of centering shuttering finishing and reinforcement including cost of admixtures in recommended proportions as per IS:9103 to accelerate/retard setting of concrete, improve workability without impairing strength and durability as per direction of the engineer-in-charge. Without fly ash.

5. The relevant specifications given for cement concrete M15 grade for concreting as per Section -1500, 1700, 2100 & 2200 of MORTH fifth revision specification.
6. The measurement shall be per cum basis.
7. The rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required
8. The mode of payment shall be in per cum. Basis.

Item No.63

Construction of 300mm thick un-reinforced, dowel jointed, plain cement concrete pavement over a prepared sub base with concrete grade M35 and with OPC-53 grade cement @425kg/cum, coarse and fine aggregate conforming to IS:383, maximum size of coarse aggregate not exceeding 25 mm, mixed in a batching and mixing plant as per approved mix design, transported to site, laid with a fixed form or slip form paver, spread, compacted and finished in a continuous operation including provision of contraction, expansion construction and longitudinal joints, joint filler, separation membrane, sealant primer, joint sealant, debonding strip, dowel bar, tie rod, admixtures as approved, curing compound, finishing to lines and grades as per drawing etc. complete as per instruction on Engineer-in-charge.

Detail specification of this Item shall be as per MoRTH section 600 and directed by engineer-in-charge and shall be as per item detail description.

The measurement and payment shall be in Cubic meter.

Item No.64

Providing and fixing pre-cast concrete kerb stone of gray cement based concrete block 30cm length,30cm height and 15cm thick of M250 grade concrete as per approved design and including excavation for fixing in proper line and level,filling the joint with C:M 1:3 (1 cement : 3 fine sand) etc complete.

1. The relevant specifications given for machine mixed plain cement concrete M25 grade as per Section -1500 & 1700 of MORT&H fifth revision specification & as per relevant RDSO specification.
2. The measurement shall be per Rmt. basis.
3. The rate includes tamping, vibrating, leveling and curing complete with all formwork, dewatering wherever required including all materials, labours, plants, machineries & tools, all leads and lifts, etc. complete as per specification.

The mode of payment shall be in Running meter basis.

Item No.65

Providing and fixing pre-cast Rubber Dye / steel Dye inter locking concrete block 60mm thick with grade of concrete M300 pneumatic compressed / vibrated mechanically and as per approved design Confirming to IS 15658 : 2006 including 35 mm Sand layer for levelling and filling the joint with sand in proper line and level as per guidelines of IRC : SP 63-2018 etc. Complete.

Monolithic Paver Block Manufacturing Facilities:

the paver block shall be made in factory with following minimum facilities:

Concrete Block making Machines:

The machine should be capable of producing high quality Paver Blocks by obtaining high level of compaction with application of hydraulic compaction and also by high intensity vibration to the moulds.

The machine has automatic control panel for uniformity in strength of 50 N/sq.m average

CURING:

The factory should have well designed curing area to ensure adequate curing of paver blocks by ponding system

Laboratory (Desirable but not essential) :

The factory should have the following:

Compression testing machine of adequate capacity.

Other tools and equipment for testing raw materials and paver blocks.

(1). Systematic record of test results of various paver blocks manufactured in the factory.

(2). Concrete Mix Design for various grade of concrete used for making of paver blocks.

SPECIFICATIONS FOR COLORED PAVER BLOCKS:

Colored concrete paver blocks shall be manufactured as per attached specifications using approved colour pigment of "BAYAER" Make "BAYFERROX IRONOXIDE PIGMENTS" with minimum colour pigment of 3% by weight of cement. The color shade shall be: RED" as selected by engineer in charge before commencement of the work.

White cement shall be used for colored pavers to obtain the desired color shade. The job also includes providing 45 mm thick sand bedding to match the shade of the paver block.

The colour of the paver block shall be guaranteed against fading of color for period of 12 months from the date of laying of the same site.

All other technical specifications & procedure for testing, laying & sampling of coloured paver will be as per attachment.

PAVER BLOCK DIMENSIONS:

Thickness 60mm

Shape Unirregular (Uniform shape with no Hollow or cracks) Uni, I shape, tri hex or directed by engineer in charge

Chamfer 4mm to 6mm along top edges

Color Natural cement grey color without use of any pigment.

For colored pavers refer "specifications for colored pavers"

Dimensional

Tolerance

(+/-) 2mm for length & width,

(+/-) 3mm for height (thickness)

TESTIN OF PAVER BLOCKS:

SR.

NO.

TEST SPECIFICATION

Average values

(Average of minimum Five Samples/Site)

Compressive strength Min. 25N/sqm. for 60 mm thick

Abrasion Resistance Maximum 1.5

Water Absorption Maximum 5.80%

Minimum Cement Content 380 Kg/ Cum (Not Essential)

Sampling and testing procedure as per enclosed specifications

SAMPLING AND TESTING PROCE FOR PAVER BLOCKS.

Sample size:

INTERNAL—Average of minimum 3 samples per 5000 Blocks.

Essential—Minimum 2 Blocks per 10000 blocks.

sampling for testing

sampling for testing of paver blocks shall be done in accordance with Appendix-A.

Compressive strength

Testing for compressive strength shall be undertaken in accordance with Appendix-B.

The average compressive strength of the blocks tested shall be Min. 25 N/Sq.mt.

Abrasion Resistance

Testing for Abrasion Resistance shall be in accordance with IS 1237 (Specification for cement concrete floor tiles)

Appendix-C

Flexural Strength

Testing for Flexural Strength shall be in accordance with IS 1237 (Specification for cement concrete floor tiles)

Appendix-D

Water Absorption

Testing for Water Absorption shall be in accordance with IS 2185:1979: Part I

(Specifications for concrete masonry units) Appendix-E.

Appendix-A.

Sampling of Paver blocks.

Method of sampling:

Before laying paver blocks, each designed section comprising not more than 50000 blocks, shall be divided in to ten approximately equal groups. Three blocks shall be drawn from each group.

Marking and identification:

All samples shall be clearly marked at the time of sampling in such a way that the designated section of part thereof, and the consignment represented by the sample, are clearly defined. The samples shall be dispatched to the approved test laboratory taking precaution to avoid damage to the paving in transit. Protect the paving from damage and contamination until they have been tested. The testing shall be carried as soon as possible, after the sample has been taken as soon as practicable after sampling. The samples shall be stored in water at 20 degree C (+) OR C(-) 5 degree C for 24 hours period to testing.

The tested blocks shall be laid in service road carriageway. The sand base of 45 mm thick uniformly graded river sand. Cushioning with proper compacting with the proper level, grade and camber etc. The sand base shall be well watered and compacted in required width by means of power road roller.

Accordingly, the sand base prepared in grade & camber and properly dressed.

The tested monolithic paver block shall be arranged on sand based carriageway as per drawing and as per the instruction of engineer in charge of work. The block shall be so arranged to have minimum gap of 2mm in between two blocks. The top surface of block arranged shall be in grade & camber. The interstices shall be filled with fine river sand and surface shall be well watered so all sand on surface shall be filled in the interstices. The work shall be carried out as per drawings, specification and instruction of engineer in charge of work.

The rate shall be paid on Square Meter basis of work done.

Item No. 66

Providing and fixing retro Reflective Prismatic grade Board using 2mm Aluminum / 4mm ACP, angle iron 75 x 75 x 6mm. Descaling and degreasing the board as per requirement using epoxyprimer epoxy paint and carrying retro reflective process by screen painting as directed etc. complete including transporting and fixing in C.C. 1:2:4 with necessary excavation curing etc. complete as per I.R.C 67-2012 design. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class -C Type- 11(NH/SH) retro reflective sheeting.

- 1 The relevant specifications of MORT&H fifth revision clause 800 shall apply to this item & directed by engineer in charge.
- 2 The mode of payment shall be in Nos. basis.

Item No. 67

Cautionary Warning Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 90 x 90 x 90 cms. equilateral triangle as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ; reflectorised with Micro Prismatic Grade retro reflective sheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T. Specifications; 3.6mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with best quality epoxy coatings in black and white bends. The details of symbol for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60 Cms. for each leg. including excavation, curing etc. complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

- 1 The relevant specifications of MORT&H fifth revision clause 800 shall apply to this item & directed by engineer in charge.
- 2 The mode of payment shall be in Nos. basis.

Item No. 68

Regulatory / Mandatory Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 60 cms Dia Circle as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.6mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from

original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

- 1 The relevant specifications of MORT&H fifth revision clause 800 shall apply to this item & directed by engineer in charge.
- 2 The mode of payment shall be in Nos. basis.

Item No. 69

Direction (Junction) Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 244x122 cms. rectangular as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 4.0mtr long (2 Nos.) stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

- 1 The relevant specifications of MORT&H fifth revision clause 800 shall apply to this item & directed by engineer in charge.
- 2 The mode of payment shall be in Nos. basis.

Item No. 70

Distance Informatory / Destination Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 180x120 cms. rectangular as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 4.0mtr long (2 Nos.) stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

- 1 The relevant specifications of MORT&H fifth revision clause 800 shall apply to this item & directed by engineer in charge.
- 2 The mode of payment shall be in Nos. basis.

Item No. 71

Chevron sign :-Providing and fixing sign boards made out of 1.5mm aluminium sheet / 3mm ACP (Aluminum composite Panel); size 60x50 cm as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.3 mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with bestquality epoxy coatings in black and white bends. the details of symbol or inscription / numerals for each board shall be as per the instruction of engineer in charge.The fixing at

site shall be in 1:2:4 CC block of size 45 x 45 x 60 Cms. for each leg including excavation, curing etc. complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

- 3 The relevant specifications of MORT&H fifth revision clause 800 shall apply to this item & directed by engineer in charge.
- 4 The mode of payment shall be in Nos. basis.

Item No. 72

Providing and fixing marble slab including engraving and painting complete. (i) Size 75cm x 60cm x 4cm.

1. Marble plate shall be white and of approved quality and shall be of size as mentioned in the item. Lettering shall be done by V-----shape engraving and shall be filled with black paint of approved quality, lettering shall be done as directed by the Engineer-in-charge. The Marble plate shall be fixed in neat cement at a place as directed by the Engineer-in-charge. Cement shall conform to relevant IS Specification.
2. Measurement shall be per number of marble plate fixed.
3. Unit rates includes cost of all material labour and tools to complete the work

Item No.73

Art painting work over various components of new flyover and underpass with three coat water coat putty of approved brand after duly rubbing the surface to make the surface even and smooth. The work includes one coat of exterior primer coat of approved brand and three or more coat of exterior plastic emulsion paint of approved brand over the prepared surface. Over this art painting work to be done as per direction and design pattern approved by Engineer-in charge. The work includes the cost of centering, shuttering, scaffolding and clearing the site properly after completion of work. The work also includes the cost of all material, manpower, stencils etc. required for art painting.

The relevant specifications as per relevant MORT&H fifth revision section 1906 & also as per Item Description shall apply to this item.

Rate shall be for unit of one Square meter.

Item No.74

Planting of Trees and their Maintenance for one Year (Planting of trees by the road side (Avenue trees) in 0.60 m dia holes, 1 m deep dug in the ground, mixing the soil with decayed farm yard/sludge manure, planting the saplings, backfilling the trench, watering, fixing the tree guard and maintaining the plants for one year)

The relevant specifications as per relevant National Highway specification and as per directed by Engineer-in-charge & also as per Item Description shall apply to this item.

Rate shall be for unit of one Each.

