

**Name of work: CONSTRUCTION OF ACCESS RAMP WITH GABION WALL SUPPORT
FROM JETTY ROAD TO STP IN SOU CAMPUS-EKTA NAGAR**

MATERIAL SPECIFICATION

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GENERAL TECHNICAL SPECIFICATIONS

1. In the specifications "as directed" / "approved" shall be taken to mean "as directed" / "approved by the Engineer-in-Charge".
2. Wherever a reference to any Indian Standard appears in the specifications, it shall be taken to mean as a reference to the latest edition of the same in force on the date of agreement.
3. In "Mode of Measurement" in the specifications wherever a dispute arises in the absence of specific mention of a particular point of aspect the provisions on these particular points, or aspects in the relevant Indian Standards shall be referred to
4. All measurements and computations, unless otherwise specified, shall be carried out nearest to the following limits:
 - (i) Length, width and depth (height) 0.01 meter
 - (ii) Areas 0.01 Sq. Mt.
 - (iii) Cubic Contents 0.01 Cu.Mt.

In recording dimensions of work the sequence of length, width and height (depth) or thickness shall be followed.
5. The distance which constitutes lead shall be determined along the shortest practical route and note necessarily the route actually taken the decision of the Engineer-in-charge in this regard shall be taken as final.
6. Where no lead is specific, it shall mean "all leads"
7. Lift shall be measured from plinth level.
8. Up to "floor two level" means actual height of floor (Maxi 4 M) up to 3 Mt. above plinth level.

9. Definite particulars covered in the items of work, though not mentioned or elucidated in its specifications shall be deemed to be included therein.
10. Reference to specifications of materials as made in the detailed specification of the items of works is in the form of a designation containing the number of the specification of the material and prefix 'M' e.g. 'M-5',
11. Approval to the samples of various materials given by the Engineer-in-charge shall not absolve the contractor from the responsibility of replacing defective material brought on site or materials used in the work found defective at a later date. The contractor shall have no claim to any payment or compensation whatsoever on account of any such materials being rejected by the Engineer-in-charge.
12. The contract rate of the item of work shall be for the work completed in all aspects.
13. No collection of materials shall be made before it is got approved from the Engineer-in charge.
14. Collection of approved materials shall be done at site of work in a systematic manner. Materials shall be stored in such a manner as to prevent damage, deterioration or intrusion of foreign matter and to ensure the preservation of their quality and fitness for the work.
15. Materials, if and when rejected by the Engineer-in-charge, shall be immediately removed from the site of work.
16. No materials shall be stored prior to, during and after execution of a structure in such a way as to cause or lead to damage or overloading of the various components of the structure.
17. All works shall be carried out in a workmanlike manner as per the best techniques for the particular item.
18. All tools, templates, machinery and equipment for correct execution of the work as well as for checking lines, levels, alignment of the works during execution shall be kept in sufficient numbers and in good working condition on the site of the work.
19. The mode, procedure and manner of execution shall be such that it does not cause damage or over-loading of the various components of the structure during execution or after completion of the structure.
20. Special modes of construction not adopted in general Engineering practice if proposed to be adopted by the Contractor, shall be considered only if the contractor provides satisfactory evidence that such special mode of construction is safe, sound and helps in speedy construction and Completion of work to the required strength and quality. Acceptance of the same by the Engineer-in-Charge shall not, however absolve the contractor of the responsibility of any adverse effects and consequences of adopting the same in the course of execution or completion of the work.

21. All installations pertaining to water supply and fixtures there of as well as drainage lines and sanitary fittings shall be deemed to be completed only after giving satisfactory tests by the contractor.
22. The contractor shall be responsible for observing the rules and regulations imposed under the "Minor Minerals Act", and such of the laws and rules prescribed by Government from time to time.
23. All necessary safety measures and precautions (including those laid down in the various relevant Indian Standards) shall be taken to ensure the safety of men. Materials and machinery on the works as also of the work itself.
24. The testing charges of all materials shall be borne by the Contractor.
25. Approval to any of the executed items for the work does not in any relieve the contractor of his responsibility for the correctness, soundness and strength of the structure as per the drawings and specifications.

SPECIFICATIONS OF MATERIALS

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 I.S. 456-2000.
- 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 I.S. 269-1976. Any indication of unsoundness, change in time of setting by 30 minutes or more or decrease of more than 10 percent 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. 6,932 (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 number 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 weatherproof 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 I.S. 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. Colored 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 3.00. The sieve analysis of course shall be as under:

I.S. Sieve Designation	Percentage by Weight Passing I.S. Sieve Designation	Percentage by Weight Passing sieve
4.75 mm	100 600 Micron	30-100
2.36 mm.	90 to 100 300 Micron	5-70
1.18 mm.	70-100 150 Micron	0-50
6.3. Fine Sand		

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

I.S Sieve ation	Percentage by weight Passing I.S. Sieve Designation through	Percentage by Weight Passing through
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 200mm. measuring cylinder. The quantity of. The sample shall be such that it fills the cylinder upto 100 mm. mark. The clean water shall be added upto 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	I.S. Sieve Designation	Percentage by Weight \Passing through
12.50 mm.	100%	4.75 mm	0-20%
10.00 mm	85-100%	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 build up the specified strength of concrete.

8.4. The necessary tests for grit shall be 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	I.S. Sieve Designation	Percentage Passing
20 mm.	100	4.75 mm	70
10 mm	86	2.36 mm.	52

M.10. Lime Mortar

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

10.2 Sand shall conform to specification M-6.

10.3 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.

10.4 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 ground for .the 180 revolution's with a

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.

10.5 Storage:

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

10.6 Use:

10.6.1. All mortar shall be used as soon as possible after grinding. It should be used off the day in 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 :

1-1.2.1. Cement and sand shall be mixed to specified proportion; sand being measured by measuring boxes. The proportion of cement will be by volume based on 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 6 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 Coares 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 the cubical in. shape. Unless special stones of 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. SievePercentage passing for Designatio single sized aggregates n of Nominal size.				I.S. SievePercentage passing for single sized Designation aggregates of Nominal size.			
40 mm 20mm 16 mm				40mm 20mm 16mm			
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	2.35mm	—	—	—
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. 456-2000 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 Coares.

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 quarries are mentioned, aggregate 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. 456-2000 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 moulded and made from suitable soils and kiln-burnt. They shall be free from iron 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 moulded with a frog of 100mm. x 40 mm. and 10mm. 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 "X2 3/4 ") 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 + 1/8 "(3.0 mm.) Width: ±1/16" (1.50 mm.) Height. + 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/Rubble :

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.

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

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.

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. Either heavier or lighter stones than the recommended should not be used in any layer of the sea wall. Use of flatter stones (except in the crest) should be avoided.

Water Absorption:

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.

Specific Gravity:

As per IS: 1124-1974 using specific gravity bottle (50 ml), value generally shall not be less than 2.60.

Weathering Test:

As per IS: 1125-1976, there should be no weather effect to the rubble stone. This test measures durability and strength of stone. The value shall not exceed 10%.

Abrasion Test:-

The abrasion value of the stone determined using impact abrasion machine shall not exceed 30 percent.

Petrography Test:-

The contractor shall have to get approval of quarry for stone before procurement and transportation of stone to be used under different item of work to site from Engineer-in-charge. Also one petrography shall have to be carried out in "GERI" laboratory for stones of approved quarry, if stones should be used from more than one quarry, for each quarry petrography test shall be carried out separately.

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

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 the 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 sometime 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. 456- 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::

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.

19.3.

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.	10mm.	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.	6.3.1 Kg./Rmt.
6.	16mm.	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-20 High Tensile Steel Wires

20.1. The high tensile wires for the use in prestressed concrete work shall conform 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 carborundum.

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 Wire

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- S 972.

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 scales or any other undesirable coating which may prevent adhesion of cement mortar.

M-22. Structural Steel

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.

22.1. 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 all conform to I.S 277-1977. The sheets shall be undamaged in carriage and handling either by rubbing off 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. sheet 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 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 specific 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 sheets shall be free from all defects such as cracks, holes deformities, chipped edges or otherwise damaged.

24.2. Ridged-& 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 locations.

24.2.2. Other accessories to be used in roof such as flashing pieces, eaves 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 ballies properly cross braced together to make the centring rigid. In places of bulky 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 diameter 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. laid on sufficiently hard base.

26.5. Double wedges shall further be provided between the sole plate and the wooden props 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 meeting 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 meet 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 meter (1 in 250) or as directed by the Engineer-in-charge 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:

26.1. 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-moulded bituminous joint filler.

26.2. Remoulded 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.

26.3. Thickness of the pre-moulded joint filler shall be 25 mm. unless otherwise specified.

26.4. Remoulded bituminous joint filler shall conform to I.S. 1838-1961.

M-28. Expansion joints-Copper strips & hold fasts:

28.1. The item provides for expansion joints in R.C.C. frame structure for internal joint as well as for exposed joints with the use of necessary copper strip and holdfasts.

28.2. Copper sheet shall be of 1.25 mm. thick and of 125 mm. width with the 'U' shape in the middle. Copper strip shall have holdfast of 3 mm. diameter copper rod fixed to the plate soldered on strip at intervals of about 30 cm. or as shown in the drawing or as directed. The width" of each flange (horizontal side) of the copper plate to be embedded in the concrete work shall be 25 mm. Depth of 'U' to be provided in the expansion joint, in the copper plate shall be

of 25 mm.

M-29. Teak wood:

29.1 The teak wood shall be of good quality as required for the item to be executed. When the kind of wood is not specifically mentioned, good Indian teak wood as approved shall be used.

29.2 Teak wood shall generally be free from large, loose, dead or cluster knots, flaws, shakes, warps, twists bends, or any other defects. It shall generally be uniform in substance and of straight fibres as far as possible. It shall be free from rot, decay, harmful fungi and other defects of harmful nature which will affect the strength durability of its usefulness for the purpose for which it is required. The colour shall be uniform as far as possible. Any effort like painting, using any adhesive or resins materials made to hide the defects shall render the pieces liable to rejection by the Engineer in-charge.

29.3. All scantlings; planks etc. shall be sawn in straight lines and planes in the direction of grains and of uniform thickness.

29.4. The tolerances in the dimensions shall be allowed at the rate of 1.5 mm. per face to be planed.

29.5. First class teak wood: 29.5.1. First class teak wood shall have no individual hard and sound knots, more than 6 sq. cm. size and the aggregate area of such knots shall not be more than 1% of area of piece. The timber shall be closed grained. 29.6 Second Class Teak wood: 29.6.1. No individual hard and sound knots shall be more than 15 sq. cms. In size and aggregate area of such knots shall not exceed 2% of the area of piece?

M-29. A. Non-teak wood:

The non-teak wood shall be chemically treated, seasoned as per IS Specifications and of good quality. The type of wood shall be got approved before collecting the same on site. Fabrication of wooden members shall be started only after approval.

For this purpose, wood of Bio, Kalali, Siras, Behda, Jamun, Sisoo will be used for door frames whereas only Kalali, Siras, Halda, Kalam etc, will be permitted for shutters after proper seasoning and chemical treatment.

The non-teak wood shall be free from large, loose, and dead or cluster knots, flows shake, warps, bends or any other defect. It shall be uniform in substance and of straight fibres as far as possible. It shall be free from rots, decay harmful fungi and other defects of nature which effect the strength, durability or its usefulness for the purpose for which it is required. The colour of wood shall be uniform as far as possible. The scantlings plank etc. shall be sawn in straight lines and planes in the direction of grain and uniform thickness.

The department will use the Agency to produce certificate from Forest Department in event of Dispute and the decision of the Department shall be final and binding to me contractor.

The tolerance in the dimension shall be allowed as 1.5 mm. per face to be planed.

M-30. Wooden flush door shutters (solid core):

30.1. The solid core type flush door shutters shall be decorative or non-decorative type as specified in the drawing. The-size and thickness of the shutter shall be as specified in drawings or as directed. The limber, species for core shall be used as per

1.5. 2202 - (Part-I) 1980. The timber shall be free from decay and insect attack. Knots and knot holes less than half the width of cross-section of the members in which they occur may be permitted. Pitch pockets, pitch streaks and harmless pin holes shall be permissible except in the exposed edges of the core members. The commercial plywood, cross-bands shall conform to I.S. 303-1275.

30.2. The face panel of the shutters shall be formed by gluing by the hot press process on both face of the core with either plywood or cross-bands and face veneers. The hopping rebating opening of glazing Venetian etc. shall be provided if specified in the drawing.

30.3. All edges of the door shutters shall be square. The shutters shall be free from twist or warp in its plane. Both faces of the shutters shall be sand papered to smooth even texture.

30.4. The shutters shall be tested for

(1) End immersion test.: The test shall be carried out as per I.S. 2202 (part-I) 1980. There shall be no delamination at the end of the test.

(2) Knife Test: The face panel when tested in accordance with I.S. 1659-1979 shall pass

the test.

(3) Glue adhesion test: The flush door shall be tested for glue adhesive test in accordance with KS...2202 (Pan 4) 1930, The shutters shall be considered to have passed the test if no delamination occurs in the-glue lines in the plywood and if no single delamination more than 80 mm. in length and more than 3 mm. in depth has occurred in the assembly glue lines between them. Plywood face and the style and rail. Delamination at the corner shall be measured continuously around the corner. Delamination at the knots, knot holes and other permissible wood defects shall not be considered in assessing the sample.