Item No.75

Supply and installation of Mono absorbent noise barrier. Noise barrier shall be standards for both acoustic and mechanical behaviours as per the provisions of IRC SP:130-2022 (Guidelines on design and installation of Noise barrier on roads) with valid EN Certifications as per EN 1793 & 1794 specifications. Noise barrier panels must be ARAI (Automotive Research Association of India) or government laboratory approved. Acoustic and non-Acoustic

Characteristics panels must confirm to the requirements of Table 5.2 and 5.3 of IRC SP:130-2022. 70-80-micron galvanum powder coated of approved RAL shade 115mm to 120 mm thick mono absorptive sound insulated panels with tongue and grooves shall be formed with special cold forming corrugation on GI sheets on both front and back for additional mechanical strength. Panels are filled with water repellent FR grade 100mm thick 96kg/m³ density rockwool as per ARAI or other government laboratory test report absorber slabs and with glass veil protection layers. Panels should have drainage provision to avoid water logging inside. Total four numbers of panel shall be installed to cover 2.0 m height. Four number of panels should be of 3000x500x120mm shall be fitted within the H beams structure with EPDM gasket as per approved drawings, Panels self-life 15-20 years. Noise barrier height 2.0 Meter from top of crash barriers STC- 34-38/EN 1793— 2 NRC 0.9/EN 1793-1.

(a) 70% of Item rate should be payable after supplying of material at site with the required test.

(b) Remaining 30% of Item rate should be payable after installation and completion of the work.

Built up H beam sections of size 152x152 welded at 16mm steel base plates with additional stiffeners, both complying with IS 2062 standards vertical post shall be fixed from back / Top of the concrete foundation / crash barrier with 6nos of 8.8 grade chemical fastener of M16-200 MM, with chemical grout including all preparation of required smooth surface and fixing of anchor with drill bits (Hilti, Fischer, Bosch or equivalent) at the distance of 3-meter c/c or as required. All steel structure shall be hot dip Galvanized as per IS Standard and epoxy paint to 60 microns of approved RAL shade. Structure shall be designed & calculated as per IS 875 guidelines for wind and other load factors.

Work shall be carried out as Item Description and as per IRC specifications/Standards and directed by Engineer In charge.

Rate shall be for unit of one Sqm.

Item No.76

providing and erecting Mains with ISI marked, 1.5KV grade electrolyte multi stranded, annealed copper conductor with heat resistant PVC insulated conforms to IS 694, IEC - 227 erected in existing pipe of following size (Specifically for control panel, relays, power switchgears, motor starters & control wiring) with required size of copper lugs, nuts and bolts if required.(g) One wire 16.00 sq. mm.

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of one Running meter basis.

Item No.77

(i) One wire 35.00 sq. mm

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of one Running meter basis.

Item No.78

Supplying and erecting Flexible PVC insulated multi strand multi core 1.1 kv grade ISI marked copper wires of following size to be erected as directed. (e) 1.50 Sq.mm 3 core round PVC sheathed."Make-Havells, RR Kabel, Finolex or Polycab".

Details specification for this item shall be as per Item Description & Electrical Specifications.

Mode of payment shall be in running meter basis.

Item No. 79

Supplying and erecting LED street light / Flood light fittings with High power White LEDs wattage of 3 Watt and above assembled on single MCPCB, efficiency more than 130 lm/w and corrosion free High pressure die cast aluminum housing with smooth finish powder coated and heat sink extruded aluminium with diffuser and Polycarbonate optics/ lenses, with toughened glass with company mark/name engraved or embossed 160 to 270 V, Power Factor more than 0.95, THD < 10 %, CCT 3000 K to 5700K, Uniformity ratio >0.45, Luminaire efficacy > 100 lumens/watt . LED driver efficiency > 85 %. (fittings required LM-79 & LM-80 certificates) (NOTE: Below description have shown ranges of Wattage capacity of LED fittings. The Engineer in charge may select any wattage capacity between the ranges shown.).

(A) Street Light (IP-65), Surge protection -4KV integral and , Light must have 440VAC line supply with over-voltage protection.

(f) Above 60 watts to 90 watts Cat-III Make-Havells, Philips, Wipro or Crompton, G.E".With 5 Year all inclusive maintenance warranty period.

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of one nos. basis.

Item No. 80

Providing and erecting Approved make Four pole moulded case circuit breaker having breaking capacity ICU of 25 KA. at 415 V, having normal current rating up to 25 A to 100A. with Fixed thermal & magnetic release suitable to work on A.C. supply 50 c/s. with all internal connections & complete erected in existing 16 G.M.S. housing. ICS=100% of ICU only, With Housing or Encloser Add 10% Cat III

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of one Nos. basis.

Item No. 81

Providing and erecting busbar chamber confirming to IS-375 fabricated from 16 G.M.S. sheet, dust & vermin proof having hinged door with rubber gasket and necessary busbar supports with COPPER busbar having current density not more than 1.6 Amp. / sq.mm (Rated current / cross section area) duly wrapped with colour insulation tape for phase sequence, three phase & neutral each suitable for following current capacity with necessary painting mounted on wall or pedestal frame of required size with necessary connections.(A) Suitable for 63/100 Amp. capacity

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of one Running meter basis.

Item No. 82

Providing and erecting Miniature circuit breaker single pole 0.5A to 2A system and having breaking capacity 10 KA to be erected in existing box. confirming to IS 8828/1996 with ISI Mark , Cat-III

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of one Nos. basis.

Item No. 83

Plastic enclosure fitted with DIN rail suitable for incorporating Three /Four nos. MCB

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of one Nos. basis.

Item No. 84

Providing and erecting Approved make ELCBs / RCCBs conforming to IS: 12640 and having sensitivity of 30 mA and Short Circuit withstand capacity of 10 KA and suitable for operation on 3 phase and neutral 415V,50Hz. having characteristic of quick action & tripping with all advance feature & do not incorporate any electronic component for following Max. rating erected as directed..(ii) 40Amps. FP Cat. III "Make-Schneider, L&T, ABB, Seimens,C&S"

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of one Nos. basis.

Item No. 85

Providing and erecting metallic vitrified danger notice board as per language suggested by engineer incharge for MEDIUM VOLTAGE installation to be erected as per IS-2551.

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of one Nos. basis.

Item No. 86

Providing and erecting Annealed Bare Copper wire 8 to 16 SWG.

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of one Kg. basis.

Item No. 87

**Supplying & erecting earth pit of minimum bore dia.150mm size approved make Earthing Electrode consisting Pipe-in-Pipe Technology as per IS 3043-1987 made of corrosion free hot dipped G.I.Pipes having Outer pipe dia of 50mm having 80-200 Micron galvanising, Inner pipe dia of 25 mm having 200-250 Micron galvanising, connection terminal dia of 12mm with constant ohmic value surrounded by highly conductive compound with high charge dissipation suitable for following type of applications with chamber and heavy duty cover.(approved make OEM has to submit test certificate) & having back filling compound of (B) Inner chemical (CCM Compound)- Resistivity:- 0.2 Ω / meter testing as per IEC 62561-2017, Voltage drop:- < 1 volt at no load & dry form, Sulphur content:- <2%(C) Back fill Compound :- Earthing compound should be capable to retain moisture for long time Necessary test report must be submitted.(a) For Electrical Installation up to 440V in normal soil
Length of pipe - 1 Mtr
Back filling compound - 1 Nos Bag of 15 Kg.**

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of Each basis.

Item No. 88

Providing , erecting , fabricating the M.S. structure as per requirement on site incorporating proper size of M.S. angles, flats, bars, channels, sections complete with cutting, welding, grinding & finishing duly painted with one coat of red oxide with erection on site as per direction of engineer in charge with necessary grouting, cementing, plastering & finishing complete.

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of one Kg. basis.

Item No. 89

Providing and erecting XLPE (IS:7098) (I)-88 ISI armoured cable multistrand / Solid Aluminium conductor for 1.1 KV. to be laid on wall with necessary clamps or in existing trench / pipe of following size of cables, (c) 4 core 10 Sq. mm.

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of one Running meter basis.

Item No. 90

Providing and erecting XLPE (IS:7098) (I)-88 ISI armoured cable multistrand Aluminium conductor for 1.1 KV. to be laid on wall with necessary clamps or in existing trench / pipe of following size of cables,(C) 4 core 35 Sq. mm.

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of one Running meter basis.

Item No. 91

Making trench in Hard Murrum / Tar Road of suitable width of 90 cms or required depth for laying any size of cable or locating the fault all over the run and back filling the same and making the surface as normal ground.

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of one Running meter basis.

Item No. 92

(B) If additional machineries like hammer driller or JCB use [Add].

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of one Running meter basis.

Item No. 93

Drilling the road without breaking the road surface (Asphalt) for laying of cable for feeding power supply by making up to following size of holes at both ends complete.(A) Up to 100 mm bore dia

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of one Running meter basis.

Item No. 94

Providing and, fixing heavy duty flange type brass cable gland with rubber ring for PVC insulated armoured cable complete with out going tails, insulating tape etc for following size of cables.

(c) 2 to 4 core 10 Sq. mm

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of Each basis.

Item No. 95

Providing and, fixing heavy duty flange type brass double compression type cable gland with rubber ring for PVC insulated armoured cable complete with out going tails, insulating tape etc for following size of cables.(a) 3 core 35/50 Sq. mm

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of Each basis.

Item No. 96

Solderless crimping type Aluminium lugs conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner.(B) 10 Sq.mm

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of Each basis.

Item No. 97

(D) 35/50 Sq.mm.

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of Each basis.

Item No. 98

Supplying and erecting approved make Octagonal pole made from HR sheet steel. The pole should be made as per IS. and shall be coated with hot dip galvanizing as per IS 2629/2633/4759, suitable suspend local wind speed with integral Junction box consist of terminal plate of min 6mm Hylam sheet, standard profile 35mmX7.5mm Din-Rail for MCB Mounting, stud type terminal and arrangement for cable termination to be erected on foundation(included) as per details given by manufacturer considering site requirement.

(D) 6 Mtr. Long 70 mm Top X 135 mm bottom dia, 3 mm thickness with 200mmX200mmX12mm base plate, 4-M20 Bolts and 600mm long J-Bolt.Approx Pole weight 59 kg. "Make-Bajaj, Transrail, valmont, Utkarsh,Jetco".

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of Each basis.

Item No. 99

(E) 7 Mtr. Long 70 mm Top X 135 mm bottom dia, 3 mm thickness with 225mmX225mmX16mm base plate, 4-M20 Bolts and 600mm long J-Bolt. Approx Pole weight 67 kg. "Make-Bajaj, Transrail, valmont, Utkarsh,Jetco".

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of Each basis.

Item No. 100

Providing and erecting street light pole bracket comprising main B Class MS pipe of 4.2 cm/require outside dia. complete with suitable B Class M.S. sleeve tubing of approx. 45cms.length and suitable for 76.5 mm / 80mm. / require size pole top having sufficient fasteners for fixing the brackets and having spread of 1 mtr. length with suitable rise as per site condition & suitable welded stiffener reducer and nipple with check nut complete painted with one coat of Red oxide / PU base primer and two coats of Aluminium / PU paint. paint with following nos of arms.[B] Double Arm Bracket 1 Mtr.

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of Each basis.

Item No. 101

Supplying & erecting IP 55 grade following size section pillar fabricated from joint less M.S. Sheet with angle iron legs made from jointless M.S. Angle with cable clamps to be buried in ground to have appropriate erection to work uniform until erected with cement concrete foundation and 45 cm high bricks work finishing with plaster etc. hinged double door internally supported on both side, with internal and outside looking arrangement with lock and keys in duplicate 35 x 35 x 5 mm M.S. Angle of Two Nos. one is welded and other with nut and bolt for erecting bakelite sheet. Painting the Section Pillar inside and outside with three tank powder coated paint. section pillar roof should be without joint with water leakage proof & tested as per IP 55 test & followed by IS 2147 of 1962, (A) 150 X 90 X 75 cm section pillar fabricated from 14 Gauge MS Sheet with angle iron legs 95 cm long made from 40 X 40 X 6 mm thick MS angle.

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of Each basis.

Item No. 102

Supplying and erecting HYLAM sheet on existing angle iron frame. for following thickness,12 mm.

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of Square meter basis.

Item No. 103

Supplying & erecting approved make Digital time switch having lithium cell 6 years operative and operate battery backup 1 channel day clock with 14 memory programme, suitable to operate on 240V + 5%, 16A with, floating contacts Minimum switching setup time 1 minimum & LCD display. Also comprised permanent ON/OFF switching. Programming switches & housed in fire proof thermoplastic enclosure & transparent cover erected as required with necessary connection erected as directed.

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of Each basis.

Item No. 104

Supplying & erecting power contactor for time switch complete erected as per direction Cat III [D] 4 pole 440V 40 Amp.

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of Each basis.

Item No. 105

Supplying & erecting power contactor for time switch complete erected as per direction Cat III [D] 4 pole 440V 40 Amp.

Details specification for this item shall be as per Item Description & Electrical Specifications.

Rate shall be for unit of Each basis.

ELECTRICAL SPECIFICATIONS

Technical :

The applicant should have completed minimum 2 nos. of the similar magnitude & Class-b of the project. The applicant shall have at least 2 licensed electrical supervisors working in the organization.

The applicant should give the information about their organization, technical experience, technical & supportive staff, spare capacity and their competency.

II) Instruction :

- 1) Following document should be attached in following order by the applicant with the prequalification bid document (On A4 document & initialed on every page).
 - Complete Organisation profile with the detail CV of the Partner / Directors & key persons in the organisation with the organisation chart.
 - Address, Contact Details.
 - Electrical Contractors License no. & registration document
 - Pan No. of the Organisation with the Income Tax clearance certificate.
 - GST No. & Clearance certificate.
 - Previous Experience of projects.
 - List of the Completed Projects with the cost & completion Certificate.
 - List of the on going Project with the cost & Work Order.
 - List of the completed Similar Magnitude & class of the project with the Completion Certificate & cost.
 - List of the on going Similar Magnitude & class of the project with the work order & cost (If any).
 - (Above all project details should be given with the following details)
 - i. Name of the Project & Year
 - ii. Clients Name & Contact Details.
 - iii. Architect & Consultants Name
 - iv. Value & time Period.
 - v. Nature of the work.
 - Applicant should have the following policies. (Details should be given)
 - i. Workman full compensation
 - ii. Contractors all risk policies

ELECTRICAL MATERIAL SPECIFICATION

1. Section Feeder Panel :

(a) STRUCTURE :

The Section pillar shall be of Double door type compartmentalized design so that circuit arc / flash products do not create secondary faults and be fabricated out of high quality CRCA sheet, suitable for Outdoor installation having doors on both the sides and if is operated from front side. All CRCA sheet steel used in the construction of Panels shall be 16 SWG thick and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet steel shall be seam welded, all welding slag grounded off and welding pits wiped smooth with plumber metal. The Section pillar shall be totally enclosed, completely dust and vermin proof and degree of protection being not less than IP:55 to IS:2147. Gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust proof. All doors and covers shall be fully gasketed with foam rubber and /or rubber strips and shall be lockable.

A base channel of 40mm x 40mm x 5mm thick & 1300mm stand height shall be provided at the bottom. Openings shall be provided for natural ventilation, but the said openings shall be screened with fine weld mesh. Knock out holes of appropriate size and number shall be provided in the Panels in conformity with the number, and the size of incoming and outgoing conduits / cables. Alternately, the section pillar shall be provided with removable sheet steel plates at bottom to drill holes for cable / conduit entry at site. The section pillar shall be designed to facilitate

easy inspection, maintenance and repair. The section pillar shall be sufficiently rigid to support the equipment without distortion under normal and under short circuit condition. They shall be suitably braced for short circuit duty.

(b) PAINTING :

The painting shall be one coat of primer and two coat of synthetic enamel colour is Siemens gray colour.

(c) ELECTRICAL POWER AND CONTROL WIRING CONNECTION :

Terminal for both incoming and outgoing cable connections shall be suitable for 1100 V grade, aluminium / copper conductor PVC insulated and PVC sheathed, armoured cable and shall be suitable for connections of solderless sockets for the cable size as indicated on the appended drawings / BOQ. Power connections for incoming feeders of the main Panels shall be suitable for 1100 V grade aluminium conductor (PVC) cables. Both control and power terminals shall be properly shrouded.

(d) L. T. SWITCHGEARS:

GENERAL: The type, size, and rating of the components shall be as indicated on the relevant single line diagrams.

MINIATURE CIRCUIT BREAKER (MCB): Miniature circuit breakers shall be quick make and break and break type conform with British standard BS: 3871 (Part-I) 1965 and IS: 8825 (1996). The housing of MCBs shall be heat resistant and having high impact strength. The fault current of MCBs shall not be less than 10000 amps, at 230 volts. The MCBs shall be flush mounted and shall be provided with trip free manual operating mechanism with mechanical "ON" and "OFF" indications. The circuit breaker dollies shall be of trip free pattern to prevent closing the breaker on a faulty current. The MCB contact shall be silver nickel and silver graphite alloy and tip coated with silver. Proper arc chutes shall be provided to quench the arc immediately. MCB's shall be provided with magnetic fluid plunger relay for over current and short circuit protection. The over load or short circuit devices shall have a common trip bar in the case of DP and TPN miniature circuit breakers.

MOULDED CASE CIRCUIT BREAKER: The MCCB shall be air break type and having quick make quick break with trip free operating mechanism. Housing of the MCCB shall be of heat resistant and flame retardant insulating material. Operating handle of the MCCB shall be in front and clearly indicate ON / OFF / TRIP positions. The electrical contact of the circuit breaker shall be of high conducting non-deteriorating silver alloy contacts. The MCCB shall be provided with thermal based trip units. All the releases shall operate on common trip busbar so that in case of operation of any one of the releases in any of the three phases, it will cut off all the three phases and thereby single phasing of the system is avoided. The MCCB shall provide extra auxiliary contacts with connections for additional controls at future date.

CONTACTORS :

The contactors shall meet with the requirements of IS : 13947.

The contactors shall have minimum making and breaking capacity in accordance with utilization category AC3 duty. If the contactor forms part of a distribution board then a separate enclosure is not required, but the installation of the contactor shall be such that it is not possible to make an accidental contact with live parts.

ELCB :

Supplying & erecting approved make ELCBs / RCCBs conforming to IS: 12640 and having sensitivity of 100 mA and Short Circuit withstand capacity of 6 KA and suitable for operation on 3 phase and neutral 415V. Having characteristic of quick action & tripping with all advance feature & do not incorporate any electronic component for following Max. rating erected as directed.

CENTRALIZED CONTROL & MONITORING SYSTEMS (CCMS)		
Sl No.	Features	Description
1	Operational Features	<ul style="list-style-type: none"> The CCMS unit should be capable of switching ON and OFF the lights of a particular switching point and/or networked switching points from Central Control Station instantaneously or automatically throughout the year on basis of Sunrise and sunset time depending on the geographical location of the switching point. It should be capable of providing Phase wise separate switching to implement alternate switching strategies if required. The CCMS unit should be a GPRS and/or GSM (with IMEI number) proven technology based remote streetlight monitoring system with capacity for self-protection from short-circuit, and anti- theft alert. The Controller shall be IoT based with high reliability and scalability The CCMS unit should have a battery backup of at least 2 hours. The CCMS Unit should have requisite Digital Input/ Output to fetch data. Enclosure Box to be Sheet-metal / FRS material with proper lock arrangement.
2	Energy measurement and communication features	<ul style="list-style-type: none"> The CCMS unit Should be able to capture (record) and provide following parameters at variable time-intervals (Individual switching point wise and/or networked switching points) : ØVoltages ØCurrent ØPower Factor ØActive Power (kW) ØApparent Power (kVA) ØMetering kWh cumulative Number of hours each group of LED luminaries was glowing (Based on load current %) Number of hours the power supply was unavailable Special emergency on/off facility with wireless control. Benchmarking capacity so as to generate alert SMS for: <ul style="list-style-type: none"> Phase-wise currents on crossing threshold values Phase-wise voltages on crossing threshold values Theft alerts Group failure of lights No output supply Alert SMS shall be forwarded to five (5) phone numbers, in each of the respective municipality. Class 1.0 accuracy Energy Meter with ISI marking/IS-13779 is to be used for power measurement. Type testing report from NABL Accredited Lab to be provided.
	Web based - Application	<ul style="list-style-type: none"> Central Control and Monitoring System functionalities CCMS shall have a web-server to receive and record all data with time stamping from the streetlight controllers. It should be able to communicate with any individual switching points or collectively amongst networked switching points for control and monitoring. It should able to record LED luminaires glowing and non-glowing hours of a particular switching point in group It should be able to display the power failure details of a particular switching point and the relevant luminaires. It should register all fault conditions like excess voltage/current drawn,

		<p>lamps failure, no-power supply, etc through the instantaneous alert messages sent by the CCMS unit.</p> <ul style="list-style-type: none"> • Reports such as energy saving report, lamp failure report, actual hours of operation, uptime (%), etc. should be generated on a daily basis from the data/readings received from the CCMS units. • It should be able to track the failure of lamps in a particular switching point based on % load • Different user authorization levels should be settable and the central server should be capable of scalability to more than 5000 CCMS units • GIS Mapping should be done covering all switching points and the details of each switch point shall be viewable in the web application software through a Google-map interface or web based digital map. • All the CCMS units should be remotely configured from the Central Control Unit: <ul style="list-style-type: none"> ○ Setting new ON/OFF timings ○ Setting the Response Time Count (RTC) time of Automation unit ○ Knowing the current status of any particular switching point. < Reset the unit. ○ Alarm limit settings • The minimum interval for the update of data should be 15 minute but programmable up to 5 minute. • Auto synchronization of controller with server timing to be further synchronized with standard GSM clock timing. • The system monitors all the following from the CCMS unit <ul style="list-style-type: none"> ○ Voltages each phase ○ Current each phase ○ PF each phase ○ Metering kWh cumulative ○ Metering kVAh • Further system is able to indicate various faults <ul style="list-style-type: none"> ○ Number of operational lights ○ Number of non-operational lights ○ Failure of contactor ○ Status of the incoming supply (power failure) ○ High /low voltage ○ Overload on the phases • CCMS shall have server preferably dedicated server set-up or cloud-based arrangement to ensure reliability of the data transmission and real time data storage for last 1 year. • Data authenticity and validation has to be ensured. Reports to be submitted in a common CSV/PDF format. • CCMS system should have a self-healing mechanism and in case of failure, Bidder to ensure resumption of service within 24 hours. Till resumption of full services, the default settings of the CCMS should ensure timely ON/ OFF operation of the street lights.
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Note :-

- Sim cards for CCMS shall be provided by AMC.

- CCMS and entire street light system should be warranted for 5 years from the date of successful completion of SITC work at no additional cost. In case of accidental damages, Authority will pay extra as per tender terms & condition, rate submitted in BOQ.