30.5. The tolerance in size of solid core type flush door shall be as under.

In Normal thickness ± 1.2 mm. In Normal height ± 3 mm.

30.6. The thick of the shutters. shall be uniform throughout with a permissible variation of not more than 0.8 mm. when measured at any two points.

M-31. Aluminum doors, windows, ventilators

31.1 Aluminium alloy used in the manufacture of extruded window sections shall conform to I.S. designation HEA-WP of

1.5. : 733-3975 and to I.S. Designation WVG-WP of I.S. 1285-1975. The Section shall be as specified in the drawing and design. The fabrication shall be done as directed.

31.2. The hinges shall be cast or extruded aluminium hinge of same type as in window but of large size.

31.3. The hinges shall normally be of 50 mm. projecting type. Non-projecting type of hinges may also be used if directed.

The handles of door shall be of specified design. A suitable lock for the door opera table either from outside or inside shall be provided. In double shutter door, the first closing shutter shall have concealed aluminium alloy bolt at top and bottom.

M-32. Rolling Shutters:

32.1. The rolling shutters shall conform to I.S. 6248-1979. Rolling shutters shall be supplied of specified type with accessories. The size of the rolling shutters shall be specified in the drawings. The shutters shall be constructed with interlocking lath sections formed from cold rolled steel strips not less than 0.9 mm. thick and 80 mm: wide for shutters upto 3.5mm., width not less than L25 mm. thick and 80 mm; wide for shutters 3.5 mm in width and at above unless otherwise specified.

32.2. Guide channels shall be of mild steel deep channel section and of rolled pressed or built up (fabricated) joint construction. The thickness of sheet used shall not be less than 3.15mm.

32.3. Hood covers shall be made of M.S. Sheets not less than 0.92 mm. thickness. For shutters having width 3.5 Meter and above, the thickness of M.S. Sheet for the hood cover shall be not less than 1.25 mm.

32.4. The spring shall be of best quality and shall be manufactured from tested high tensile spring steel wire or strip of adequate strength to balance the shutters in all position. The spring pipe shaft etc. shall be supported on strong M.S. or malleable C.I. brackets. The brackets shall be fixed on or under the lintel as specified with raw plugs and screws bolts etc.

32.5. The roiling shutters shall be of self-rolling type up to 8 Sq. in. clear area without ball bearing and up to 12 sq. m. clear area with ball bearing. If the rolling shutters are larger, then gear operated type shutters shall be used.

32.6. The locking arrangement shall be provided at the bottom of shutter at both ends. The shutters shall be opened from outside.

32.7. The shutters shall be completed with door suspension shafts, locking arrangements, pulling hooks, handles and other accessories.

M-33. Collapsible. Steel-Gate:

33.1. The collapsible steel gate shall be in one or two leaves and size as per approved drawings or as specified. The gate shall be fabricated from best quality mild steel channels, flats etc. Either steel pulleys or ball bearings shall be provided in every double channel. Unless otherwise specified the particulars of collapsible gate shall be as under:

(a) Pickets: These shall be of 20 mm. M.S., channels of heavy sections unless otherwise shown on drawings. The distance centre to centre of pickets shall be 12 cms. With an opening of 10 cms.

(b) . Pivoted M.S. flats shall be 20 mm x 6 mm.

- (c) Top and bottom guides shall be from tee or flat iron of approved size.
- (d) The fittings like stoppers, fixing hold fasts, locking cleats, brass handles and cast iron rollers shall be of approved design and size.

M-34. Welded Steel Wire Fabric:

34.1. Welded steel wire fabric for general purpose shall be manufactured from cold drawn steel wire "as drawn" or galvanized steel conforming to I.S. 226-1975 with longitudinal and transverse wire securely connected at every intersection by a process of electrical resistance welding and conforming to I.S. 4948-1974. It shall be fabricated and finished in workmanlike manner and shall be free from injurious defects and shall be rustproof. The type of mesh shall be oblong or square as directed. The mesh sizes and size of wire for square as well as oblong welded steel wire fabric shall be as directed the steel wire fabric in panels shall be in one whole piece in each panel as far as stock size permit.

M-35. Expanded Metal Sheets:

35.1. The expanded metal sheets shall be free from flaws, joints, broken strands, laminations and other harmful surface. Expanded metal steel sheet shall conform to I.S. 412-1975, except that blank sheets need not be with guaranteed mechanical properties. The size of the diamond mesh of expanded metal and dimensions of strands (width and thickness) shall be as specified. The tolerance in nominal weight of expanded metal sheets shall be of + 10 percent.

35.2 Expanded metal in Pannels shall be in one whole piece panel each as far as stock size permit. The expanded metal sheets shall be coated with suitable protective coating to prevent corrosion.

M-36. Mild Steel Wire (Wire Gauze Jali):

36.1 Mild steel wire, may be galvanized, as indicated. All finished steel wire shall be well cleanly drawn to! He dimensions and-size of wire as specified in item. The wire shall be sound, free from splits, surface flaws, rough jagfied and imperfect edges and other harmful surface defects and shall conform to I.S. 280-1978.

M-37. Plywood:

37.1. The plywood for general purpose shall conform I: S. 303- 1975.

Plywood is made by cementing together thin boards or sheets of wood into panels. There are always an odd number of layers 3, 5, 7, 9 ply etc. The plies are placed so that grain of each layer is right angle to the grain in the adjacent layer.

37.2. The chief advantages of plywood over a signal board of the same thickness is the more uniform strength of the plywood, along the length and width of the plywood and greater resistance to cracking and splitting with change in moisture content,

37.3. Usually synthetic resins are used for gluing, pherolic resins are usually cured in a hot press which compresses and simultaneously heats the plies between hot plates which maintain a temperature of 90 degree. C. to 140 degree C. and a pressure of 11 to 14 Kg/Sq. Cm. on the wood. The times of healing may be anything from 2 to 60 minutes depending upon thickness.

37.4. When water glue are used, the wood absorbs so much water that the finished plywood must be dried carefully. When synthetic resins are use as adhesive finished plywood must be exposed to an atmosphere of controlled humidity until the proper amount of moisture, has been absorbed.

37.5. According to I.S. 303-1975 the plywood for general purpose shall be of three grades namely BWR, WWR and CWR, depending upon the adhesives used for bonding and veneers, and it will be farther classified into six types namely AA. AB. AC, BB, BC and C,C based on the quality of the two faces, each face being of three finds namely, A, B. and C. After pressing, the finished ply wood should be reconditioned to a moisture content not less than 8 percent and not more than 16 percent.

37.6. Thickness of ply wood Boards :

37.7. TABLE

Board	Thickness	Board,	Thickness	Board	Thickness	Board	Thickness
3 ply	3mm	5 ply	5mm	7 ply.	9mm	9 ply.	16mm.
	4 mm.		6mm.		13mm.		19 mm.
	5 mm:		8mm.		16mm.	11 Ply.	19 mm.

	6 mm.		9mm.	9 Ply.	13mm.		22mm.
							25 mm.

M.38. Glass:

38.1 All glass shall be of the best quality, free from specks, bubbles, smokes, veins, air holes blisters and other defects. The kind of glass to be used shall be mentioned in the item or specification or in the special provisions or as shown in detailed drawings. Thickness of glass panes shall be uniform. The specifications of different kinds of glass shall be as under:

38.2. Sheet Glass:

38.2.1. In absence of any specified thickness or weight in the item or detailed specifications of the item of work, sheet glass shall be weighing 73 Kg/Sq.m. for panes upto 600 mm x 600 mm.

38.2.2. For panes larger than 600 mm. x 600 mm. and upto 800 mm. x 800 mm. the glass weighing not less than 8.75 Kg/Sq m. shall be used. For bigger panes upto 900 mm. x 900 mm. glass weighing not less than 11.25 Kg/Sq. m. shall be used.

38.2.3. Sheet glass shall be patent, flattened glass of best quality and for glazing and framing purposes shall conform to I.S.: 1761 -1960. Sheet glass of the specified colours shall be used, if so shown on detailed drawings or so specified. For important buildings and for panes with any dimension over 900 mm. plate glass of specified thickness shall be used.

38.3. Plate Glass. 38.3.1. When plate glass is specified, it shall be 'Polished patent plate glass' of best quality. It shall have both the surface ground flat and parallel and polished to obtain clear undisturbed vision and reflection. The plate glass shall be of the thickness mentioned in the item or as shown in the detailed drawing or as specified. In absence of any specified thickness the thickness of plate glass to be supplied shall be 6mm and a tolerance of 0.20 mm. shall be admissible.

38.4. Obscured Glass: 38.4.1. This type of glass transmits light so that vision is partially or almost completely obscured. Glass shall be plain rolled, figured, ribbed or fluted or frosted glass as may be specified as required. The thickness and type of glass shall be as per details on drawings or as specified or as directed.

38.5. Wired Glass: 38.5.1. Glass shall be with wire netting embedded in a sheet of plate glass electrically welded 13 mm. Georgian square mesh may be used. Thickness of glass shall not be less than 6 mm. Wired glass shall be of type and thickness as specified.

M-39. Acrylic Sheets:

39.1. Acrylic sheet shall be of thickness as specified in the item and of a specified shape and size. Panels may be flat or curved. It should be light in weight. It shall be colourless or coloured or opaque as specified in the item. Colourless sheet shall be as transparent as the finest optical glass, its light transmission rate shall be about 95%. Transparency shall not be affected for the sheets of larger thickness. It shall be extremely resistant to sunlight, weather and low temperatures. It shall not show any significant yellowing or change in physical properties or loss of light transmission over a longer period of use. The sheet shall be impact resistant also. Sheets should be available in complete range of standard transparent, translucent and opaque colours. Sheets shall be of such quality that they can be cut bent and jointed as desired. Solution for the joints shall be used as per the requirement of manufacturer.

M-40. Particle board:

40.1. The particle boards used for face panels shall be of best quality free from any defects. The particle boards shall be made with phenolaldehyde adhesive. The particle boards shall conform to I.S.: 3087-1965. "Specification for wood particle board for general purpose". The size and the thickness shall be as indicated.

M-41. Expanded polystyrene of framed styroper slabs:

41.1. The expanded polystyrene ceiling boards and files shall be of approved make and shall be of size, thickness, finish and color as indicated. It shall be of high density and suitable for use as insulating material. The insulating material shall be like slab of Thermo Cole etc.

M-42. Resin bonded fiber glass:

42.1 The resin bonded fibre glass tiles, or rolls shall be of approved make and shall be of sizes, thickness and finish as indicated.

42.2. For test of Mineral wool thermal insulation Blanket I.S.: 3144/1965 shall be followed.

42.3. Insulation wool blanket shall be with following coverings on one or both sides as

indicated.

(1) Bituminised hessian Kraft paper suitable for use in position where moisture has to be excluded.

(2) Hessian cloth or Kraft paper for keeping out dust.

(3) G.I. wire netting, suitable for surfaces to be plastered over.

M-43. Fixtures and fastenings:

43.1. General:

43.1.1. The fixtures and fastenings, that is, butt, hinges, tee and strap hinges, sliding door bolts, tower bolts, door latch, bathroom latch, handles, door stoppers, casement window fasteners, casement stays and ventilators catch shall be made of the metal as specified in the item or its specifications.

43.1.2. They shall be of iron, brags, aluminium, chromium plated iron, and chromium plated brass, copper oxidised iron, and copper oxidised brass or anodised aluminium as specified.

43.1.3. The fixtures shall be heavy, medium or light type. The fixtures and fastenings shall be smooth finished and shall be such as will ensure ease of operation.

43.1.4. The samples of fixtures and fastenings shall be got approved as regards quality and shape before providing them in position.

43.1.5. Brass and anodised aluminium fixtures and fastenings shall be bright finished.

43.2. Holdfasts: 43.2.1. Holdfasts shall be made from mild steel flat 30 cm. length and one of the holdfasts shall be bent at right angle and two nos. of 6 mm. diameter holes shall be made in it for fixing it to the Frame with screws. At the other end, the holdfast shall be forked and bent at right angles in opposite directions.

43.2. Butt hinges:

43.3.1. Railway standard heavy type butt hinges shall be used when so specified. 43.3.2. Tee and strap hinges shall be manufactured from M.S. Sheet.

43.4. Siding door bolts (AL drops): 43.4.1. The AL drops as specified in the item shall be used and shall be got approved.

43.5. Tower bolts (Barrel Type): 43.5.1. Tower bolts as specified in the item shall be used and shall be got approved.

43.6. Door latch: 43.6.1. The size of door latch shall be taken as the length of latch.

43.7. Bathroom Latch: 43.7.1. Bathroom latch shall be similar to tower bolt.

Handle: The size of the handles shall be determined by the inside grip length of the handles. Handles shall have a base plate of length 50 mm. more than the size of the handle.

43.8. Door Stoppers: 43.9.1. Door stoppers shall be either floor door stopper type or door catch type. Floor stopped shall be of overall size as specified and shall have a rubber cushion.