Technical Specifications

- Supply : 1 Phase 230 V AC +/- 10 %
- Unit Power Consumption : 3 W (Stand by), 10 W (on full load)
- Controller : 32 Bit micro controller or better
- Switching output: 03 nos - separate for each phase contactor
- Programming function :
 - Switching on Longitude & Latitude base
 - Schedule based - Separate schedule for each phase should be possible
 - Manual operation from web based interface
- Real Time Clock : With battery backed for more than 10 years
- Local Storage : With special device which hold the data for more data than 10 years with automatic history sync function
- By pass : Provision to bypass by way of Auto / manual switch
- Operating Temperature : 2 to 55°C and humidity 90 % non-condensing
- Installation : Outdoor type. Floor Mounted. Material of construction : 16 gauge M S with industrial exterior powder coated.
- Panel intruder alarm: Door open sensor to be provided

Smart Feeder Panel with CCMS		
SN	Item	Qty Per System
A	BOQ	
1	Enclosure; Size 1500(H) x 900(W) x 600(D) with 40x40x5 mm Angles	1
2	Energy Meter; Class 1, - / 5, As per IS 13779, With RS 485 modbus rtu interface	1
3	CCMS with IoT based controller, Astronomical timer as well as schedule-based switching, including 60 months Cloud hosting and Web portal	1
4	3P, 32A, Contactor, AC3 duty	3
5	TPN, 32A, MCB, C curve	1
6	SP MCB, 6-32A, C Curve	12
7	FP, ELCB, 32A, 100ma	1
8	Auto/Manual Switch	1
9	Door open sensor	1
10	Panel accessories and cables	1
11	Design, engineering and commissioning	1
12	Battery with charger for 2 hrs backup	1
B	CCMS features	Compliance - Yes/No
1	Scheduling of Streetlight operations as per Astronomical timings	
2	Local operation through maintenance switch with key lock	
2	Remote operation of streetlight cluster from central control room	
3	Energy consumption monitoring and local storage for more than 30 days	

4	Data transmission to central server and two-way communication through cellular GPRS based connectivity	
5	Local communication to CCMS controller through communication device – Laptop / Smart phone	
6	Device settings update locally using communication device or remotely through central server	
7	IoT based MQTT protocol for handling communication from thousands of devices concurrently from central server	
8	DI / DO for status inputs and commands	
9	Energy meter interface – RS 485Modbus rtu	
10	Local storage - SD card expandable upto 32 GB	
11	GPRS connectivity – Quad band	
12	Built-in RTC with battery backup	
13	Overload / under load switching logics	
14	Power interruption and Run hours monitoring	
15	Open communication to connect with existing CCMS system installed certain zones of AMC	
16	CCMS Software covers:	
	Web based monitoring through secure username and password	
	Tree type GUI with Zone – Ward – Switching point hierarchy for summary as well as individual Switch point monitoring	
	Google mashups with GIS mapping	
	Multi level user authorizations and security	
	Reporting for overload, under-load, lights failure(group derived from consumption profile), theft, unscheduled consumption etc.	

2 BUS BAR CONNECTIONS

Bus bar and interconnections shall be of high conductivity electrolytic grade copper as indicated in the bill of quantities complying with requirement of IS : 5082 – 1981 and of rectangular cross section suitable for carrying the rated full load current and short circuit current and shall be extendable on either side. Bus bars and interconnections shall be insulated with heat shrinkable sleeve of 1.1 KV grade and shall be colour coded. Bus bars shall be supported on glass fiber reinforced thermosetting plastic insulated supports at regular intervals to withstand the force arising from in case of short circuit in the system. All bus bars shall be provided in a separate chamber and all connections shall be done by connected by means of bus bar connectors to avoid tapings on solid bus bars. Additional cross sectional area to be added to the bus bar to compensate for the holes if required. All connections between bus bars and breakers shall be through solid / Flexible copper strips of proper size to carry full rated current and insulated with insulating sleeves.

2.2.1 TEMPERATURE - RISE LIMIT

Unless otherwise specified, in the case of external surface of enclosures of bus bar trunking system which shall be accessible but do not need to be touched during normal operation, an increase in the temperature rise limits of 25° C above ambient temperature shall be permissible for metal surface and of 15° C above ambient temperature for insulating surfaces as per IS 8623(Part-2) 1993.

All main distribution panels and sub distribution panels shall be provided with MCCB of appropriate capacity as per Single Line Diagram. All final Distribution boards shall be provided with Miniature Circuit

Breakers. Final Single Phase Distribution boards shall be connected to the incoming supply through double pole MCB units & earth leakage circuit breakers. All wiring for final distribution boards shall be concealed behind 5 mm thick bakelite sheet or M S sheet cover. All Distribution boards shall be completely factory wired, ready for connection. All the terminals shall be of proper current rating and sized to suit individual feeder requirements. Each circuit shall be clearly numbered from left to right to correspond with wiring diagram. All the switches and circuits shall be distinctly marked with a small description of the service installed.

Continuous earth bus sized for prospective fault current shall be provided with arrangement for connecting to station earth at two points. Hinged doors/ frames shall be connected to earth through adequately sized flexible braids.

3.0 CABLE COMPARTMENTS

Cable compartment of adequate size shall be provided in the Distribution panels for easy clamping of all incoming and outgoing cables entering from the top/bottom. Adequate supports shall be provided in cable compartment to support cables.

4.0 MOULDED CASE CIRCUIT BREAKER (MCCB)

The MCCB should be current limiting type with trip time of less than 10 msec under short circuit conditions. The MCCB should be either 3 or 4 poles as specified in BOQ. MCCB shall comply with the requirements of the relevant standards IS13947 – Part 2/IEC 60947-2 and should have test certificates for Breaking capacities from independent test authorities CPRI / ERDA or any accredited international lab.

MCCB shall comprise of Quick Make -break switching mechanism, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses

The breaking capacity of MCCB shall be as specified in the schedule of quantities. The rated service breaking capacity (Ics) should be equal to rated ultimate breaking capacities (Icu). MCCB's for motor application should be selected in line with Type-2 Co-ordination as per IEC-60947-2, 1989/IS 13947-2. The breaker as supplied with ROM should meet IP54 degree of protection.

4.4.1 Protection Functions

- MCCB's with ratings up to 200 A shall be equipped with Thermal-magnetic (thermal for overload and magnetic for short-circuit protection) trip units
- Microprocessor MCCB's with ratings 250A and above shall be equipped with microprocessor based trip units.
- Microprocessor and thermal-magnetic trip units shall be adjustable and it shall be possible to fit lead seals to prevent unauthorised access to the settings
- Microprocessor trip units shall comply with appendix F of IEC 60947-2 standard (measurement of rms current values, electromagnetic compatibility, etc.)
- Protection settings shall apply to all poles of circuit breaker.
- All Microprocessor components shall withstand temperatures up to 125 °C

4.4.2 Testing

- a) Original test certificate of the MCCB as per IEC 60947-1 & 2 or IS13947 shall be furnished.
- b) Pre-commissioning tests on the switch board panel incorporating the MCCB shall be done as per standard specifications.

4.4.3 Interlocking

Moulded, case circuit breakers shall be provided with the following interlocking devices for interlocking the door of a switch board.

- a) Handle interlock to prevent unnecessary manipulations of the breaker.
- b) Door interlock to prevent the door being opened when the breaker is in ON position.
- c) Defeat-interlocking device to open the door even if the breaker is in ON position.
- The MCCB shall be current limiting type and comprise of quick make – Break switching mechanism. MCCB's shall be capable of defined variable overload adjustment. All MCCB's rated 200 Amps and above shall have adjustable over load & short circuit pick-up both in Thermal magnetic and Microprocessor Trip Units.
- All MCCB with microprocessor based release unit, the protection shall be adjustable Overload, Short circuit and earth fault protection with time delay.
- The trip command shall override all other commands.

5.0 MINIATURE CIRCUIT BREAKER (MCB)

Miniature Circuit Breaker shall comply with IS-8828-1996/IEC898-1995. Miniature circuit breakers shall be quick make and break type for 240/415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection. The breaking capacity shall not be less than 10 KA at 415 VAC. MCB's shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). MCB's shall be classified (B,C,D ref IS standard) as per their Tripping Characteristic curves defined by the manufacturer. The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/IEC and the manufacturer shall publish the values. MCB shall ensure complete electrical isolation & downstream circuit or equipment when the MCB is switched OFF.

The housing shall be heat resistant and having a high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP, TPN and 4 Pole miniature circuit breakers shall have a common trip bar independent to the external operating handle.

6.0 EARTHING

Earthing shall be provided as per IS:3043-1987.

7.0 PAINTING

All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating (seven tank processing) and then painted with electrostatic paint (Powder coating). The shade of colour of panel inside/outside shall be as per BOQ confirming to IS Code No.5.

8.0 LABELS

Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the distribution panels shall be pasted on inside of the panel door and covered with transparent plastic sheet.

9.0 METERS

- i. All voltmeters and indicating lamps shall be through MCB's.
- ii. Meters and indicating instruments shall be flush type.
- iii. All CT's connection for meters shall be through Test Terminal Block (TTB).
- iv. CT ratio and burdens shall be as specified on the Single line diagram.

10 CURRENT TRANSFORMERS

Current transformers shall be provided for Distribution panels carrying current in excess of 60 amps. All phase shall be provided with current transformers of suitable VA burden with 5 amps secondaries for operation of associated metering.

The CT's shall conform to relevant Indian Standards. The design and construction shall be dry type, epoxy resin cast robust to withstand thermal and dynamic stresses during short circuits. Secondary terminals of CTs shall be brought out suitable to a terminal block which shall be easily accessible for

testing and terminal connections. The protection CT's shall be of accuracy class 5P10 and measurement CTs shall be of accuracy class I.

11 POTENTIAL FREE CONTACTS

Potential free contacts shall be provided for connection to Building Automation System in panels indicated in Schedule of Quantities.

12 INDICATING PANEL

All meters and indicating instruments shall be in accordance with relevant Indian Standards. Meters shall be flush mounted type. Indicating lamps shall be of low burden, and shall be backed up with 2 amps MCB/MPCB as per relevant fault level and toggle switch.

13 TESTING

13.1 The following drawings shall be submitted before procurement for approval from the client.

1. General arrangement and Fabrication details.
2. Power wiring diagram of the panel.
3. Control wiring diagram of panel.
4. C.T. ratios with connection.
5. Material list with make, catalogue nos.

13.2 Testing and setting the relay set – point and co-ordination between relay on LT/HT fuses, breaker, setting shall be done by contractor. The downstream of the setting should be provided.

13.3 The relay should be tested by reputed agencies and test report of the relay should be submitted by the contractor.

14.4 Testing of panels shall be as per following codes:

IS: 8623 (Part -I) 1977 for factory built assemblies of switch gear for voltages up to and including 1000 VAC.

IS: 13947: 1993 Degree of protection

IS: 5578 & 11353:1985 Arrangement of bus bars.

15 WIRING

In wiring a distribution panel it shall be insured that total load of various distribution panel and/or consuming devices is divided evenly between the phases and number of ways as per Consultants drawing.

16 Mode of Measurement:

Panel shall be considered as one unit for measurement and payment.

17 Medium Voltage Cables

17.1 Scope

This section shall cover supply of medium voltage cables.

17.2 Standards

The following standards and rules shall be applicable:

IS: 7098 XLPE insulated electric cables (heavy duty).

IS: 1753 Aluminium conductors for insulated cables.

IS: 3961 Recommended current ratings for cables.

IS: 8130 Aluminium conductors for insulated cables

Indian Electricity Act and Rules.

17.3 Measurements

The cables will be measured in meters. The unit rate shall include cutting the cable into required lengths, packing, loading, unloading, insurance, transportation, delivery to stores/site as per work order, stocking in stores, testing of cables at stores etc. of medium voltage cable.

18.4 General

The medium voltage cables shall be supplied, laid, connected, tested and commissioned in accordance with the drawings, specifications, relevant Indian Standards specifications, manufacturer's instructions. The cables shall be delivered at site in original drums with manufacturer's name, size, and type, clearly written on the drums.

18.5 Material

The MV cables shall be cross linked polyethylene (XLPE) insulated PVC sheathed of 1100 volts grade aluminium or copper conductor, armoured and unarmoured heavy duty, conforming to IS : 7098 Part I IS : 1988 Part I. as asked for in the schedule of quantities.

18.5.1 All XLPE Aluminium/Copper Power cables shall be 1100 Volts grade, multi core constructed as per IS : 7098 Part-I of 1988 as follows :

- a. Stranded Aluminium /Copper conductor of high conductivity up to 4 mm.² size, the conductor shall be solid multi strand above 4 mm.², conductors shall be concentrically stranded as per IEC: 228.
- b. Cores laid up
- c. The inner sheath should be bonded over with thermo-plastic material for protection against mechanical and electrical damage.
- d. Armoring should be provided over the inner sheath to guard against mechanical damage. Armoring should be Galvanized steel wires or galvanized steel strips. (In single core cables used in A.C. system armoring should be non-magnetic hard aluminium Wires/Strips. Round steel wires should be used where diameter over the inner sheath does not exceed 13 mm; above 13 mm flat steel armour should be used. Round wire of different sizes should be provided against specific request.)
- e. The outer sheath should be specially formulated heat resistant black PVC compound conforming to the requirement of type ST2 of IS: 5831-1984 extruded to form the outer sheath.

18.5.2 Conductor shall be of electrolytic Aluminium/Copper conforming to IS : 8130 and are compact circular or compact shaped.

18.5.3 Insulation shall be of XLPE type as per latest IS general purpose insulation for maximum rated conductor temperature 70 degree centigrade.

18.5.4 In Inner sheath laid up cores shall be bonded over with thermoplastic material for protection against mechanical and electrical damage.

18.5.5 Insulation, inner sheath and outer sheath shall be applied by extrusion and lapping up process only.

18.5.6 Armoring shall be of galvanized steel wire/ strip.

Galvanized steel flat strip / round wires applied helically in single layers complete with covering the assembly of cores.

For cable size up to 25 Sq. mm: Armour of 1.4 mm dia. G.I. round wire

For cable size above 25 Sq. mm: Armour of 4 mm wide 0.8 mm thick G.I. strip

18.5.7 Repaired cables shall not be used.

18.5.8 Current ratings of the cables shall be as per IS: 3961.

18.5.9 The XLPE insulated cables shall conform to latest revision IS read along with this specifications. The Conductor shall be stranded Aluminium/Copper circular/ sector shaped and compacted. In multi core cables the core shall be identified by red, yellow, blue and black colouring of insulation as following.

Core identification:

Two cores	:	Red and Black
Three cores	:	Red, Yellow and Blue
Four core	:	Red, Yellow, Blue and Black

Single core : Green, Yellow for earthing
Black shall always be used for neutral.

18.5.10 The XLPE insulated 1100 Volts grade power cables shall conform to latest IS and shall be suitable for a steady conductor temperature of 70 degree centigrade. The conductor shall be stranded Aluminium/Copper as called for in the Schedule of quantities. The outer sheath shall be as per the requirement of type ST-2 of IS: 5831 of 1984.

18.5.11 The cables shall be suitable for laying in racks, ducts, trenches, conduits and underground buried installation with uncontrolled back fill and chances of flooding by water.

18.5.12 Progressive automatic in line sequential marking of the length of cables in meters at every one meter shall be provided on the outer sheath of all cables.

18.5.13 Cables shall be supplied in non returnable wooden drums as per IS: 10418.

Both ends of the cables shall be properly sealed with PVC/Rubber caps so as to eliminate ingress of water during transportation, storage and erection.

18.5.14 The product should be coded as per IS: - 7098 Part-I as follows:-

Aluminium Conductor	A
XLPE Insulation	2X
Steel round wire armour	W
Steel strip armour	F
Steel Double round wire armour	WW
Steel Double strip armour	FF
Non-magnetic (Al.) round wire armour	Wa
Non-magnetic (Al.) strip armour	Fa
PVC outer sheath	Y

18.6 General

All cables shall be adequately protected against any risk of mechanical damage to which they may be liable in normal conditions of handling during transportation, loading, unloading etc.

The cable shall be supplied in single length i.e. without any intermediate joint or cut unless specifically approved by the client.

The cable ends shall be suitably sealed against entry of moisture, dust, water etc. with cable compound as per standard practice.

19 Testing

19.1 Finished Cable Tests At Manufacturer's Works

The finished cables shall be tested at manufacturer's works. Following routine tests for each and every length of cable and copy of test results shall be furnished for each length of cable along with supply. If specified, the cables shall be tested in presence of clients' representative / PMC / Consultant

a. Voltage test

Each core of cable shall be tested at room temperature at 3 KV A.C. R.M.S. for duration of 5 minutes.

b. Conductor resistance test

The D.C. Resistance of each conductor shall be measured at room temperature and the results shall be corrected to 20° c. to check the compliance with the values specified in IS 8130 - 1976.

Prior to dispatching cables and at the time of delivering the cables at stores, following tests shall be carried out:-

Insulation Resistance test between phases and phase to Neutral and phase to earth

Continuity test of all the phases, neutral and earth continuity conductor

Sheathing continuity test

Earth resistance test of all the phases and neutral

All tests shall be carried out in accordance with relevant Indian Standard Code of practice and Indian Electricity Rules. The Vendor shall provide necessary instruments, equipments and labour for conducting the above test and shall bear all expenses in connection with such tests. All tests shall be carried out in the presence of the client / PMC / Consultant and results shall be recorded in the prescribed forms.

19.2 Cable Marking Embossing On Outer Sheath

The outer sheath shall be legibly embossed with following legend:

ELECTRIC CABLE: 1100 V, SIZE: 3.5 C x ----- mm ².

Manufacturer's Name & year of manufacturing.

19.3 Sealing, Drumming & Packing

After tests at the manufacturer's works, both ends of the cable shall be sealed to prevent the ingress of moisture during transportation and storage.

Cable shall supply in length of 500 ± 10% meters on packed non-returnable drums of sufficiently sturdy construction.

Cables of length more than 250 meters shall also be supplied on non-returnable drums.

The spindle hole shall be 110 mm minimum diameter.

Each drum shall bear on the outside flange, legibly and indelibly in the English literature, a distinguishing number, the manufacturer's name and particulars of the cable i.e. voltage grade, length, conductor size, cable type, insulation type and gross weight shall also be clearly visible. The direction for rolling shall be indicated by an arrow. The drum flange shall also be marked with manufacturer's name and year of manufacturing etc.

20 LED LIGHT FIXTURE SPECIFICATION

The LED Street light system will have to meet the following Specifications :

20.1 Electrical Specifications :

• Parameter	-	Value
• Input Voltage	-	AC 120 to 260V
• Input Frequency	-	50 Hz+/- 3Hz
• Power Factor	-	≥ 0.95
• Usage hours	-	Dusk to dawn (12 hours)
• Distortion Current	-	<10%
• Voltage	-	<3%
• Working humidity	-	10% to 90% RH

20.2 LED Luminaire Specification :

Life expectancy to the product at least 50,000 hrs maintaining lumen output at 70% or above compared with the luminaries initial output.

• Colour Temperature	-	4000K (± 5%)
• Colour rendering index	-	>70%
• Lumen/ Watt (luminary)	-	Minimum 120 Lumens per watt
• Housing	-	High quality housing such as pressure die cast aluminum with Smooth finish powder coated for better environmental protection.
• Efficiency of Driver	-	>80%
• Junction temp	-	<75°c
• Uniformity ratio	-	>0.4
• Maintenance factor	-	0.8
• Index of protection level	-	IP 65
• LED lance material	-	Poly Carbonate

- Protection - Over heat, over load, short circuit, HV surge up to 10 kv
- LED chip - Philips, Cree, OSRAM, Nichia
- Driver current - $\leq 750\text{mA}$
- LED Driver type - Constant current
- Beam Angle - 135° Horizontal / 80° Vertical

Note : Efficacy of the system should not allow below 120 lumens /watt and wattage specified indicative maximum for the said lumens output, No negative tolerance allowed and no power loading shall be consider for this tender.

20.3 Particulars and Details to be submitted by the in order to properly assess and due diligence submissions, the proponent should provide following information on the quality and photometric of proposed luminaries.

20.3.1 General description :

Following details of the proposed luminaire shall be submitted as per Annexure – I

1. Luminaire manufacturer
2. Luminaire Model name
3. Wattage
4. Stated lumen output
5. IP rating
6. Lumen output (as per LM 79 report, mentioning current in MA)
7. Lumen depreciation (L70 mentioning Temperature in OC and current in mA)
8. Correlated colour temperature (CCT)
9. Colour rendering index (CRI)

20.3.2 Electrical Specifications :

Electrical ratings of the proposed luminaire for the following criteria shall be submitted in Annexure

Voltage range or rating on single Phase AC

1. Amperage range or rating
2. Frequency Range
3. Power Factor
4. Total harmonic distortion
5. Working humidity
6. Working temperature
7. ingress protection
8. Electrical connector
9. Ability to operate under condition of unpredictable voltage variations. submit the information.

20.4 LED Chip and driver information : details to be filled up by bidder :

LED Chip and driver information of the proposed luminaire product for the following criteria in Annexure .III

1. Name of the LED Chip manufacturer
2. LED chip model name and number
3. LM 80 report from the LED chip manufacturer on the lumen depreciation characteristics of the specific LED Chip employed in the proposed luminaire product
4. Junction temperature (OC)
5. Information on drivers employed in the proposed luminaire

6. Name of the manufacturer
7. Model name and number.
8. Expected lifetime of the LED driver used in the proposed luminaire
9. Estimated cost of driver replacement by your company, including component and installation cost.

20.5 Bidder shall have to offer the following minimum warranty:

LED Chip and driver information of the proposed luminaire product for the following criteria in Annexure .III

- (a) Bidder should provide 25% Extra (of the supplied nos. of fittings) ballast / driver & SPD to AMC, The bidder should consider the cost of the same in the tender while quoting.
- (b) Provide a five year on-site replacement warranty covering warranty covering material fixture finish and workmanship, to include transportation, removal, and installation of new products.
- (c) provide five year replacement warranty for defective or non -starting LED source assemblies and all drivers.
- (d) Provide a five year warranty for luminaries exhibiting inadequate lumen maintenance at the end of the warranty period in compliance with the following table:

L 70 lifetime claim Min.Lumen maint @ 5Year.

(1) 30,000 Hours	-	92.50%
(2) 50,000 Hours	-	85.50%
(3) 1,00,000 Hours	-	80.00%

- (e) A luminaire dirt depreciation (LDD) factor may be included in the above calculation, such a value be determined by mutual agreement between AMC and the manufacturer, consistent with local ambient environmental conditions and practice.
- (f) A monitoring program to implement 20.5(c) above will be determined by mutual agreement between AMC and the Bidder. The costs of the monitoring programme over the five year warranty period will be borne by the bidder, unless agreed otherwise by AMC and the Bidder.

20.6 Photometric information:

The proponent needs to submit the following photometric

1. photometric modeling results, preferably within a LM79 report, from an independent accredited laboratory showing generic candlepower traces and iso foot-candle plots for the proposed luminaries product.
2. Photometric information, data and diagrams that model the luminance flux distribution of the proposed luminaire referencing the site characteristics given in section 20.5 above. The proponent should consider the following during the modeling exercise.
3. Such modeling should verify that the proponent's proposed luminaire will meet National Lighting Code , which specifies average luminance (Eavg) and uniformity (Emin /Eavg) for roads at the above sites. As specified in table 20.9
4. Use industry accepted, standardized software like Dialux for the above moduling while modeling, a maintenance factor of 0.8 should be used.

20.7 Lumen maintenance statement :

1. The proponent must submit a lumen maintenance statement that estimates how many operating hours can be expected from the proposed luminaire product until its light output declines to 70% of its initial output (L70) given the specific climactic character, including extremes of temperature and high humidity, associated with the local condition.
2. The lumen maintenance statement should also clearly explain that how or what method was used to determine the rated life time.
3. Describe in details the thermal management: how the physical and thermal design of the luminaire will prevent the LED chips from overheating on extremely hot days.

20.8 Luminaire Specifications - other:

The proponent shall provide information and certifications

1. Luminaries : General Requirements, Tests, and Certifications specified in IS 10322.
2. Electrical safety certifications such as ISI and CII.
3. Ingress protection certification IP 65.