43.9. Door Catch: 43.10.1. Door catch shall be fixed at a height of about 900 mm. from the floor level so that one part of the catch is fitted on the inside of the shutter and the other part is fixed in the wall with necessary wooden plug arrangements for appropriate fixity. The catch shall be fixed 20 mm. inside the face of the door for easy operation of catch.

43.10. Wooden Door Stop with hinges: 43.11.1. Wooden doors stop of size 100 mm x 60 mm x 40 mm shall be fixed on the door frame with a hinge of 75 mm size and at a height of 900 mm. from the floor level. The wooden doorstop shall be provided with 3 coats of approved oil paint.

43.11. Casement window Fastener: Casement window fastener for single leaf window shutter shall be left or right handled as directed.

43.12. Casement stays (Straight Peg Stay): 43.13.1. The stays shall be made from a channel section having three holes at appropriate position so that the window can be opened either fully or partially as directed. Size of the stay shall be 250 mm. to 300 mm. as directed.

43.13. Ventilator Catch: 43.14.1. The pattern and shape of the catch shall be as approved.

43.14. Pivot: 43.15.1. The base and socket plate shall be made from minimum 3 mm. thick plate and projected pivot shall not be less than 12 mm. diameter and 12 mm. length and shall be firmly riveted to the base plate in case of iron pivot and in single piece base plate in the case of brass pivot.

M-44. Paints: 44.1 (A) Oil paints:

44.1.1. Oil paints shall be of the specified color and shade, and as approved. The ready mixed paints shall only be used. However, if ready mixed paint or specific shade or tint is not available, white ready mixed paint with approved strainer 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 re-dispersed with a paddle to a smooth homogeneous state. The paint shall show no curdling, leveraging, caking or color separation and shall be free from lumps and skins.

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

(iii) The paint shall not skin within 48 hours in 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-45 French polish:

45.1. The French polish of required tint and shape shall be prepared with the below mentioned ingredients and other necessary materials:

(i) Denatured spirit of approved quality (ii) Chandras (iii) Shellac (IV) Pigment.

45.2. The French polish so prepared shall conform to I.S.: 348-1968.

M-46 Marble chips for marble mosaic terrazzo:

46.1. The marble chips shall be of approved quality and shades. It shall be hard, sound, dense and homogeneous in texture with crystalline and coarse grains. It shall be uniform in color and free from stains, cracks decay and weathering.

46.2. The size of various colours of marble chips ranging from the smallest up to 20 mm. shall be used where the thickness of top wearing layer is 6 mm. size. The marble chips of approved quality and colours only as per grading as decided by the Engineer-in-charge shall be used for marble mosaic tiles or works.

46.3 The marble chips shall be machine crushed. They shall be free from foreign matter, dust etc. Except as above, the chips shall conform to I. S.: 2114-1962.

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 millimetre. Tolerance on thickness shall be plus 5 mm.

47.1.6. The tiles shall satisfy the tests as regards transverse strength resistance to wear and water absorption as per I.S: 1237-1980.

47.2 (B) Plain Coloured 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 6 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 samples, if found suitable shall be approved by the Engineer-in-charge, or he may ask for a few more samples to be prepared indicating roughly the particular sized chips to be more-or less in the samples 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 chequer shall not be less than 25 mm. and not more than 50 mm. 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 chequers 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. 1237-1930.

47.5 (E) Chequered Tiles for Staircases:

47.5.1. The requirements of these tiles shall be the same as chequered as per (D) above except in following respects;

(1) The length of a tile including nose shall be 330 mm.

(2) The minimum thickness shall be 28 mm.

(3) The nosing shall have also the same wearing layer as at the top.

(4) The nosing edge shall be rounded.

(5) The front portion of the tile for a minimum length of 75 mm. from and including the

nosing shall have grooves running parallel to nosing and at centre not exceeding 25 mm. Beyond that the tiles shall have normal chequer pattern.

M-48. Rough Kotah Stone:

48.1. The kotah. stones shall be hard, even, sound, and regular in shape and generally uniform in color. The color of the stone shall generally be green. Brown color stones shall not be allowed for use. They shall be without any softveins, cracks or flows.

48.2 The size of the stones to be used for flooring shall be of size 600 mm x 600 mm and/or size 600 mm x 450 mm, as directed. However smaller sizes will be allowed to be used to the extent of maintaining required pattern. Thickness shall be as specified.

48.3. Tolerance of minus 30 mm. on account of chisel dressing of edges shall be permitted for length as well as breadth. Tolerance in thickness shall be + 3 mm.

48.4. The edges of stones shall be truly chiselled and table rubbed with coarse sand before paving. All angles and edges of the stone shall be true, square and free from chipping and surface shall be true and plain.

48.5 When machine cut edges are specified, the exposed edges and the edges at joints shall be machine cut. The thickness of the exposed machine cut edges shall be uniform.

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-50. Dholpur Stone Slab:

50.1 Dholpur stone slab shall be of best quality as approved by the Engineer-in-charge the stone slab shall be even, sound and durable, regular in shape and of uniform color.

50.2. The size of the stone shall be specified in the item or detailed drawings or as approved by the Engineer-in-charge. The thickness of the stone shall be as specified in the item of work with the permissible tolerance of plus or minus 2 mm. The provisions in respect of polishing as for polished Kotah stone shall apply to polished Dholpur stone also. All angles and edges of the face of the stone slab shall be fine chiselled or polished as specified in the item of work and all the four edges shall be machine cut.

All angle and edges of the stone slab shall be true and plane.

50.3 The sample of stone shall be got approved from the Engineer-in-charge for shade and tint for a particular work. It shall be ensured that the stones to bemuse in a particular work shall not differ much in shade or tint from the approved sample.

M-51. Marble Slab:

51.1. Marble slab shall be white or of other color 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 plant 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 palter.

51.4. The slab shall not be thinner than the specified thickness at its thinnest part. A few specimens 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-52. Granite Stone Slab:

52.1. Granite shall be of approved color and quality. The stone shall be hard, even, sound

regular in shape and generally uniform in color. It shall be without any soft veins, cracks or flaws.

52.2. The thickness of the stone shall be as specified in the items.

52.3. All exposed face shall be double polished to tender truly smooth and the even reflecting surface. The exposed edges and corners shall be rounded off as directed. The exposed edges shall be machine cut and shall have uniform thickness.

M-53 P.V.C Flooring:

53.1. P. V.C sheets for P.V.C. floor covering shall be of homogeneous flexible type, conforming to I.S. 3452-1966. The P.V.C. covering shall neither develop any toxic effect while put to use nor shall give off any disagreeable odour.

53.2 Thickness of flexible type covering tiles shall be as specified in the description of the item.

53.3. The flexible type shall be backed with hessain or other woven fabric. The following tolerances shall be applicable on the nominal dimension of the sheet rolls or tiles :

(a) Thickness 0.15 mm

(b) Length or Width:

1 300 mm. square tiles ± 0.20 mm. 39.00 mm. square tiles ± 0.30 mm.

2 600mm. ““ ± 0.40 mm. 4. Sheets and rolls + 0.10 percent

53.4. Adhesive:

53.4.1. The adhesive for PVC flooring shall be of the type and make recommended by the manufacturers of PVC sheets/tiles.

M-54. Facing tiles:

54.1. The facing tiles (burnt clay facing bricks) shall be free from cracks, flaws and nodules of free lime. They shall be thoroughly burnt and shall have plane rectangular faces with parallel sides and sharp straight right edged faces. The texture of the finished surface that will be exposed when in place, shall conform to an approved sample consisting not less than four stretcher bricks each representing the texture desired. The facing tiles shall have a pleasing appearance, sufficient resistance to penetration by rain and greater durability than common bricks. The tiles shall conform to I.S. 2691-1972.

54.2. The standard size effacing brick tiles shall be 19 x 9 x 4 cms. The facing brick tiles shall be provided with frog which shall conform to I.S. 1077-1976.

54.0. The permissible tolerance in dimensions specified above shall be as follows :

Size Tolerance for

	1st class Brick	2nd class Brick
19 Cm.	± 6 mm.	± 10 mm.
9cm.	± 3 mm.	± 7 mm.
4cm.	± 1.5 mm	± 3 mm.

54.4. The tolerance for distortion or warpage of face or edges of individual brick from a plane surface and from a straight line respectively shall be as follows:

Facing dimensions

Permissible tolerance

Max. Below 19

cms.Max. 2.5mm.

-Do- above 19 cm.Max. 3.0 mm.

54.5. The average compressive strength obtained as a sample of five dies when tested in accordance with the procedure laid as per I.S. 1077-1976 shall be not less than 175 Kg/Sq. Cm. The average compressive strength of any individual bricks shall be not less than 160 Kg/Sq.Cm.

54.6. The average water absorption for five bricks files shall not exceed 12 percent of average weight of brick before testing.

The absorption for each individual bricks snail not exceed 25 percent.

54.7. The brick tiles when tested in accordance with I.S. 1077-1976, the rate of efflorescence shall not be more than 'Slightly effloresced.'

M-55. White glazed tiles:

55.1. The tiles shall be of best quality as approved by the Engineer-in-charge. They shall be flat and true to shape. They shall be free from cracks, crazing, spots, chipped edges and corners. The glazing shall be of uniform shade.

55.2. The tiles shall be nominal size of 150 mm. x 150 mm. unless otherwise specified. The maximum variation from the stated sizes, other than the thickness of tile, shall be plus or minus 1.5 mm. The thickness of tile shall be 6 mm. except as above the tiles shall conform to I.S. 777 1970.

M-56. Galvanized iron pipes and fittings:

56.1. Galvanized iron pipe shall be of the medium type and of required diameter and shall comply with I.S. 1239-1979. The specified diameter of the pipes shall refer to the inside diameter of the bore. Clamps, screw and all galvanized iron fittings shall be of the standard 'R' or equivalent make.

M-57. Bib cock and stop cock:

57.1. A bib cock is a draw off tap with a horizontal inlet and free outlet. A stop cock is a valve with a suitable means of connection for insertion in a pipe line for controlling or stopping the flow.

57.2. They shall be of screw down type and of brass chromium plated and of diameter as specified in the description of the item. They shall conform to I.S. 781-1977 and they shall be of best Indian make. They shall be polished bright.

57.3. The minimum finished weight of bib cock and stop cock shall be as given below :

Diameter	Bib cock	Stop cock	Diameter	Bib cock	Stop cock
8 mm	0.25 Kg.	0.25 Kg.	15 mm.	0.40 Kg.	0.40 Kg.
10 mm.	0.30 Kg.	0.35 Kg.	20 mm.	0.75 Kg.	0.75 Kg.

M-58. Gun metal wheel valve:

58.1. The gun metal wheel valve be of approved quality. These shall be gun metal fitted with wheel and shall be of gate valve opening full way and of the size as specified. These shall conform to I.S. 778-1971.

M-59. White glazed porcelain wash basin:

59.1. Wash basin shall be of white porcelain first quality best Indian make and it shall conform to I.S. 2556 (Part-IV) 1972 and I.S. 771-1979.

The size of the wash basin shall be as specified in the item, Wash basin shall be of one piece construction with continued over-flow arrangements. All internal angles shall be designed so as to facilitate cleaning. Wash basin shall have single tap hole or two holes as specified. Each basin shall have a circular waste hole which is either rabbled or beveled internally with 65 mm. diameter at top and 10 mm. depth to suit the waste fitting. The necessary stud slot to receive the bracket on the underside of the basin shall be provided. Basin shall have an internal soap holder recess which shall fully drain into the bowl.

59.2 White glazed pedestal of the quality and color as that of the basin shall be provided where specified in the item. It shall be completely recessed at the back for reception of supply and wash pipe. It shall be capable of supporting the basin rigidly and adequately and shall be so designed as to make the height from floor to top of the rim of basin 750 mm. to 800 mm. as directed.

M-60. European type water closet/with low level flushing:

60.1. The European type water closet shall be white glazed porcelain first quality and shall be of wash down type conforming to I.S. 2556-1973 and I.S. 771-1979.

60.2. 'S' trap shall be provided as required with water seal not less than 50 mm. The solid plastic seat and cover shall be of the best Indian make conforming to I.S. 2548-1980. They shall be made of moulded syntactic materials which shall be tough and hard with high resistance to solvents and shall be free from blisters and other surface defects and shall have chromium plated brass hinges and rubber buffer of suitable size.

M-61. Orissa type water closet:

61.1. The specification of Orissa type white glazed water closet of first quality shall conform

to I.S. 2556 (Pan-III) 1981 and relevant specification of Indian type water closet except that pan will be with the integral squatting pan of size 580 mm. x 440 mm. with raised footrest.

M-62. Indian type water closet:

62.1. The Indian lye white glazed water closet of first duality shall be of size as specified in the item and conforming to I.S. 771-1979 and I.S. 2556 (Part-II) 1981. Each pan shall have integral flushing ring of suitable type with adequate number of holes around as directed to have satisfactory flushing. It shall also have an inlet at back or front for connecting flush pipe as directed. The inside of the bottom of the pan shall have sufficient slope from the front towards the outlet and surface shall be uniform and smooth.

Pan shall be provided with 100 mm. diameter 'P' OR's' trap with approximately 50 mm. water seal and 50 mm. diameter vent horn.