20.9 Lighting Level Criteria :

Luminaries : Maintenance Factor : 0.8

Lux Levels, Uniformity should be achieved on the Road as under :

	Average Lux Level	Uniformity : Min / Max	Uniformity : Min / Avg
Carriage Way	35 – 40 Lux	0.4	0.6
Pedestrian pathway	15 – 20 Lux	0.3	0.4

21 LIGHT POLES

21.1 SCOPE:

The scope of this specification covers the manufacture, transport, installation, testing and commissioning of Poles, including the Civil Foundation Works with all items required for the safe and efficient operation and maintenance of the lighting system, whether explicitly stated in the following pages or not, shall be included by the Contractor.

21.2 LIGHTING POLES :

The street light poles shall be fabricated from heavy duty steel tubes / Steel Sheets conforming to IS:1239 and hot dip galvanized or painted as specified.

The street light pole shall be fabricated as per the details and dimensions shown in the drawing.

The street light poles shall have base plate, inbuilt Junction Box for street light and advertisement signage, and necessary fixture mounting bracket at top.

The Junction box shall provide easy access to a multiway connector and MCB, to be mounted inside the pole. The access shall be specially fabricated with adequate reinforcement and weather protection gasket to prevent ingress of moisture and vandal proofed.

Poles shall have large diameter entries for incoming and outgoing cables and two earth studs & Spiral earthing.

The poles fabricated shall conform to the drawings and where such drawing is not available, the contractor shall make such drawing and have it approved before fabricated.

The pole shall house a multi way type terminal block and MCB as shown on the drawings. Poles shall have concrete coping.

21.2.1 **Octagonal Poles**

Design

The Octagonal Poles shall be designed to withstand the maximum wind speed of 160 km / hr. The top loading i.e. the weight and the area of top luminaries are to be considered to calculate maximum deflection of the pole and the same shall meet the requirement of BS: 5649 Part VI 1982.

Pole Shaft

The pole shaft shall have **octagonal** cross section and shall be continuously tapered with **single longitudinal welding**. There shall not be any circumferential welding. The welding of pole shaft shall be done by Submerged Arc Welding (SAW) process.

All **octagonal** pole shafts shall be provided with the rigid flange plate of suitable thickness as mentioned in BOQ / Drawing with provision for fixing 4 foundation bolts. This base plate shall be fillet welded to the pole shaft at two locations i.e. from inside and outside. The welding shall be done as per qualified MMAW process.

Door opening

The octagonal Poles shall have door of minimum size of 250 mm X 65 mm at the elevation of 1000 mm from the Base plate. The door shall be vandal resistance and shall be dust proof to ensure safety of inside connections. The door shall be flush with the exterior surface and shall have suitable locking arrangement. There shall also be suitable arrangement for the purpose of earthing. Also, pole should have suitable separate Junction box for advertisement

The pole shall be adequately strengthened at the location of the door to compensate for the loss in section.

Material

Octagonal Poles : Confirming to ST 35 grade.

Base Plate : Fe 410 conforming to IS 226 / IS 2062

Foundation Bolts : 6.8 Gr. As per IS 1367

Coating : coating thickness 70 micron

Welding

The welding shall be carried out confirming to approved procedures duly qualified by third party inspection Agency / PMC. The welders shall also be qualified for welding the octagonal shafts.

Pole sections

The Octagonal Poles up to the length of 12 meters **shall be in single piece with single longitudinal welding joint**. There shall not be any circumferential weld joint. However, the pole with length of 12

meters and above shall be of 2 sections with telescopic fitment with minimum overlap of 1.5 times the diameter.

The manufacturing unit shall have In house pole testing facility for validation of structure design data, The pole testing facility shall be as per BSEN 40-2.1& 3

Galvanization

The poles shall be hot dip galvanized as per BSEN ISO 1461 standards with average coating thickness of 70 micron. The galvanizing shall be done in single dipping.

Fixing Type

The Octagonal Poles shall be bolted on a pre-cast foundation with a set of four foundation bolts for greater rigidity.

Top Mountings

The galvanized double / single arm shall be supplied along with the Octagonal Poles for installation of the luminaries.

22 EARTHING

22.1 EARTHING

The system shall be TNS with four wire supply system (R,Y,B,N and 2 Nos. E) brought from the main L T Panel. All the non-current carrying metal parts of electrical installation and all metal conduits trunking, cable sheaths, switchgear, distribution panels, light fittings and all other parts made of metal shall be bonded together and connected by means of specified earthing conductors to an efficient earthing system. All metal work such as pipe lines, ducts, cable trays, stair case railing etc shall be bonded to earth.

All earthing shall be in conformity with IS:3043 1987, and the basic system of earthing shall be TNS.

22.2 EARTHING CONDUCTORS

Earthing conductors shall be of copper / GI as mentioned in schedule of quantities and shall be protected against mechanical injury and corrosion.

22.3 SIZING OF EARTHING CONDUCTORS

The cross sectional area of earthing conductor shall not be smaller than half of the largest current carrying conductor subject to an upper limit of 80 Sq.mm. If the area of the largest current carrying conductor or bus bar exceeds 160 sq.mm then two or more earthing conductors shall be used in parallel, to provide at least half the cross sectional area of the current carrying conductor or bus bars. All fixtures, outlet boxes, junction boxes and power circuits upto 15 amps shall be earthed with PVC insulated copper wire.

All 3 phase switches and distribution panels upto 60 amps rating shall be earthed with 2 Nos. distinct and independent 4 mm dia copper / GI wires. All 3 phase switches and distribution panels upto 100 amps rating shall be earthed with 2 Nos. distinct and independent 6 mm dia copper / GI wires. All switches, bus bar, ducts and distribution panels of rating 200 amps and above shall be earthed with minimum of 2 nos separate and independent 25 mm x 3 mm copper / GI tape.

22.4 CONNECTION OF EARTHING CONDUCTORS

Main earthing conductors shall be taken from the earth connections at the main L T panel to an earth electrode with which the connection is to be made. All joints in tapes shall be with four rivets and shall be brazed in case of copper and by welding bolting in case of GI, wires shall be connected with crimping lugs, all bolts shall have spring washers. Sub- mains earthing conductors shall run from the main

distribution panel to the sub distribution panel. Final distribution panel earthing conductors shall run from sub-distribution panel.

Circuit earthing conductor shall run from the exposed metal of equipment and shall be connected to any point on the main earthing conductor, or its distribution panel. Metal conduits, cable sheathing and armouring shall be earthed at the ends adjacent to distribution panel at which they originate, or otherwise at the commencement of the run by an earthing conductor in effective electrical contact with cable sheathing. Where equipment is connected by flexible cord, all exposed metal parts of the equipment shall be earthed by means of an earthing conductor enclosed with the current carrying conductors within the flexible cord. Switches, accessories, lighting fitting etc. which are rigidly secured in effective electrical contact with a run of metallic conduit shall not be considered as a part of the earthing conductor for earthing purposes, even though the run of metallic conduit is earthed.

The plate/pipe electrode, as far as practicable, shall be buried below permanent moisture level but in no case not less than 2.5 M below finished ground level.

The plate/pipe electrode shall be kept clear of the building foundation and in no case, it shall be nearer by less than 2 M from outer face of the respective building wall / column.

The plate electrode shall be installed vertically and shall be surrounded with 150 mm. thick layers of Charcoal dust and Salt mixture.

19 mm. dia. G.I. pipe for watering, shall run from top edge of the plate / pipe electrode to the mid level of block masonry chamber.

Top of the pipe shall be provided with G.I. funnel and screen for watering the earth / ground through the pipe.

The funnel with screen over the G.I. pipe for watering to the earth shall be housed in a block masonry chamber as shown in the drawing.

The masonry chamber shall be provided with a Cast Iron hinged cover resting over the Cast Iron frame which shall be embedded in the block masonry.

Construction of the earthing station shall in general be as shown in the drawing and shall conform to the requirement on earth electrodes mentioned in the latest edition of Indian Standard IS : 3043, Code of Practice for Earthing Installation.

The earth conductors (Strips / Wires copper / Hot dip G.I.) inside the building shall properly be clamped / supported on the wall with Galvanised Iron clamps and Mild Steel Zinc Passivated screws / bolts. The conductors outside the building shall be laid atleast 600 mm. below the finished ground level.

The earth conductors shall either terminate on earthing socket provided on the equipment or shall be fastened to the foundation bolt and / or on frames of the equipment. The earthing connection to equipment body shall be done after removing paint and other oily substances from the body and then properly be finished.

Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long.

The earth conductors shall be in one length between the earthing grid and the equipment to be earthed.

EARTH LEADS AND CONNECTIONS :

Earth lead shall be bare copper or Galvanised steel as specified with sizes shown on drawings. Copper lead shall have a phosphor content of not over 0.15 %. G.I strips buried in the ground shall be protected with bitumen and hessian wrap or polythene faced hessian and bitumen coating. At road crossing

necessary Hume pipes shall be laid. Earth lead run on surface of wall or ceiling shall be fixed on saddles so that strip is at least 8 mm away from the wall surface.

The complete earthing system shall be mechanically and electrically bonded to provide an independent return path to the earth source.

22.5 **PROHIBITED CONNECTIONS**

Neutral conductor, sprinkler pipes, or pipes conveying gas, water or inflammable liquid, structural steel work, metallic enclosures, metallic conduits and lightning protection system conductors shall not be used as a means of earthing an installation or even as a link in an earthing system. The electrical resistance measured between earth connection at the main L T panel and any other point on the completed installation shall be low enough to permit the passage of current necessary to operate or circuit breakers, and shall not exceed 1 ohm. All switches carrying medium voltage shall be connected with earth by two separate and distinct connections. The earthing conductors inside the building wherever exposed shall be properly protected from mechanical injury by running the same in GI pipe of adequate size. The overlapping in strips at joints where required shall be minimum 75 mm. The joints shall be riveted and brazed in case of copper and by welding / bolting in case of GI in an approved manner. Sweated lugs of adequate capacity and size shall be used for termination of all conductor wires above 6 sq.mm size. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substances and properly tinned. Equipotential bonding of all metallic structures shall be done.

22.6. **EARTHING**

The following must always be ensured in earthing system.

- All earths must be interconnected at the earth pits. This includes generator neutrals, transformer neutrals, transformer body, lightning protection system earths, UPS earths etc.
- Extraneous conductive parts such as gas pipes, other service pipes and ducting risers and pipes of fire protection equipment and exposed metallic parts of the building structure.

22.7 **RESISTANCE TO EARTH**

The resistance of earthing system shall not exceed 1 ohm.

22.9 **SPECIFICATION FOR HOT DIP GALVANIZING PROCESS FOR MILD STEEL USED FOR EARTHING FOR ELECTRICAL INSTALLATION**

GENERAL REQUIREMENTS

I. Quality of Zinc

Zinc to be used shall conform to minimum Zn 98 grade as per requirement of IS:209-1992.

II. Coating Requirement

Minimum weight of zinc coating for mild steel flats with thickness upto 6 mm in accordance with IS:6745-1972 shall be 400 g/sqm.

The weight of coating expressed in grams per square metre shall be calculated by dividing the total weight of Zinc by total area (both sides) of the coated surface.

The Zinc coating shall be uniform, smooth and free from imperfections as flux, ash and dross inclusions, bare patches black spots, pimples, lumpiness, runs, rust stains bulky white deposits, blisters.

Mild steel flats / wires shall undergo a process of degreasing pickling in acid, cold rinsing and then galvanizing. Jointing of earthing tape shall be by welding. All joints and cut ends shall be properly painted with aluminium paint.

22.10 Chemical Earthing System – specification

Earthing system should offer a resistance of less than 2 ohms throughout the year. In places where Soil resistivity is more, total length of the earthing rod has to be increased by adding 1m length rods (one over the other) to achieve low and stable resistance value. In rocky places ,multiple earth rods have to be installed and inter-connected to get the required value.