M-62.A Foot Rests: 62-A-1. A pair of white glazed-earthen ware rectangular foot rests of minimum size 250 mm. x 130 mm. 20 mm. shall be provided with water closet.

M-63. Glazed Earthen Ware Sink:

63.1. The glazed earthen-ware sink shall be specified size, color and quality. The sink shall conform to I.S. 771 Part-II-1979. The brackets for sinks shall conform to I.S. 775-1970.

63.2. The pipes shall conform to I.S. 1239-Part-11973 and I.S. 404-1962 for steel and lead pipes respectively 32 mm. brass waste coupling of standard pattern with brass chain and rubber plug shall be provided with sink.

M-64. Glazed earthen ware Lipped type flat back urinal/corner type urinal:

64.1 The lipped type urinal shall be flat back or corner type as specified in the item and shall conform to I.S. 771-1979. It shall be of best Indian make and size as specified and approved by the Engineer-in-charge. The flat back or corner type urinal must be of 1st quality free from any defects, cracks, etc.

M-65. Low level enamel flushing tank:

65.1. The low level enamel flushing tank shall be of 15 litres capacity. It shall conform to I.S. 774-1971. The flushing cistern shall be of best quality and free from any defects. The flushing tank shall have outlet 32 mm. diameter. The outlet shall be connected with W.C. Pan by lead pipe or P.V.C. pipe as specified. The flushing tank shall be provided with inlet and outlet for fixing G.I. inlet pipes and over-flow pipes. The flushing cistern shall be provided with chromium plated handle for flushing. The flushing tank shall be provided with bracket of cast iron so that it can be fixed on wall at specified height. The brackets shall conform to I.S. 775-1970.

M-66. Cast iron flushing cistern:

66.1. The cast iron flushing cistern shall be of 15 litres capacity. It shall conform to I.S. 774-1971. The flushing cistern shall be of best quality free from any defects. The flushing cistern shall have outlet of 32 mm. diameter. The outlet shall be connected to lead pipe of 32 mm. diameter. The lead pipe shall conform to I.S. 404 (Part-I) 1962. For fixing G.I. inlet pipes and overflow pipe 20 mm. dia. inlet and outlet shall be provided. The flushing cistern shall be provided with galvanized iron chain and pull of sufficient length and shall be got approved from the Engineer-in-charge. The cast iron flushing cistern shall be painted with one coat of anticorrosive paint and two coats of paints. The flushing cistern shall be fixed on two C.I. brackets. The C.I. brackets shall conform to I.S. 775-1970.

M-67. Flush cock:

67.1. Half turn flush cusec (Heavy weight) shall be of gun metal chromium plated of diameter as specified in the description of the item. The flush cock shall conform to relevant Indian Standard.

M-68. Cast iron pipes and fittings:

68.1 All soil, water, vent and anti-syphon age pipes and fittings shall conform to I.S. 1729-1964. The pipe shall have spigot and socket ends with head on spigot end. The pipes and fittings shall be true to shape, smooth, cylindrical, their inner and outlet surfaces being as nearly as practicable concentric. They shall be sound and nicely cast and shall be free from cracks, laps, pinholes or other imperfection and shall be neatly dressed and carefully fettled.

68.2. The end of pipes and fittings shall be reasonable square to their axis.

68.3. The sand cast iron pipes shall be of the diameter as specified in the description and shall

be in lengths of 1.5 M. 1.8 M. and 2 M. including socket ends of the pipe unless shorter lengths are either specified or required at junctions etc. The pipes and fittings shall be supplied without ears unless specified or directed otherwise.

Tolerances:

68.4.1. The Standard weights and thickness of pipes shall be as shown in the following table:
A tolerance upto minus 10 per cent may however be allowed against these standard weights.

Sr.	Nominal dia. of	Thickness	1.5 m.long	Overall Weight of Pipe excluding ears 2 m. long	
No.	bore			1.8m. long.	2m. long
1	75 mm	5.0 mm	12.83 Kg.	16.52 Kg.	18.37 Kg.
2	100 mm	5.0 mm	18.14 Kg.	21.67 Kg.	24.15 Kg.

68.4.2. A tolerance upto minus 15 percent in thickness and 20 mm. in length will be allowed. For fittings tolerance in lengths shall be plus 15 mm. and minus 10 mm.

68.4.3. The thickness of fittings and their socket and spigot dimensions shall conform to the thickness and dimensions specified for the corresponding sizes of straight pipes. The tolerances in weights and thickness shall be the same as for straight pipes.

M-69. Nahni Trap:

69.1. Nahni trap shall be of cast iron and shall be sound and free from porosity or other defects which affect serviceability. The thickness of the base metal shall not be less than 6.5 mm. The surface shall be smooth and free from craze, ships and other flaws or any other kind of defects which affect serviceability. The size of nahni trap shall be as specified and shall be of self-cleansing design.

69.2. The nahni trap shall be of quality approved by the Engineer-in-charge and shall generally conform to the relevant Indian Standards.

69.3. The Nahni trap provided shall be with deep seal, minimum 50 mm, except at places where trap with deep seal cannot be accommodated. The cover shall be cast iron. Perforated cover shall be provided *on* the trap of appropriate size.

M-70. Gully Trap:

70.1 Gully trap shall conform to I.S. 651-1980. It shall be sound, free from defects such as fire cracks. The glaze of the traps shall be free from crazing. They shall give a sharp clear note when struck with light hammer. There shall be no broken blisters.

70.2. The size of the gully trap shall be as specified in the item.

70.3. Each gully trap shall have one C.I. grating of square size corresponding to the dimensions of inlet of gully trap. It will also have a water tight C.I. cover with frame inside dimensions 300 mm; x 300 mm., the cover with frame inside dimension, 300 mm. x 300 mm., the cover weighing not less than 4.53 Kg. and the frame not less than 2.72 Kg. The grating cover and frame shall be of sound and good casting and shall have truly square machined seating faces.

M-71. Glaze Stone Ware Pipe And Fitting:

71.1. The pipes and fittings shall be of best quality as approved by the Engineer-in-charge. The pipe shall be of best quality manufactured from stone-ware of fire clay, salt glazed thoroughly burnt through the whole thickness, of a close even texture, free from air blows, fire blisters, crack and other imperfections, which effect the serviceability. The inner and outer surfaces shall be smooth and perfectly glazed. The pipe shall be capable to-withstand pressure of 1.5 m. lead without showing sign of leakage. The thickness of the wall shall not be less than 1/12th of the internal dia. The depth of socket shall not be less than 38 mm. The socket shall be sufficiently large to allow a joint of 1 mm. around the pipe.

71.2. The pipes shall generally conform to relevant I.S. 651 -1980.

M-72. Wall Peg Rail:

72.1. The aluminium wall peg rail shall have three aluminium pegs of approved quality and size. It shall be fixed on leak wood plank of size 450 mm. x 75 mm. x 20 mm. The teakwood shall be French polished or oil painted as specified.

M-73. G.I. Water Spot:

73.1. The G.I. pipes of 40 mm. dia shall be of medium quality and specials shall be of 'R' brand or equivalent brand of best approved quality.

73.2. The pipe shall have length as required for the thickness of wall in which it is fixed, and at the outside end tee and bend cut at half the length shall be provided and at other end coupling shall be provided to have better fixing. The water spout shall be provided as per detailed drawing or as directed.

M-74. Asbestos Cement Pipe (A.C. Pipe):

74.1. The asbestos cement pipe of diameter as specified in the description of the item shall conform to I.S. 1626-1980. Specials like bends, shoes cowls, etc. shall conform to relevant Indian Standards. The interior of pipe shall have a smooth finish, regular surface and regular, internal diameter. The tolerance in all dimensions shall be as per I.S. 1626-Part-11980.

M-75. Corydon Ball Valve:

75.1. Ball valve of screwed type including polthylene float and necessary lever etc. shall be of the size as mentioned in the description of item and shall conform to I.S. 1703-1977.

M-76. Bitumen Felt For Water Proofing And Damp Proofing:

76.1 Bitumen felt shall be on the fibre bases and shall be type 2, self-finished grade-2 and shall conform to I.S. 1322-1970.

M-77 Select Earth:

77.1. The selected earth shall be that obtained from excavated material or shall have to brought from outside as indicated in the item. If item does not indicate anything, the selected earth shall have to be brought from outside.

77.2 The selected earth shall be good yellow soil and shall be got approved from the Engineer-in-charge. La no case black cotton soil or similar expansive and shrinkable soil shall be used. It shall be clean and free from all rubbish and perishable materials, stones or brick bats. The clods shall be broken to a size of 50. Mm or less, Contractor shall make his own arrangement at his own cost for land for borrowing selected earth. The stacking of material shall be done as directed by the Engineer-in-charge in such a way as not to interfere with any constructional activities and in proper stacks.

77.3 When excavated material is to be used, only selected stuff got approved from the Engineer-in-charge shall be used. It shall be stacked separately and shall comply with all the requirements of selected earth mentioned above :

M-78. Barbed Wire:

78.1 The barbed wire shall be of galvanized steel and it shall generally conform to I.S. 278-1978. The barbed wire shall be of type-I whose nominal diameter for line wire shall be 2.5 mm. and point wire 2.24 mm. The nominal distance between two bars shall be 75 mm. unless otherwise specified in the item. The barbed wire shall be formed by twisting together two line wires, one containing the barbs. The size of the line and point wires and barb spacing's shall be as specified above. The permissible deviation from the nominal diameter of the line wire and point wire shall not exceed ± 0.08 mm.

78.2 The barbs shall carry four points shall be formed by twisting two point wires, each two turns, lightly round one line wire, making altogether four complete turns. The barbs shall be so finished that the four points are -set and looked at right angles to each other. The barbs shall have a length of not less than 13 mm. and not more than 18 mm. The point, shall be sharp and cut at an angle not greater than 35 degree of the axis of the wire forming the barbs.

78.3 The line and point wire shall be circular section free from scale and other defects and shall be uniformly galvanized. The line wire shall be in continuous length and shall not contain any weld other than those in the rod before it is drawn. The distance between two successive splices shall not be less than 15 meters.

78.4 The lengths per 100 Kg. of barbed wire

I.S. type I shall be as under Nominal 1000 meter

Minimum 834 Meter Maximum 1066 Meter.

M-79 Water Bound Distemper

79.1 It shall be from Asian, Berger or Asian or equivalent as approved by Architect. It shall conform to relevant IS codes.

79.2 It can be in powder form or liquid form as per the manufacture's specification. If it is in powder form it can be prepared by adding warm water in the proportion recommended by the manufacture.

79.3 It shall be applied by the conventional distemper brush to all plastered surface. It shall be applied by the conventional distemper brush to all plastered walls, ceilings and woodwork. Priming coat shall be applied before applying the paint.

M-80 Plastic Emulsion Paint

80.1 Plastic emulsion paint shall conform to IS: 5411 of approved brand and manufacture and of the required shade shall be used.

80.2 The plastic emulsion paint is not suitable for application on external, wood and iron surface and surfaces which are liable to heavy condensation. These paints are to be used on internal surfaces except wooden and steel.

M-81 Cement Paint

81.1 The cement paint shall be (conforming to IS: 5410) of approved brand and manufacture.

81.2 The cement paint shall be brought to the site of work by the contractor in its original container in sealed condition. The material shall be brought by the contractor at a time in adequate to suffice for the whole work or at least for a fortnight's work. The material shall be kept in joint custody of Architect and engineer-in-charge. Empty tins shall not be removed from the the site of work, till this item of work has been completed and passed by the engineer-in-charge.

81.3 It shall be manufactured from selected range of raw materials and a special cement, so the it shall be suitable for both indoors and outdoors. It shall be suitably used on concrete renderings, cement/sand renderings, cement/lime/sand renderings, asbestos sheets, fiber boards, brickwork, etc. It shall offer matt finish. It shall require no primer and shall be water thinkable. It shall offer a covering capacity as per manufacture's specification, depending on the surface and shade used. It shall preferably not be applied under direct sunlight to avoid patchy effect.

M-82 Textured wall finish

82.1 It shall be from Bakelite Hilum Ltd or equivalent as approved by Architect or engineer-in-charge. It shall conform to relevant IS codes. It shall be granules, flakes, granite flakes and granules and flakes mix. 82.2 It shall be of two component or one component as specified by the Architect or engineer-in-charge. It shall be easily applicable by trained applicators. The single coat shall be 1.5 mm thick as specified in the item description. It shall be weather and fade resistant, water and damp resistant, durable and highly washable. It shall be acid and alkali resistant, high abrasion resistant, non-toxic and shall be capable to taking any shape. It can be applied on wide variety of surface like cement mortar, plywood, plaster board, AC sheet, Asbestos board, gypsum plaster or any other materials, to get homogenous layer.

82.3 It shall be water thinkable to avoid water contamination, incombustible and flexible. It shall be good fire-resistant, anti-fungal, good impact resistant having adhesion strength more than 8 kg. /cm². There shall not be any development of hair line cracks and no peeling off shall occur, after the maximum drying time of 4 hours and curing period of 2 days.

M-83 Silicone paint

83.1 It shall be of the best quality, like Wacker, GE Silicone, Pixilate, Dow Corning or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS Codes.

83.2 It shall be prepared by mixing Silicone and Epoxy. It shall be applied on dry as well as damp surfaces. It shall be non-toxic and odorless, so shall be suitable for drinking water

structures also. It shall render the surface impervious to water and shall prevent water penetration. It itself shall penetrate into the structure and shall form a strong film on the pores of the structure surface, making the surface watertight, non-toxic and erosion free.

83.3 It shall be water thinkable. Before use, the hardener of the Silicon ate Epoxy shall be mixed with resin and thinned with water, in the proportions described by the manufacturer. It shall be applied with a suitable spray gun with a fine nozzle. An overlap of 25 to 30 cm. shall be preferred. It shall be semitransparent but on drying it shall become transparent.

M-84 Synthetic Enamel Paint

84.1 Synthetic Enamel paint shall conform to IS: 2933. It shall be from Nerolac, Berger, Asian Paints or equivalent. It shall offer variety of finishes like Glossy, Semi-glossy, Pearl luster and Matt finish.

84.2 It shall be applied either by brush, roll or spray. It shall have a covering capacity of as specified by the manufacture, depending on the surface to be painted. It shall be used both on metal and wood surfaces.

84.3 It shall have a viscosity of application of 30 to 40 seconds, if brush or rollers are used and 20 to 25 seconds, if spraying is done. The drying time shall however vary with the ambient temperature and humidity.

M-85 Acrylic Paint

85.1 It shall be from Asian Paints, ICI, and Berger, Nerolac or equivalent as approved by the Architect. It shall conform to the relevant IS Codes.

85.2 It shall be used on both interiors and exteriors on all different types of plaster, wooden surfaces, stone, brickwork, asbestos cement sheets, hard and soft boards, etc. as specified in the drawing. It shall render rich smooth finish and shall provide a tough film that forms a suitable protection against all elements.

85.3 It shall be water thin able. On interior surface it shall be applied after one coat of cement primer and in case of exterior surface it shall be applied on waterproof cement coating. On a new but highly absorbent surface, a thin coat of the paint shall be applied by adding two parts of water by volume to two parts of Acrylic Emulsion by volume. On previously painted surfaces, one coat of the acrylic paint shall be applied by thinning four parts of the emulsion with one or two parts of water. It shall be applied by brush, roller or spray. It shall have a covering capacity as per manufacture's specification, depending on the surface and shade used. It can be washed to remove the day-to-day dirt, after the surface has been painted, minimum for a month. It should be non-flammable. For the best performance of paint proper washing and cleaning of all algal and fungal growth at regular intervals at six months is required.

M-86 French polish

86.1 Pure Shellac conforming to IS: 16 varying from pale orange to lemon yellow color free from resin or dirt shall be dissolved in methylated spirit at the rate of 140 gm. of Shellac to 1 liter of spirit. Suitable pigment shall be added to get the required shade.

86.2 Readymade polish conforming to IS: 348 can also be used. The French polish so prepared shall Conform to IS: 348.

M-87 Aluminum Sheets

87.1 It shall be of the best quality and from reputed manufacturer like Hidalgo or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to IS: 1254, in all respects. The aluminum alloys used in the manufacture of the sheets shall conform to IS: 737.

87.2 The sheets shall be extremely light with high-strength-to weight ratio. Having a density of about 2.70 gms/cm³. It is corrosion resistant in almost any kind of environment. Even in

highly-corrosive industrial environments, it should be resistant to fumes and vapors of organic compounds and to chemicals like ammonia, carbon-dioxide and acids like hydrochloric acid, nitric acid and sulphuric acid. This corrosion resistant property gives the metal a long life and keeps it looking good throughout its life the sheets shall be non-fragile and shall be exceptionally durable. As aluminum reflects a high proportion of the radiant heat, the sheets provide excellent insulation when used for cladding/roofing. The sheets shall be non-combustible, non-flammable and non-sparking. As aluminum is elastic, the sheets shall offer high resistance to denting and shall be shatter-proof. Co-efficient of linear expansion of aluminum is 0.000024 per co. and therefore the lateral expansion of the sheets shall be readily accommodated in the corrugations. The sheets shall offer no health hazard and shall be totally hygienic. Aluminum is a good conductor of heat, its high reflectivity of radiant heat and light (75 to 80 per cent when new, 60 per cent after several years) keeps the interiors of an aluminum building from five to eight-degree Celsius cooler in summer while its low emission rate cuts heat loss during winter.

87.3 It shall be available in trapezoidal and rounded corrugations and shall be extensively used for various Industrial buildings, Warehouses, Aircraft hangers, Power plants, Storage sheds, Bunk houses etc. It shall be innovatively used as interior partitions, wall panels, false ceiling etc.

M-88 PVC Sheet

88.1 PVC sheet should be of Finolex or equivalent as sample approved by Architect and engineer-in-charge. PVC sheet should be corrosion resistant and chemical resistant. It should resist actions against chemicals like mineral acids, alkalis, plating solutions, pickling solutions, paper making chemicals, most inorganic compounds, alcohols, aliphatic hydrocarbons, glycols, amines and phenols in both liquid and vapor form.

88.2 It should be hygienic, virtually maintenance free, UV resistant, highly flexible so that it can be bent perpendicular or parallel to corrugation. It should be light weight than it can be easily handled and transported.

80.3 It should possess excellent thermal insulation and rust proof to make it ideal for coastal regions.

80.4 It should be fire retardant as per the sample approved by engineer-in-charge. It should be such a type that it can be used in heavy industries, factories and warehouses, agricultural and food processing industries and for coastal construction.

M-89 PVC Water stops.

89.1 The PVC water stop shall be of approved make, as approved by the Architect and Engineer-in-charge.

89.2 It shall have optimum resilience, high elasticity & stretch strength, immune to corrosion, excellent weather resistance. They shall be manufactured to safeguard against hydrostatic pressure, water seepage, expansion or contraction of joints and to take care of any deflection or displacement arising due to change in temperature or settlement of foundation to eliminate danger of cracks.

89.3 They shall be effective in a tropical climate having high mechanical strength, good ageing, longer life, shall be unaffected by acids, alkalis, metal salts and other chemicals. It shall not be hazardous and shall have fire retardant properties. It shall absorb less water than rubber, shall work as watertight seal but shall allow safe passage of seepage water and shall withstand high hydrostatic pressure. It shall be easily welded and can be installed easily, having high tensile strength and shall be capable of bearing heavy shocks arising due to turbines, earthquakes, floods etc.

89.4 It shall withstand a minimum hydrostatic pressure of 30 m. high column of water.

89.5 The selection criteria of water stop depends upon the hydrostatic pressure; however the following points should be kept in mind:

- 1) Where substantial expansion/contraction of joints takes place, Dumb Bell type shall be used.
- 2) Where a firm grip in concrete is desired, serrated types should be used.
- 3) The overall width of the water stop should not be greater than the thickness of concrete.
- 4) The distance from the face of the concrete to the water stop must not be less than half the width of the water stops.
- 5) The width of the water stop must be at least 6 times the largest aggregate used for satisfactory compaction.

89.6 The prior approval of selected size and type of water stop shall be taken from the Architect and Engineering-charge, before use.

M-90 Admixtures for Mass Concrete and Mortar

M-90A Joint Sealant:

90A.1 the sealant shall be of the best quality and from manufacturers like CICO, MC-BAUCHEMIE, PIDILITE, HMP or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

90A.2 it shall be a two-component poly sulfide rubber joint sealant, based on a low molecular weight polymer. It should not contain chlorides or other corrosive substances.

90A.3 It shall be used for sealing joints in water retaining structures, roofs, external walls, cladding, floors, partitions, ceilings etc. It shall have excellent property to adhere to most of building materials like Aluminum, Stainless Steel, Glass, Concrete, Marble, Stone, Brick, Masonry block, Plaster, Ceramic and quarry tiles, Timber etc. The modulus of elasticity of the sealant shall be less than 0.16 MPa, +10% at 100% elongation. The shore "A" hardness of the sealant shall be 22+3 @ 25OC. The operating temperature range for the sealant shall be -25OC to 80OC. The permanent dynamic movement capability of the sealant shall be +25%. The tensile strength of the sealant shall not be less than 0.4 MPa. The optimum width/depth ratio shall be 2:1. The Sp.gr. of the sealant shall be 1.6 kg/lit. The sealant should be capable of resisting the attack of water, sunlight, oxidation, corrosive fumes, oils, petrol, diluted acids and alkalis, salt spray, aliphatic and aromatic solvents and shall not contain tar or bituminous ingredients. 89A.4 it shall possess the properties like 550% elongation at break, non-toxicity when fully cured, no staining and shrinkage less than 1%. The trafficable strength shall be achieved within 24 hours and full at 7 days (at 25OC & 250% RH). It shall possess excellent coverage capacity and more strength at low dry temperatures.

M-90B Abrasion Resistant Industrial Flooring Aggregate:

90B.1 the flooring aggregate shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

90B.2 the flooring aggregate shall be a factory processed and specially graded non-oxidizing, non-magnetic and chemically inert metallic flooring aggregate, free from oil and grease.

90B.3 it shall be used as a surface hardener to concrete floors. It is recommended for Factory floors, Warehouses, Hangers, Car parks and such other areas, subjected to heavy vehicular traffic. It shall also be used on open and continuously wet surfaces. The flooring aggregate shall build in wear resistance and shall produce high abrasion resistant floor surface. It shall

impart extreme surface density and shall offer resistance to oil and water penetration. It should provide a non-rusting floor surface which is easy to maintain.

90B.4 It shall be used with cement in the ratio, as per the manufacturer's instructions and spread evenly on the surface to be treated, at the rate depending on the type of floor. The flooring aggregate shall be spread when the surface of the concrete floor is still fresh, i.e. as soon as the surface water has evaporated and then trowled, in stages, to bring about a uniform and smooth finish.

M-90C Concrete Hardener and Dustproofed:

90C.1 The Concrete hardener and dustproofed, shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code. 90C.2 It shall have a specific gravity of 1.18 and shall be applied on concrete floors, at the rate of at least 25 lit's per 100 m². Per coat. A total of three coats shall be applied for permanently hardened concrete floor, with increased abrasion resistance, increased surface density, and increased resistance to chemical attack and to eliminate dust accumulation. Drying time of 4-6 hours for each coat shall be allowed before the floor is use or is applied with another coat of the product. Precautions shall be taken while using the product, to avoid contact with eyes and open wounds and to work in good ventilation. After application, the affected parts shall be washed copiously. It shall not be stored for a period of more than 2 months before use.

M-90D Water Repellent Coating:

90D.1 The Water repellent coating shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

90D.2 Water repellent coatings for exterior exposed surfaces shall be acrylic resin based, having a Flash point of approx. 400C and specific gravity of 0.95.

90D.3 it shall be suitably used for concrete, brick, stone and plastered surfaces preventing moisture penetration and thus any damage to the interiors. It shall be quick acting, long lasting, invisible i.e. colorless so as to maintain the original color of the surface treated. It shall impart sealing characteristics so that the treated surface becomes stain and dust free. The coating itself shall not darken or turn yellow with age.

M-90E Accelerating, Water Reducing Admixture and Plasticizer:

90E.1 The Accelerating, Water reducing admixture and plasticizer, shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

90E.2 It shall be in liquid state with a specific gravity of 1.30 and complying with ASTM C-494 Type E, IS: 9103 & IS : 2645. It shall accelerate the setting and hardening of the concrete mix, thereby achieving higher early age strength. It shall reduce the water content of the concrete without affecting its workability. It is useful for pre-cast/pre-stressed works, structural concrete works, floors, roads, runways, paving etc. It shall be used at the rate instructed by the manufacturer, with cement, depending on the amount of acceleration of hardening required. It should be compatible to all types of cement.

M-90F Retarding, Water Reducing Admixture and Plasticizer:

90F.1 The Retarding, water reducing admixture and plasticizer, shall be of best quality and from manufacturer like CICO, Feb Rife or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

90F.2 It shall be in liquid state with a specific gravity of 1.22 and complying with ASTM C-494 Type B & D, IS: 9103, CRD-C87 Type B & D, BS 5075 Part 1. It shall be added to the concrete mix during the mixing process, at the same time as the water or the aggregates. No extension of normal mixing time is necessary. It shall extend the period of time as to placing the concrete and compacting, i.e., delay the initial and final setting time. It shall help to spread the heat of hydration over a longer period of time. It shall give a highly workable concrete with a low W/C ratio. It shall be used at the rate instructed by the manufacturer, with cement, depending on the amount of acceleration of hardening required. It should be compatible to all types of cement.

M-91 Corrugated GI Sheet

91.1 CPWD specification clause no. 12.1.1, 12.1.2 shall be followed.

M-92 GEO FABRIC WOVEN FABRIC:-

The Geo fabric filter shall be of good quality and shall confirm the following specification.

Geo fabric filter shall be polypropylene multifilament woven fabric. The individual multifilament shall be woven together in such a manner so as to provide dimensional stability relative to each other. It shall be ideal for reinforcement, drainage and filtration function.

Geo textile shall be resistant to ultraviolet degradation and to biological and chemical environments normally found in soils. Geo fabric shall confirm to physical tests prescribed by bureau of Indian standard (IS-1969). The material shall have been following physical properties.