Solid Copper coated rods are recommended as earth electrode than a pipe due to the fact that solid rods have much longer life and can be easily driven by electric/hydraulic hammers. Copper has much longer life than all other materials as explained in IS 3043. Deep driven rods provide more stable and less Earth Resistance. Doubling the length of the rod will reduce earth resistance up to 40 %, whereas doubling the diameter will reduce the resistance by only 10 %, but may increase the cost by 4 times. Lower earth resistance can also be achieved by increasing the number of earth rods. E.g. 40 % reduction in earth resistance is possible if the rods are increased from 1 to 2. The minimum spacing between earth pits should be equal to TWICE the length of the rod. Increasing the spacing between earth pits also reduces the earth resistance significantly.

Need and importance of Earthing:

- Human and Personnel safety.
- Equipment protection.
- Provides low impedance path for fault currents.
- To ensure good quality power.
- Protection against lightning and transient currents, noise reductions, Limitation of EMI.

References:

IEC 60364: Low Voltage Electrical Installations-Part 5-54: Selection & Erection of Electrical equipment- Earthing arrangement & protective conductors.

IEC 62561: Lightning Protection system Components. Part 1 to 7.

IEC 62305: Protection Against Lightning –Part 3: Protection of structures & life Hazards

IS 2309: Code of practice for protection of buildings & allied structures from lightning

IS 3043: Code of practice for earthing.

Components of earthing system:

- Earth electrode
- Connectors and fasteners
- Inspection Chamber (Earth Pit)
- Earth enhancement material
- Connecting cable/tape/strip with accessories.

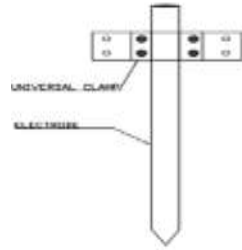
Earth Electrode:

Copper coated Solid steel Rods shall be made of high tensile low carbon steel rod, molecularly bonded with 99.9% electrolytic copper with minimum coating thickness of 250 microns as per IEC 62561 part -2: Requirement for Conductor & Earth Electrodes. The length of the earth rod shall be 3 meter so that driving into the ground is easier (scaffolding is not necessary). For dry areas, length of the rods can go up to several meters by driving the rods one over the other. Earth rods should be of diameter 20 mm. These rods should have facility to couple with hammer inserts so that they could be driven easily with an electric/hydraulic hammer. Additional rods should be added without external couplers. The earth rods should have peg & bore arrangement so that additional rods are added without external couplers.

Interconnecting Strips / Earthing Conductor: Copper coated steel strips / tapes should be used to interconnect different earthing rods as well as horizontal earthing (Ring earthing). These strips should have a coating thickness of minimum 70 microns.

Couplers / Connecting clamps:

Connectors/fasteners for connecting Electrode with Earthing conductor/strip should be of Stainless Steel as it is compatible with all other materials viz Copper, GI etc. Fasteners should be made of Stainless steel



Inspection Chamber :

Should have an inner dimension of 250 mmX 250 mm X 250 mm made of FRP material. Flush Mounted, removable cover of the earth pit should be able to withstand moderate loads. The area inside the inspection chamber should be such that, the UNIVERSAL CLAMP/EBB/Bus bars not too deep inside the inspection chamber or projecting out of inspection chamber. The chamber should have facility for marking earth resistance and latest testing date by paint at the cover and previous recorded values inside the cover.

Earth Enhancement material:

This is a conductive mineral compound to provide low resistance to the earth termination system. Earth enhancing compound should contain minerals which in normal use is reliable and without creating any hazards to persons and the surroundings. The material shall be chemically inert to sub soil and shall not pollute the environment. It shall provide a stable environment in terms of physical and chemical properties and exhibit low resistivity. It shall not be corrosive to the earth electrode itself. The material should have a resistivity less than 50 Ohm meter

Installation:

Dig a pit of 1m* 1m * 0.5m depth.

At the center of the pit, Earth rod of 3 m has to be hammered electrically or hydraulically.

The number of Earth rods can be added one over the other to get the required length.

Fill the dug up area with Earth enhancing compound mixed with water & soil to get slurry form in such a way that the earth inspection pit is in flush with the earth surface.

Connect the connectors with fasteners & connect the down conductors.

Close the lid of earth inspection pit.

Inspection & maintenance:

Maintenance of the earthing system has to be done at least once in 6 months, preferably before the monsoon period and a record should be maintained to verify earthing system conductors and components, electrical continuity, earth resistance value, re-fastening of components viz-nuts, bolts etc.

22.11 Test

The entire earthing installation shall be tested as per requirements of Indian Standard Specification IS: 3043.

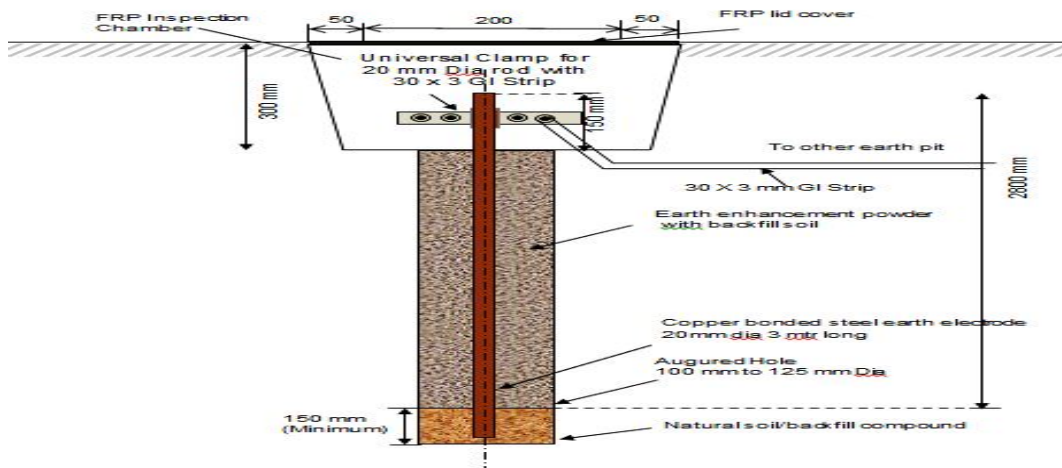
The following earth resistance values shall be measured with an approved earth megger and recorded.

- 1) Each earthing station
- 2) earthing system as a whole
- 3) Earth continuity conductors
- 4) Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 5 ohm in each case.

Measurements of earth resistance shall be carried out before earth connections are made between the earth and the object to be earthed.

All tests shall be carried out in presence of the client's representative/ PMC / Consultant.

Earthing Auguring Method



Installation :

23 ERECTION, TESTING & COMMISSIONING OF ELECTRICAL INSTALLATIONS

23.1 SCOPE

The intent of this specification is to define the requirements for the installation, testing and commissioning of the electrical system like M.V panels, Cables, earthing network and External lighting, Light fixtures etc. Requirement of this project shall be as specified in bill of quantities / approved drawings / general specifications or as per the battery limits fixed by the owner / consultant.

24 STANDARDS

24.1 The work shall be carried out in the best workman like manner in conformity with this specification, the relevant specification / codes of practice of the Indian Standards Institution, approved drawings and the instructions issued by the authorised representative, from time to time. Some of the relevant Indian Standards are listed elsewhere in this tender document.

The following standards and rules shall be applicable :

STANDARD NO.	PARTICULAR
IS 1913	General and safety requirements for light fittings.
IS 1944	Code of practice for lighting public thoroughfares.
IS 3528	Water proof electric lighting fittings.
IS 3553	Water tight electric lighting fittings
IS 1239.	M.S. tubular and other wrought steel pipe fittings.
IS 10322 (Parts / Sec. 3)	Luminaire for street lighting

Indian Electricity Act and rules.

All codes and standards mean the latest. Where not specified otherwise the installation shall generally follow the Indian Standard Code of Practice or the British Standard Code of Practice in the absence of Indian Standard.

24.2 In addition to the standards mentioned in above, all works shall also conform to the requirement of the following :

- Indian Electricity Act and Rules framed thereunder.
- Fire Insurance Regulations.
- Regulations laid down by the Chief Electrical Inspector of the State / State Electricity Board / Union Territory.
- Regulations laid down by the Factory Inspector of the State / Union Territory.
- Any other regulations laid down by the local authorities.
- Installation & operation manuals of original manufacturers of equipment.

25 EQUIPMENT AND ACCESSORIES SPECIFICATIONS:

This defines specifications and requirements mainly for the equipment and accessories, which are generally supplied by the erection agency.

All materials, accessories, consumable to be supplied by the contractor shall be selected from the list of specified make in consultation with the Client/Architect/Consultant without any extra cost and shall conform to the specification given here under. The equipment shall be manufactured in accordance with current Indian Standard specifications wherever they exist or with the BS or NEC specifications, if no such IS standards are available. In the absence of any specification & if any item not mentioned in the make of the material & any where else, the materials shall be as approved by the owner / consultant in writing manner.

All similar materials and removable parts shall be uniform and interchangeable with one another. Makes of bought out items selected by the contractor must be furnished by him as per the pro forma given in elsewhere in this tender document. Tenderer should have to specify the list of makes considered in the tender while quoting the rates in the tender, in covering letter of separate letter enclosure. However, the final decision for accepting make specified by tenderer would be of client/Architect/Consultants.

Within a week of work order, the contractor shall submit the sample of each item / component of above mentioned approved make for the approval of the Client/Architect/Consultant.

Bidder to submit authorization letter for supply of light fixtures and lamps only from regional sales manager/director-sales of lighting company with duly signed and stamped with mentioning the name of project, total quantity, type of light fitting etc. The letter should be submitted with valid proof and original documents to consultant. These authorizations are to be obtained prior to supply of material and should be approved by electrical consultant/architect/Client.

26 ERECTION

The contractor shall make his own arrangement for safe transportation of all the items to the erection site and also carry out complete loading / unloading during transportation. Equipment shall not be removed from packing cases unless the floor has been made ready for installing them. The cases shall be opened in presence of the client / consultant or his authorised representative. The empty packing cases shall be returned to the stores and any document if found with the equipment shall be handed

over to the client's representative. Any damage or shortage noticed shall be reported to the client / consultant in writing immediately after opening of packing cases.

26.1 Section feeder Pillar :

TESTING :

Before electrical panel is energised, the insulation resistance of each bus shall be measured from phase to ground. Measurement shall be repeated with circuit breakers in operating positions and contacts open.

Before switchgear is energised, the insulation resistance of all control circuits shall be measured from line to ground.

The following tests shall be performed on all circuit breakers during erection.

- Contact alignment and wipe shall be checked and adjustment where necessary in accordance with the breaker manufacturer's instructions.
- Each circuit breaker shall be drawn out of its cubicles, closed manually and its insulation resistance measured from phase to phase and phase to ground.
- All adjustable direct acting trip devices shall be set using values given by the consultant/ manufacturer.
- The dielectric strength of insulating oil wherever applicable, shall be checked.

Before switchgear is energised, the following tests shall be performed on each circuit breaker in its test position.

- Close and trip the circuit breaker from its local control switch push button or operating handle. Switchgear control bus may be energised to permit test operation of circuit breaker with A.C. closing with prior permission of the client / consultant.
- Test tripping of the electrically operated circuit breaker by operating mechanical trip device.
- Test proper operation of circuit breakers latch, check carriage limit switch if provided. Test proper operation of lockout device in the closing circuit. Wherever provided by simulating conditions which would cause a lockout to occur.
- Trip breaker either manually or by applying current or voltage to each of its associated protective release.
- Before switchgear is energised, the tests covered above shall be repeated with each breaker in its normal operating position.
- Capacitor banks shall be tested as per manufacturer's instructions. In addition, test for output and/or capacitance, insulation resistance test and test for efficiency of discharge device shall be carried out.
- All electrical equipment alarms shall be tested for proper operation by causing alarms to sound under simulated abnormal conditions.