Sr.No	Physical properties	Test Method		Value
I	Polymer composition, Structure and Physical properties			
1	Polymer	Polypropylene		
2	Structure	Woven with multifilament yarn in both Warp and weft directions		
3	Mass per unit area	ASTM D 3776		240 g/m
II	Mechanical Properties			
1	Tensile strength	Warp	IS 1969	55 KN/m
		Weft		30 KN/m
2	Elongation at designated peak tensile load	Warp		< 25%
		Weft		< 25%
3	Trapezoidal tearing strength	Warp	ASTM D 4533	> 1100 N
		Weft		> 750 N
4	Puncture strength(Mini)		ASTM D 4833	> 600 N
III	Hydraulic properties			
1	Apparent opening size		ASTM D 4751	< 0.075
2	Permeability		ASTM D 44981	> 20 lit/m²/sec
Roll Dimensions rate normal to the plane		Standard roll length;100 m Standard roll width; 5 m.		

GABIOON :-

Definitions of terms :

- **Gabion** : a double twisted wire mesh container of variable sizes, uniformly partitioned into internal cells, inter-connected with other similar units, and filled with stone at the project site to form flexible, permeable monolithic structures such as retaining walls, sea wall, channel, linings, revetments and weirs for erosion control project.

- **Double - twisted wire mesh**, a non raveling mesh made by twisting continuous pairs of wires through three one half turns (commonly called double twisted) to form hexagon shaped opening which are then interconnected to adjacent wires to form hexagonal opening.
- **Selvedge wire** - a terminal wire used to edge the wire mesh perpendicular to the double twist by mechanically wrapping the mesh wire around at least 2.5 times.
- **Edge wire**-a terminal wire of same diameter as the selvedge wire used to edge the wire mesh parallel to the double twist by continuously weaving it mechanically into the wire mesh.
- **Lacing wire**-a galvanized wire or galvanized wire with PVC coating used to assemble and interconnect empty units, to close and secure stone-filled units, and internal stiffeners.
- **Stiffener**- a length of galvanized wire with PVC coating used for support of facing by connecting the front panel to the back panel Rubble/Stone

Materials and Manufacture:

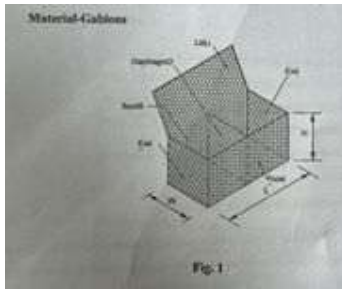
- The wire used in the manufacture of double twisted mesh for use in gabions shall conform to the specification given below
- Double - twisted mesh shall be manufactured from the same type of galvanized steel wire as style 1 with an additional PVC coating extruded on to the galvanized steel wire. The PVC coating shall conform to the properties given below.
- Lacing wire and stiffeners shall be made of wire having the same coating materials as the double twisted wire mesh furnished on the order and confirming to specification IS 4826/IS16014, with a tensile strength in accordance with details given below.
- Gabions shall be manufactured with all components mechanically connected at the production facility with the exception of the mattress lid which is produced separately from the base. All gabions shall be supplied in the collapsed form, either folded and bundled or rolled for shipping.
- Below mentioned tests and testing method shall be adopted prior to manufacture of mesh in approved laboratory of manufacturer.2

Mechanically woven, Double Twisted hexagonal wire mesh rockfill Netting:

- **Terminology**
 - Item consists of supplying and laying mechanically woven double twisted Hexagonal Zn+ PVC coated box wire mesh gabions of Size 1m x 1m x 1m with mesh size 10 x 12 cm & Size 1m x 1m x 0.5m with mesh size 10 x 12 cm including packing, interlocking of stones & fusing top of gabion & tying to each other & laying to the required line, level and slope, section including all leads & lifts, conveying material from stack etc. complete as directed by Engineer-in-charge.
- **Discription**

This item includes of furnishing, assembling, and filling mechanically woven double twist hexagonal wire mesh gabions with rock as specified in the contract to the dimensions, lines and grades shown on the plans, or as determined by the engineer. These specifications are

mainly in accordance with Indian Standards IS 16014 and MORTH (Fifth Revision) 2013, Clause 2500.



Material Gabion

1. Wire

- All tests on the mesh, lacing wire and selvedge wire must be performed prior to manufacturing the mesh.
- Tensile strength: The wire used for the manufacture of Mesh shall have a tensile strength minimum 350 N/mm^2 in accordance with IS 280. Wire tolerances (Table below) shall be in accordance with IS 16014:2012 (Class T1).
- Elongation: Elongation shall not be less than 10%, in accordance with IS 16014:2012 and MoRTH (Fifth Revision) Clause 3100. Test must be carried out on a sample at least 20 cm long.

2. Internal Connecting Wires

- Cross Ties/ stiffener wire: Diameter 2.2 mm, Zn+ 10% Al alloy coated wire with PVC coating, 3.2mm when measured with PVC coating

3. Zn+ 10% Al alloy Coating

- Zn+ 10% Al alloy coating: Minimum quantities of Zn+ 10% Al alloy shall be as shown in table in following para no. 2.
- Adhesion of Zn+ 10% Al alloy coating: The adhesion of the Zn+ 10% Al alloy coating to the wire shall be such that, when the wire is wrapped ten turns around a mandrel having four times the diameter of the wire, it does not flake or crack when rubbing it with the bare fingers in accordance with IS 4826:1979.

4. PVC (Polyvinyl Chloride) Coating

PVC coating thickness: Nominal-0.5 mm, Minimum - 0.4 mm:

Specific weight: 1.3 kg/dm^3 1.35 kg/dm^3 in accordance with IS 13360, Part 3, section 1.

Hardness: between 50 and 60 Shore D, according to IS 13360, Part 5, section 11

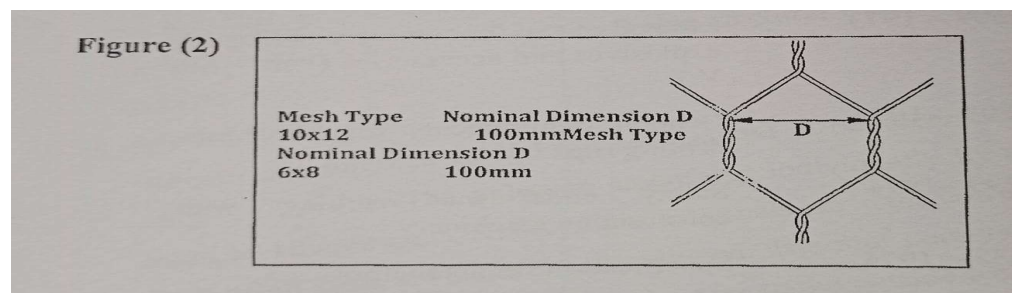
Tensile strength: Higher than 20.6 MPa, according to IS 13360, Part 5, section 1

Elongation at break: not less than 200% in accordance with IS 13360, Part 5, section 1.

5. Wire Mesh

- Mesh opening: Nominal Dimension $D = 100$, as per Fig. 2
- Tolerances in Mesh Opening size: 2% to +2% DT mesh shall have minimum 10 numbers of mesh openings per meter of mesh perpendicular to twist of mesh.
- Procedure for verification of mesh opening
 - a. Gabion Box/Mattress shall be unfolded on the plain ground,

- b. Any shrink in the unfolded Gabion Mesh shall be removed, by stretching the Mesh panel.
- c. Marking on the ground shall be made from the Centre of the twist of one mesh and the second. Marking shall be done at 1 m distance.
- d. The number of mesh Openings in the 1 m shall be counted & verified.



6. Tolerances

Wire: wire diameter tolerance and minimum Zn+ 10% Al alloy coating requirement shall be as per following table

Table

Wire Diameter mm	2.2 mm	2.7 mm	3.4 mm
Wire Tolerance +- mm	0.06	0.06	0.07
Minimum Qty of Zn+ 10% alloy (gm/m ²)	230	245	264

7. Tolerance in gabion dimensions

+ 5% in all dimensions (length, breadth and height) shall be allowed as tolerance for Gabion units.

8. Fabrication

Gabions shall be manufactured with all components mechanically connected at the production facility. The front, base, back and lid of the gabions shall be woven into a single unit. The ends and diaphragm(s) shall be factory connected to the base. The lid may be a separate piece made of the same type mesh as the basket. All perimeter edges of the mesh forming the basket and top, or lid, shall be selvedge with wire having a larger diameter.

Gabion is divided into cells by means of diaphragms positioned at approximately 1m centers. The diaphragms shall be secured in position to the base so that no additional lacing is necessary at the jobsite.

- **Construction Requirements**

Gabion filling and lacing and erection at site should be strictly as per the instruction of approved (by engineer) manufacturer's instructions as per the site specific requirements.

- **Assembly**

Gabions are supplied folded flat and packed in bundles. Larger units may be supplied in rolls. The units are assembled individually by erecting the sides, ends, and diaphragms, ensuring that all panels are in the correct position, and the tops of all sides are satisfactorily aligned. The four corners shall be connected first, followed by the internal diaphragms to the outside walls.

The procedure for using lacing wire consists of cutting a sufficient length of wire, and first looping and/or twisting the lacing wire to the wire mesh. Proceed to lace with alternating double and single loops through every mesh opening, pulling each loop tight and finally securing the end of the lacing wire to the wire mesh by looping and/or twisting. Refer figure 3.

- **Installation**

After initial assembly, the gabions are carried to their final position and are securely joined together along the vertical and top edges of their contact surfaces using the same connecting procedure(s) described earlier. Whenever a structure requires more than one layer, the upper empty baskets shall also be connected to the top of the lower layer along the front and back edges of the contact surface using the same connecting procedure(s) described in Section assembly.

ITEM WISE SPECIFICATION

ITEM No 1: Clearing and grubbing road land including uprooting rank vegetation grass bushes, shrubs, sapling and trees girth up to 300 mm removal of stumps of trees cut earlier and disposal of unserviceable materials (C) By mechanical means in area of light jungle.

MORTH Vth REVISION Cl. No. 200 Pg No. 37

201.1 scope

This work shall consist of cutting, removing and disposing of all materials such as trees, bushes, shrubs, stumps, roots, grass, weeds, rubbish, top organic soil, etc. to an average depth of 150 mm in thickness, which in the opinion of the Engineer are unsuitable for incorporation in the works, from the area of road land containing road embankment, drains, cross-drainage structures and such other areas as may be specified on the drawings or by the Engineer. It shall include necessary excavation, backfilling of pits resulting from uprooting of trees and stumps to required compaction, handling, salvaging, and disposal of cleared materials with all leads and lifts. Clearing and grubbing shall be performed in advance of earthwork operations and in accordance with the requirements of these Specifications.

201.2 preservation of property/amenities

Roadside trees, shrubs, any other plants, pole lines, fences, signs, monuments, buildings, pipelines, sewers and all highway facilities within or adjacent to the highway which are not to be disturbed shall be protected from injury or damage. The Contractor shall provide and install at his own cost, suitable safeguards approved by the Engineer for this purpose.

During clearing and grubbing, the Contractor shall take all adequate precautions against soil erosion, water pollution, etc., and where required, undertake additional works to that effect vide Clause 306. Before start of operations, the Contractor shall submit to the Engineer for approval, his work plan including the procedure to be followed for disposal of waste materials, etc., and the schedules for carrying out temporary and permanent erosion control works as stipulated in Clause 306.3.

201.3 Methods, tools and equipment

Only such methods, tools and equipment as are approved by the Engineer and which will not affect any property to be preserved shall be adopted for the Work. If the area has thick vegetation/roots/trees, a crawler or pneumatic tyred dozer of adequate capacity may be used for clearance purposes. The dozer shall have ripper attachments for removal of tree stumps. All trees, stumps, etc., falling within excavation and fill lines shall be cut to such depth below ground level that in no case these fall within 500 mm of the bottom of the subgrade. Also, all vegetation such as roots, under-growth, grass and other deleterious matter unsuitable for incorporation in the embankment/subgrade shall be removed between fill lines to the satisfaction of the Engineer. All branches of trees extending above the roadway shall be trimmed as directed by the Engineer.

All excavations below the general ground level arising out of the removal of trees, stumps, etc., shall be filled with suitable material and compacted thoroughly so as to make the surface at these points conform to the surrounding area.

Ant-hills both above and below the ground, as are liable to collapse and obstruct free subsoil water flow shall be removed and their workings, which may extend to several metres, shall be suitably treated.

201.4 disposal of Materials

All materials arising from clearing and grubbing operations shall be taken over and shall be disposed of by the Contractor at suitable disposal sites with all leads and lifts. The disposal shall be in accordance with local, State and Central regulations

201.5 Measurements for payment

Clearing and grubbing for road embankment, drains and cross-drainage structures shall be measured on area basis in terms of hectares. Cutting of trees up to 300 mm in girth and removal of their stumps, including removal of stumps up to 300 mm in girth left over after trees have been cut by any other agency, and trimming of branches of trees extending above the roadway and backfilling to the required compaction shall be considered incidental to the clearing and grubbing operations. Clearing and grubbing of borrow areas shall be deemed to be a part of works preparatory to embankment construction and shall be deemed to have been included in the rates quoted for the embankment construction item and no separate payment shall be made for the same.