(c) PROFORMA FOR PCC, MCC, DB, CONTROL PANEL TEST :

- Circuit breaker or contactor module designation / bus no.
- Insulation resistance test (contacts open, breaker racked in position)

a)	between each phase of bus	:	Mega ohm
b)	between each phase and earth	:	Mega ohm

- c) DC and AC control and auxiliary circuits : Mega ohm
- d) between each phase of CT / PT and
between CT & PT circuit if any : Mega ohm
- CT checks :
 - a) CT ratio
 - b) CT secondary resistance
 - c) CT polarity check
- Check for contact alignment and wipe.
- Check / test all releases / relays.
- Check mechanical interlocks.
- Check electrical interlocks.
- Check switchgear / control panel wiring.
- Check breaker / contactor circuit for :
 - a) Closing - local & remote (wherever applicable)
 - b) Tripping - local & remote (wherever applicable)
- Opening time of breaker / contactor.
- Closing time of breaker / contactor.

[This proforma shall be jointly signed by the CLIENT / PMC and the contractor in duplicate].

26.2 INSTALLATION OF CABLE NETWORK :

Cable network shall include power, control and lighting cables which shall be laid in underground trenches, cable trays, G.I. pipes, or on building structures as detailed in the relevant drawings, cable schedules or as per the client / consultant's instructions. Supply & installation of cable trays, G.I. pipes / conduits, cable glands and sockets of both end isolators, junction boxes, remote push button stations, etc. shall be under the scope of the contractor.

(a) General requirements for handling cables :

Near Each pole 1mtr. Extra Cable length should be provided at both the end.

Before laying cables, this shall be tested for physical damage, continuity, absence of cross phasing, insulation resistance to earth and between conductors. Insulation resistance tests shall be carried out with 500 / 1000 V megger.

The cables shall be supplied at site, wound on wooden drums as far as possible. For smaller length and sizes, cables in properly coiled form can be accepted. The cables shall be laid by mounting the drum of the cable on drum carriage. Where the carriage is not available, the drum shall be mounted on a properly supported axle, and the cable laid out from the top of the drum. In no case the cable will be rolled on as it produces kinks which may damage the conductor.

Sharp bending of cable shall be avoided. The bending radius for PVC insulated and sheathed, armoured cable shall not be less than 10 D, where "D" is overall diameter of the cable.

While drawing cables through DWC / G.I. pipes, conduits, RCC pipes, ensure that size of pipe is such that, after drawing cables, 40% area is free. After drawing cables, the end of pipe shall be sealed with cotton / bituminous compound.

High voltage (11 kV and above), medium voltage (240 V and above) and other control cables shall be separated from each other by adequate spacing or running through independent pipes / trays.

Armoured cables shall never be concealed in floors / roads without DWC Pipe or RCC pipes.

Joints in the cable throughout its length of laying shall be avoided as far as possible and if unavoidable, prior approval of site engineer shall be taken. If allowed, proper straight through epoxy resin tight joint shall be made, without any additional cost.

minimum loop of 3 mtr. shall be provided on both ends of the cable near SFP, and on both ends of straight through cable joint. This additional length shall be used for fresh termination in future. Cable for this loop shall be paid for supply and laying.

Cable shall be neatly arranged in the trenches / trays in such manner so that criss-crossing is avoided and final take off to the motor / switchgear is facilitated. Arrangement of cable within the trenches / trays shall be the responsibility of the contractor.

All cable routes shall be carefully measured and cable cut to the required lengths and undue wastage of cables to be avoided. The routes indicated in the drawings is indicative only and the same may be rechecked with the PMC before cutting of cables. While selecting cable routes interference with structures, foundations, pipelines, future expansion of buildings etc. should be avoided.

All temporary ends of cables must be protected against dirt and moisture to prevent damage to the insulation. For this purpose, ends of all XLPE insulated cables shall be taped with an approved PVC or rubber insulating tapes. Use of friction type or other fabric type tape is not permitted. Lead sheathed cables shall be plumbed with lead alloy.

Wherever cable rises from underground / concrete / masonry trenches to motors / switchgears / push buttons, these shall be taken in DWC / G.I. pipes of suitable size, for mechanical protection upto 300 mm. distance of concerned cable gland or as instructed by the client / consultant / PMC.

The cable pass through foundation / walls of other underground structures, the necessary ducts for opening will be provided in advance for the same. However, should it become necessary to cut holes in existing foundation of structures the electrical contractor shall determine the location and obtain approval of the client / consultant before cutting is done.

(b) LAYING OF CABLES (UNDERGROUND SYSTEM)

- Cables shall be so laid in trench that this will not interfere with other underground structure. All water pipes, sewage lines or other structures which become exposed by excavation shall be properly supported and protected from injury until the filling has been rammed solidly in places under and around them. Any telephone or other cables coming in the way are to be properly shielded / diverted as directed by the owner / consultant.
- Cable shall be laid at minimum depth of 900 mm. in case of L.T. and 1200 mm. in case of H.T. from ground level. Excavation will be generally in ordinary soil. The width of trench shall be sufficient for laying of required no. of cables.
- Sand bedding 75 mm. thick shall be made below and above the cables. Layer of bricks (full size) shall be laid above sand bedding on the sides and above the cables to cover cables completely. More than one

cable can be laid in the same trench. However, the relative location of cables in trench shall be maintained till termination. The surface of the ground after back filling the earth shall be made good so as to conform in all respects to the surrounded ground and to the entire satisfaction of the client / consultant.

➤ For all underground cables, route markers should be used :

- a) Separate route markers should be used for LT, HT and telephone cables.
- b) Route markers should be grounded in ground with 1:2:4 cement concrete pedestal size 230 x 230 x 300 mm.
- c) Cable markers should be installed at an interval not exceeding 30 mtr. along the straight routes of cables at a distance of 0.5 mtr. away from centre of cable with the arrow marked on the cable marker plate indicating the location of cable. Cable markers should also be used to identify change in direction of cable route and for location of every joint in underground cable.

➤ RCC Hume pipe for crossing road in cable laying shall be provided by employer. No deduction shall be made for cable laying in Hume pipe for not providing bricks, sand and excavation. RCC hump pipe at the ends shall be sealed by bituminous compound after laying and testing of cables by electrical contractor without any extra charge.

(D) TESTING OF CABLES :

- i. Before energising, the insulation resistance of every circuit shall be measured from phase to ground. This requires 3 measurements if one side is grounded and 6 measurements for 3 phase circuits.
- ii. Where splices or terminations are required in circuits rated above 650 volts, measure insulation resistance of each length of cable before splicing and/or terminating. Repeat measurements after splices and/or terminations are complete.
- iii. DC high voltage test shall be made after installation on the following :
 - a) All 1100 volts grade cables in which straight through joints have been made.
 - b) All cables above 1100 V grade.

For record purpose test data shall include the measured values of leakage current versus time.

The DC high voltage test shall be performed as detailed below :

Cables shall be installed in final position with all the straight through joints complete. Terminations shall be kept unfinished so that motors, switchgear, transformer etc. are not subjected to test voltage.

The test voltage and duration shall be as per relevant codes and practices of Indian Standards Institution.

iv. PROFORMA FOR TESTING CABLES :

DATE OF TEST

- a) Drum No. from which cable taken.
- b) Cable from to
- c) Length of run of this cable meter
- d) **Insulation resistance test**
 - i) between core-1 to earth mega-ohm

ii)	between core-2 to earth	mega-ohm
iii)	between core-3 to earth	mega-ohm
iv)	between core-1 to core-2	mega-ohm
v)	between core-2 to core-3	mega-ohm
vi)	between core-3 to core-1	mega-ohm
vii)	duration used	: 1 kV
e)	High Voltage test	Voltage Duration
i)	between core-1 to earth	
ii)	between individual cores	

[This proforma shall be jointly signed by the CLIENT / PMC and the contractor in duplicate].

27 COMPLETION TESTS :

After supply and installation of complete project or a particular building / area, As per I.E. rules tests shall be carried out by the contractor before switching on the power to installation and the results shall be recorded and submitted to the Site-Engineer. If results are not satisfactory / as per standards set herewith, the contractor shall identify the defects / short coming and shall rectify the same. Nothing extra shall be paid for carrying out these tests and contractor has to arrange all necessary instruments.

28 HANDING OVER / TAKING OVER: (Including all Electrical work...)

After completion of works and tests specified above, the various installations of the project can be taken over by the employer as and when these are ready in all respects after issuance of certificate from Engineer in charge with in fifteen days. The Defect Liability Period cum Maintenance Period of 60 months shall start from the date, when all the installations of the project have been executed, tested as described above, successfully commissioned and handed over.

The Contractor has to produce the Final As – Built drawings duly signed by Engineer In charge, Consultant, Architect & Client before finalizing the Final bill.

Completion certificate will not be considered if as built drawings not provided by contractor as following.

Final As built documents

- As built drawings with RTP (Reproducible Tracing Paper). : 1 Set
- As built drawings with Colored Print out : 4 Sets
- Soft Copy of the same : 6 Copies
- Instruction and maintenance manual - Six copies.
- Test certificates - Six copies.

29 Defect Liability Period : (Including all Civil, Electrical work)

Turn around time for Contractor in Defect Liability period for any of the damage & Instruction of Engineer in charge must be less than 2 days & Work should be completed in next 2 day (For Electrical work) or 7 days (for Civil Work). If contractor fails to comply the same the penalty of Rs. 10,000 / Day (Delay) will be deducted.

Defect Liability Period for Electrical work as per following (DLP will start after Final handover to client):

- | | |
|--|------------|
| 1) Section Feeder Pillar & Energy Saver Unit | : 1 Years. |
| With all internal Circuit breakers & Accessories | |
| 2) Poles with galvanizing or Paint | : 5 Years. |
| 3) Light Fixtures | : 5 Years |
| 4) Chemical Type earthing | : 1 years |

Any other item not mentioned above for electrical work shall be covered under DLP as per DLP clause mentioned in General specifications.

LIST OF APPROVED MAKE / MANUFACTURER FOR ELECTRICAL WORK MATERIALS

- | | | | |
|-----|--|---|---|
| 1) | Rigid PVC Conduit | : | ISI & FIA approved & manufactured from virgin material. Precision, Nihir. |
| 2) | Accessories for conduit | : | Same make as of pipe. |
| 3) | Flexible Copper Wires | : | Havells, Polycab, Finolex, RR Kable, KEI, Gloster |
| 4) | MCBs, ELMCB, MCCB | : | Schneider MG (Multi 9), Legrand (MDS-lexic), L&T |
| 6) | Meters | : | Conserve, Schneider (Digital type only with in built selector switch) |
| 7) | PVC tape | : | Steel grip, Anchor |
| 8) | Main Cables (XLPE) | : | Havells, Polycab, Finolex, RR Kable, KEI, Gloster |
| 9) | Glands | : | Double Compression type, Heavy duty and deep threading with rubber ring and double washers. (Sample to be approved) HMI, Raychem |
| 10) | Cable Lugs | : | Dowells, 3-D. |
| 11) | Connectors | : | Hensel, Wohner. |
| 12) | Light Fixture | : | Phillips, Kesselec (Schreder), Crompton, Bajaj |
| 13) | Energy Meters | : | L & T, Havell's, Conserve, HPL |
| 14) | Timer, Contactor | : | Theben, Legrand, L & T, Schneider. |
| 15) | Electrode type Earthing
(Chemical Earthing) | : | Ashlok, LPI. |
| 16) | Junction Box | : | Hensel, Spelsberg, OBO Betterman |
| 17) | DWC Pipe | : | Gemini, Duraline, REX. (Anti-rodent type only) |
| 18) | Octagonal Poles | : | Bajaj, Valmount, Surya Roshni Ltd. |

19) CCMS : Salzer, surya Roshni Ltd., Schnell Energy Equipment (p)
Ltd., Micro Instruments Ltd. Pneumatic Controls, MEW Electricals,
Hari Krupa

Contractor must initial on every page of specification.

Refer Clause no. 3 of S4 : ERECTION, TESTING & COMMISSIONING OF ELECTRICAL INSTALLATIONS

Sign & Seal of Contractor