Ground levels shall be taken prior to and after clearing and grubbing. Levels taken prior to clearing and grubbing shall be the base level and will be accordingly used for assessing the depth of clearing and grubbing and computation of quantity of any unsuitable material which is required to be removed. The levels taken subsequent to clearing and grubbing shall be the base level for computation of earthwork for embankment.

Cutting of trees, excluding removal of stumps and roots of trees of girth above 300 mm shall be measured in terms of number according to the girth sizes given below

- i) Above 300 mm to 600 mm
- ii) Above 600 mm to 900 mm
- iii) Above 900 mm to 1800 mm
- iv) Above 1800 mm

Removal of stumps and roots including backfilling with suitable material to required compaction shall be a separate item and shall be measured in terms of number according to the sizes given below:

- i) Above 300 mm to 600 mm
- ii) Above 600 mm to 900 mm
- iii) Above 900 mm to 1800 mm
- iv) Above 1800 mm

For the purpose of cutting of trees and removal of roots and stumps, the girth shall be measured at a height of 1 m above ground or at the top of the stump if the height of the stump is less than one metre from the ground.

201.6 Rates

201.6.1 The Contract unit rates for the various items of clearing and grubbing shall be payment in full for carrying out the required operations including full compensation for all labour, materials, tools, equipment and incidentals necessary to complete the work. These will also include removal of stumps of trees less than 300 mm girth excavation and back filling to required density, where necessary, and handling, giving credit towards salvage value disposing of the cleared materials with all lifts and leads. Clearing and grubbing done in excess of 150 mm by the Contractor shall be made good by the Contractor at his own cost as per Clause 301.3.3 to the satisfaction of the Engineer prior to taking up earthwork. Where clearing and grubbing is to be done to a level beyond 150 mm, due to site considerations, as directed by the Engineer, the extra quantity shall be measured and paid separately.

201.6.2 The Contract unit rate for cutting trees of girth above 300 mm shall include handling, giving credit towards salvage value disposing of the cleared materials with all lifts and leads.

201.6.3 The Contract unit rate for removal of stumps and roots of trees girth above 300 mm shall include excavation and backfilling with suitable material to required compaction, handling, giving credit towards salvage value disposing of the cleared materials with all lifts and leads.

201.6.4 The Contract unit rate is deemed to include credit towards value of usable materials, salvage value of unusable materials and off-set price of cut trees and stumps belonging to the Forest Department. The off-set price of cut trees and stumps belonging to the Forest Department shall be deducted from the amount due to the Contractor and deposited with the State Forest Department. In case the cut trees and stumps are required to be deposited with the Forest Department the Contractor shall do so and no deduction towards the off-set price shall be affected. The offset price shall be as per guidelines / estimates of the State Forest Department.

201.6.5 Where a Contract does not include separate items of clearing and grubbing, the same shall be considered incidental to the earthwork items and the Contract unit prices for the same shall be considered as including clearing and grubbing operations.

ITEM No 2: Demarcation 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 on both sides of 0.30 m. x 0.30M. Including supplying of labours and all materials for every work etc complete.

109 Setting out (MORTH Vth REVISION Cl. No. 109 Pg No. 11)

109.1 The Contractor shall establish working bench marks tied with the Reference bench mark in the area soon after taking possession of the site. The Reference bench mark for the area shall be as indicated in the Contract Documents and the values of the same shall be obtained by the Contractor from the Engineer. The working bench marks shall be at the rate of four per km and also at or near all drainage structures, over-bridges and underpasses. The working bench marks/levels should be got approved from the Engineer. Checks must be made on these bench marks once every month and adjustments, if any, got approved from the Engineer and recorded. An up-to-date record of all bench marks including approved adjustments, if any, shall be maintained by the Contractor and also a copy supplied to the Engineer for his record.

109.2 The lines and levels of formation, side slopes, drainage works, carriageways and shoulders shall be carefully set out and frequently checked, care being taken to ensure that correct gradients and cross-sections are obtained everywhere.

109.3 In order to facilitate the setting out of the works, the centre line of the carriageway or highway must be accurately established by the Contractor and approved by the Engineer. It must then be accurately referenced in a manner satisfactory to the Engineer, at every 50 m intervals in plain and rolling terrains and 20 m intervals in hilly terrain and in all curve points as directed by the Engineer, with marker pegs and chainage boards set in or near the fence line, and a schedule of reference dimensions shall be prepared and supplied by the Contractor to the Engineer. These markers shall be maintained until the works reach finished formation level and are accepted by the Engineer.

109.4 On construction reaching the formation level stage, the centre line shall again be set out by the Contractor and when approved by the Engineer, shall be accurately referenced in a manner satisfactory to the Engineer by marker pegs set at the outer limits of the formation.

109.5 No reference peg or marker shall be moved or withdrawn without the approval of the Engineer and no earthwork or structural work shall commence until the centre line has been referenced.

109.6 The Contractor will be the sole responsible party for safe-guarding all survey monuments, bench marks, beacons, etc. The Engineer will provide the Contractor with the data necessary for setting out the centre line. All dimensions and levels shown on the drawings or mentioned in documents forming part of or issued under the Contract shall be verified by the Contractor on the site and he shall immediately inform the Engineer of any apparent errors or discrepancies in such dimensions and levels. The Contractor shall, in connection with the staking out of the centre line, survey the terrain along the road and shall submit to the Engineer for his approval, a profile along the road centre line and cross-sections at intervals as required by the Engineer.

The construction staking shall be done by personnel who are trained and experienced in construction layout and staking of the type and kind required in the Contract.

Field notes shall be kept in standard, bound field notebooks as approved by the Engineer. Field notes shall be subject to inspection by the Engineer and shall be the property of the Employer.

The Contractor shall correct any deficient staking or construction work which resulted from inaccuracies in the staking operations or from the Contractor's failure to report inaccuracies in the plans or survey data furnished by the Department.

109.7 After obtaining approval of the Engineer, work on earthwork can commence. The profile and cross-sections as per Section 305, shall form the basis for measurements and payment. The Contractor shall be responsible for ensuring that all the basic traverse points are in place at the commencement of the contract and, if any, are missing, or appear to have been disturbed, the Contractor shall make arrangements to re-establish these points. A "survey File" containing the necessary data will be made available for this purpose. If in the opinion of the Engineer, design modifications of the centre line or grade are advisable, the Engineer will issue detailed instructions to the Contractor and the Contractor shall perform the modifications in the field, as required, and modify the ground levels on the cross-sections 639 Section 600 Concrete Pavement accordingly as many times as required. There will be no separate payment for any survey work performed by the Contractor. The cost of these services shall be considered as being included in the rate of the items of work in the Bill of Quantities.

109.8 Precision automatic levels, having a standard deviation of ± 2 mm per km, and fitted with micrometre attachment shall be used for all double run levelling work. Setting out of the road alignment and measurement of angles shall be done by using Total Station with traversing target, having an accuracy of one second. Measurement of distances shall be done preferably using precision instruments like Distomat.

109.9 The work of setting out shall be deemed to be a part of general works preparatory to the execution of work and no separate payment shall be made for the same.

ITEM No 3 : Fabrication & Installation of a steel portable barricade with horizontal rail 300 mm wide, 2.5 m in length fitted on a 'A' frame made with 45 x 45 x 5 mm angle iron section, 1.5 m in height, horizontal rail painted (2 coats) with yellow and white stripes, 150 mm in width at an angle of 45°, 'A' frame painted with 2 coats of yellow paint, complete as per IRC:SP:55-2001

1. The relevant Specification for item description shall apply to this item.
2. The measurement shall be based on Nos. of barricade for barricading sheet
3. The rate includes labours, material, equipment, shifting of barricading as per requirement of progress of work and removal the same after completion of work
4. The mode of payment for this item shall be on **Nos.** basis

ITEM No 4: Dismantling of Cement Concrete Pavement (Dismantling of cement concrete pavement by mechanical means using pneumatic tools, breaking to pieces not exceeding 0.02 cum in volume and stock piling at designated locations and disposal of dismantled materials up to a lead of 1000 metres, stacking serviceable and unserviceable materials separately)

Dismantling of cement concrete pavement by mechanical means using pneumatic tools, breaking the concrete into pieces not exceeding 0.02 Cum in volume, stockpiling at designated locations, and disposing of dismantled materials up to a lead of 1000 metres, with serviceable and unserviceable materials stacked separately.

The item shall be executed as per the item description and the instructions of the Engineer-in-Charge and/or his authorized representative.

The rate shall be inclusive of all labour, machinery, tools, equipment, transportation, handling, loading, unloading, stacking, disposal of dismantled material within the specified lead, and all other incidental expenses required for satisfactory completion of the work.

The work shall be carried out using suitable machinery as per site requirements.

No extra payment shall be made for any additional lead, lift, handling, loading, unloading, transportation, or disposal of dismantled material beyond what is deemed necessary for completion of the item. The contractor shall be deemed to have considered all such requirements while quoting the rate.

The mode of payment for this item shall be on **Cubic Metre (Cum)** basis.

ITEM No 5: Excavation for foundation in sand, gravel, clay soft soils and murrum etc. including shoring, strutting dewatering as necessary and disposing of the excavated stuff as directed. (A) Depth unto 3.0 M. and lead up to 100m for 10 Cum

The excavation in foundation shall be carried out in true line and level and shall have the width and depth as shown in the drawings or as directed. The Bidders shall do the necessary shoring and shutting or providing necessary slopes to a safe angle, at his own-cost. The payment for such precautionary measures shall be paid separately if not specified. The bottom of the excavated area shall be 1 evened both longitudinally and transversely. as directed by removing and watering as required. No earth filling will be allowed for bringing it to level, if mistake or any other reason excavation is made. deeper or wider than shown on the plan or directed. The extra depth or width shall be made up with concrete of same proportion as specified for the foundation concrete at the cost of the Bidders. The excavation up to 3.0 M. depth shall be measured under this item.

Disposal of the excavated stuff:

The excavated stuff of the selected type shall be used in filling the trenches and plinth or levelling the ground in layer including ramming and watering etc. The balance of the excavated quantity shall be removed by the Bidders from the site of work to a place as directed with lead up to 100 M. and all lift.

Mode of measurement and payment:

The measurement of excavation in trenches for foundation shall be made according to the sections of trenches shown on the drawing or as per sections given by the Engineer-in-charge. No payment shall be made for surplus excavation made in excess of above requirements or due to slopping and sloping back as found necessary on account of conditions of soil, and requirements of safety.

The Item shall be carried as per Item Description in tender document and as Per prevailing latest IS & IRC Code & General Specification booklet and as per instruction of Engineer-in-Charge and/or his authorized representative.

No separate or extra payment shall be made for dumping, disposal, spreading, levelling, transportation, handling, or any other activity related to the excavated material, whether reusable or surplus. The contractor shall make his own arrangements for disposal of excess excavated material as directed by the Engineer-in-Charge, and the cost thereof shall be deemed to be included in the quoted rate of the item.

The mode of payment for this item shall be on **Cmt.** basis

ITEM No 6 Excavation in large boulders and soft rock by welding including shoring, shuttering and dewatering as necessary and disposing of the excavated stuff as directed.

1. The Relevant Specification of Item No. 8 shall apply to this item.
2. The measurement and payment shall be in Cu.m basis.

ITEM No 7 Providing and laying controlled cement concrete M.150 for curing complete excluding cost of formwork and reinforcement for reinforced concrete work in (A) Foundations, footings, Base of columns and Mass concrete.

1. The relevant specifications given for machine mixed plain cement concrete M15 grade as per Section -1500, 1700 & 2100 of MORT&H fifth revision specification.
2. The measurement & payment 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.

ITEM No 8 Filling available excavated earth (excluding rock) in trenches. Plinth, sides of foundations etc. in layers not exceeding 20 cm. in depth consolidating each deposited layer by ramming and watering.

1. The filling material shall be coarse, granular, clean, free from dust and deleterious matters obtained from a source as approved by the Engineer-in-charge.
2. For a trenches, plinth, sides of foundations shall be filled in suitable layers not exceeding 20 cms. at a time and each layer shall be well compacted.
3. **No extra payment shall be made for procurement, loading, unloading, transportation, lead, lift, handling, spreading, watering, compaction, or any other operation required for proper filling and consolidation of the earthwork.**
4. Mode of measurement shall be the total cubical content (in **cmt.**) of the area covered by sand filling.

ITEM No 9 Providing and supplying mechanically double twisted highly galvanized with (PVC) poly chloride coating gabions made of mesh size 10 x 12 mm woven wire as per ASTHMA 10 x 12 mm woven wire as per ASTHMA 975-97, Size of gabion 1 m x 1 m x 1m including providing and laying stones in the gabions and arranging them in a required manner in the section of break water or such other structure including quarrying, blasting, loading at quarry site to transporting at work site and arranging in the gabion in workman like manner with required layer thickness and arranging this gabions in required layers with the crane if required capacity (if required as per drawings or as directed) with all material, labours, tools etc. comp,

This work shall consist of furnishing, assembling, and filling mechanically woven double twist hexagonal wire mesh gabions with rock as specified in the contract to the dimensions, lines and grades shown on the plans, or as determined by the engineer. These specifications are mainly in accordance with International Standards EN 10223& EN 10244.

1.0 Material Specification as Per M-16 & M-92

2.1 Mechanically Woven Wire Mesh Gabions

2.1.1 Wire

All tests on the mesh wire, lacing wire and selvedge wire must be performed prior to manufacturing the mesh.

Tensile strength: The wire used for the manufacture of mesh shall have a tensile strength minimum 380-550 N/mm² in accordance with EN 10223-3.

Elongation: Elongation shall not be less than 10%, in accordance with EN 10223-3. Test must be carried out on a sample at least 25 cm long.

Cross Ties/ stiffener wire: Galvanized wire diameter 2.2 mm, and with Polymeric coating, 3.2 mm when measured with Polymeric coating

2.1.2 Metallic coating:

The wire shall have minimum quantities of metallic coating given in

Accordance with IS 4826 and Zn Al alloy coating has been given as per Table 1

Ageing and corrosion resistance

1. Zinc metallic coating- When subjected to test in a sulphur dioxide environment according to the procedures in ISO 6988 (0,2 dm³ SO₂ per 2 dm³ water) after 14 cycles of discontinuous test, the mesh samples surface shall not show more than 5 % of DBR (Dark Brown Rust).

When subjected to the neutral salt spray test according to the procedures in ISO 9227 after a period of 500 h of exposure, the mesh sample surface shall not show more than 5 % of DBR.

2. 95% Zn+ 5%Al - When subjected to test in sulphur dioxide environment according to procedures in ISO 6988 after 28 cycles of discontinuous test, the test samples shall not show more than 5% of DBR (Dark Brown Rust). When subjected to the neutral salt spray test according to the procedures in ISO 9227 after a period of 1000 hr of exposure, the mesh samples shall not show more than 5 % of DBR.

3. 90% Zn+ 10%Al - When subjected to test in sulphur dioxide environment according to procedures in ISO 6988 after 56 cycles of discontinuous test, the test samples shall not show more than 5% of DBR (Dark Brown Rust). When subjected to the neutral salt spray test according to the procedures in ISO 9227 after a period of 2000 hr of exposure, the mesh samples shall not show more than 5 % of DBR.

Adhesion of metallic coating: The adhesion of the zinc coating to the wire shall be such that, when the wire is wrapped six turns around a mandrel having four times the diameter of the wire, it does not flake or crack when rubbing it with the bare fingers in accordance with EN 10244-1 and IS 4826

**Table 1 Minimum Mass of Metallic Coating for Heavily Coated,
Soft Type for Different Wire Sizes Used in Gabion and revet Mattresses**

Sr. No	Nominal Diameter of Galvanized Wire mm	Mass of Zinc/Zinc Alloy coating g/m²	Permitted Tolerances on wire diameters mm
1	2.00	240	±0.05
2	2.20	240	±0.06
3	2.40	260	±0.06
4	2.70	260	±0.07
5	3.00	270	±0.08
6	3.40	270	±0.09
7	3.90	280	±0.10

2.1.3 PVC (Polyvinyl Chloride) Coating

The technical characteristics and the resistance of the PVC to ageing shall meet the relevant standards. All tests on the PVC must be performed prior to manufacturing the mesh PVC coating thickness: Nominal – 0.5 mm, Minimum – 0.4mm;
 Specific weight: 1.3 kg/dm³ – 1.35 kg/dm³ in accordance with IS 13360 (Part 3) /ISO 1183.
 Hardness: between 50 and 60 Shore D, according to IS 13360 (Part 5)/ ISO 868.
 Tensile strength: Not less than 20.6 MPa when tested in accordance with IS 13360 (Part 5) /ISO 527. Elongation at break: not less than 200% in accordance with ISO 527.
 Resistance of PVC coating to sodium chloride solution — When PVC coated wire is tested in accordance with IS 16014, there shall be no loss of mass
 Salt spray exposure — The PVC shall show no effect after 3000 h of salt spray exposure in accordance with IS 13360 (Part 8)/ ISO 9227

2.1.4 Mess Opening

Mechanically woven wire mesh has mesh opening as show in Fig. 2b. Mesh opening for different mesh type is shown in Table 2

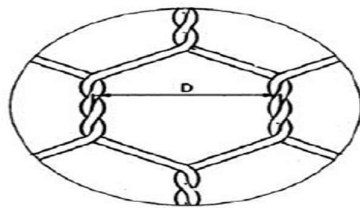


Fig. 2b: Mesh Type and Nominal Size (D)

Table 2 Mesh Opening Size

Mesh Type	'D' Mesh Opening Nominal Size (mm)	Tolerance (%)
6 X 8	60	0 to +8
8 X 10	80	0 to +12
10 X 12	100	-4 to +12

Table 3 Technical Specification of Gabion [4]

Sr. No.	Characteristics	Mesh Type					
		10x12			8x10		
		Only Zn / Zn Al alloy		Zn / Zn Al alloy + Polymer coated	Only Zn / Zn Al alloy		Zn / Zn Al alloy + Polymer coated
1	Mesh wire dia,mm	2.70	3.00	2.70/3.70 (ID/OD)*	2.70	3.00	2.7/3.7(ID/OD)*
2	Edge/Selvedge wire dia,mm	3.40	3.90	3.40/4.40(ID/OD)*	3.40	3.90	3.40/4.40(ID/OD)*
3	Lacing wire dia,mm	2.20	2.20	2.20/3.20(ID/OD)*	2.20	2.20	2.20/3.20(ID/OD)*
4	Polymeric coating thickness, mm	NA		Nominal 0.50, Minimum-0.40			Nominal-0.50, Minimum-0.40
5	Typical sizes-Length x Width x Height (in meter) (Number of diaphragms)	4x1x1(3 Nos), 3x1x1(2 Nos), 2x1x1(1Nos), 1.5x1x1(0 Nos), 2x1x0.5(1 Nos), 3x1x0.5(2 Nos), 4x1x0.5(3 Nos), 2x1x0.3(1 Nos), 3x1x0.3(2 Nos), 4x1x0.3(3 Nos)					
6	Tolerance in size of gabion box	Length and Width ±5 percent; Height >0.3 m ±5 percent; Height≤0.3m ±10 percent;					

* ID/OD - Internal diameter/Outer diameter of Polymer coated wire

Table 4: Technical Specification of Revet Mattresses [4]

Sr. No.	Characteristics	Mesh Type	
		6x8	
		Only Zn / Zn Al alloy	Zn / Zn Al alloy + Poly coated
1	Mesh wire dia, mm	2.20	2.20/3.20 (ID/OD)*
2	Edge/Selvedge wire dia, mm	2.70	2.70/3.70(ID/OD)*
3	Lacing wire dia,mm	2.20	2.20/3.20(ID/OD)*
4	Polymeric coating thickness, mm	NA	Nominal-0.50, Minimum-0.40
5	Typical sizes-Length x Width x Height (in meter) (Number of diaphragms)	4x2x0.17(3Nos), 3x2x0.17(2 Nos), 2x2x0.17(1 No), 4x2x0.23(3 Nos), 3x2x0.23(2 Nos), 2x2x0.23(1Nos), 4x2x0.30(3 Nos), 3x2x0.30(2 Nos), 2x2x0.30(1 No)	
6	Tolerance in size of gabion box	Length and Width...±5 percent; Height≤0.3 m.....±10 percent	

* ID/OD - Internal diameter/Outer diameter of Polymer coated wire

4.0 Tests and Standard of Acceptance

Gabion and revert mattress mesh and materials shall be tested in accordance with procedure outline below and IS 16014 and shall meet prescribed criteria mentioned in Table 5.

Quality Control Tests for Wire Gabions:

- Within 10 days of receipt of work order the contractor shall submit Three specimen wire gabion along with each wire of 3 mt length from which gabions are manufactured conforming to specification laid to Engineer-in charge for approval.
- The contractor shall arrange for testing of Specimen gabion at approved lab by Engineer in Charge in presence of authorized representative of Government of Gujarat / Third party inspection / Quality Control approved equivalent certifying agency for conforming the following according to laid specifications :
 - Mesh Strength
 - Diameter of wire for mesh, selvedge border and lacing
 - Tensile strength
 - Galvanization
 - Physical dimension of gabion
 - Mesh size
 - PVC coating thickness
- After the tests described in 1 above are found satisfactory and the specimen gabion is found acceptable the Engineer-in-charge shall permit the contractor to use of wire gabions needed for the work.
- Every **1000 Nos.** of wire gabion shall deemed to be a lot. A representative wire gabion shall be selected from the lot by authorized representative of Government of Gujarat/ Third party inspection / Quality Control and the same shall be none destructively tested for conforming wire diameter, physical dimensions and mesh size at site.
- Three gabion from every 1000 Nos. received on site shall be selected for tests described in 1 at approved laboratory in presence of authorized representative of Government of Gujarat / Third party inspection / Quality Control.**
- The contractor shall bear all the expenses for transportation of sample at laboratories as specified by Engineer in Charge.

7. The contractor shall provide supply wire of each diameter of **3.0 m length for tensile test for each lot of 1000 number of gabion or part thereof.**
8. **If less than 1000 nos. of wire gabion is to be used in the work then testing should be done as per the discretion and instructions of the engineer in charge.** However, Material test certificate of materials supplied by the manufacturer shall have to be produced by the contractor at his own expenses.
9. The contractor shall provide 3.0 mt long wire of each diameter for tests shown in Table-1 for each lot of 1000 Nos of gabion.

Certification:

Material test certificate of materials supplied by the manufacturer shall be produced by the contractor. The certificate shall mention that the material meets the contract specification.

4.1 Tensile Strength of Wire Mesh Panel

The wire mesh specimens shall be representative of proper field construction as to materials, mesh geometry, and workmanship, and shall be as large as practical to minimize the effect of variations. The tests shall be run with the load applied parallel to the axis of the twist and repeated on a separate test specimen with the load applied perpendicular to the axis of the twist.

Place the mesh into the machine grips such that the gripped mesh will be maintained in the mesh geometry characteristic of field use. The specimen of approximately 0.8 m width and 0.5 m height shall be tested. The effective width to be considered for test specimen shall be the distance between two extreme gripping points. The specimen should extend by at least one mesh repetition beyond the extreme gripping points on either side. However, specimen should not extend more than two mesh repetitions beyond extreme gripping points. The mesh shall be pre-loaded to 10% of the specified minimum strength and machine head travel stopped. The mesh gauge dimensions shall be recorded at this time and taken as the initial dimensions of the specimen where such dimensions are required. If the sample slips at any of the gripping point during the test, such a test shall be discarded and a new sample shall be taken. The loading shall then continue uniformly maintaining the displacement rate of 75 to 100 mm per minute, until first fracture or unwrapping of an individual wire in the system occurs. The distortion of the mesh or changes in gauge length shall be measured to accuracy consistent with reporting the percentage elongation to the nearest 0.5%

Punch Test

The punch test could be done using two different apparatus.

1) Pre-Tensioned Punch Test

An uncut section of 1.82 m in length (unselvaged) and not less than 0.91 m in width shall have the ends securely clamped for 0.91 m along the width of the sample. When the width of the section under test exceeds 0.91 m, the clamps shall be cantered along the width and the excess width will be allowed to fall free on each side of the clamped section. The sample shall then be subjected to tension sufficient to cause 10% elongation of the sample section between the clamps. After elongation and while clamped as described above (and otherwise unsupported), the section shall be subjected to a load over 960 cm² of area applied to the approximate center of the sample section between the clamps and in a direction perpendicular to the direction of the tension force.

2) Secured Punch Test

An uncut section of 1.24 m in length and not less than 0.9 m in width (selvaged), including all selvage bindings, shall have the sides and the ends securely clamped at every mesh opening to a rigid frame. After being secured as described above, the section shall be

subjected to a load over 960 cm² applied to the approximate center of the sample section between the clamps and in a direction perpendicular to the direction of the tension force.

The sample shall withstand, without rupture of any strand or opening of any mesh fastening, an actual load applied by means of a circular ram at a uniform rate not to exceed 220 N/s equalling or exceeding the values shown in Table 5. The ram head used in the test shall be circular with a 350 mm diameter and have its edges bevelled or rounded to prevent cutting of the wire strands.

Pull-Apart Resistance Test

A set of two identical rectangular gabion panels, each with a width about 10½ mesh openings along a selvedge wire, shall be joined by properly installed wire fasteners along the two selvedge wires so that each fastener confines two selvedge and two mesh wires. If the fasteners are also to be used to join two individual empty gabion baskets, two additional selvedge wires that are each mechanically wrapped with mesh wires shall be included so that each fastener confines four selvedge and four mesh wires. The set of the jointed panels shall be subject to pull-apart resistance test. The specimen shall be mounted on a loading machine with grips or clamps such that the panels are uniformly secured along the full width. The grips or clamps shall be designed to only transmit tension forces. The load will then be applied at a uniform rate not to exceed 220 N/s until failure occurs. The failure is defined as when the maximum load is reached and a drop of strength is observed with subsequent loading or alternately the opening between any two closest selvedge wires, applicable to a fastener confining either two or four selvedge wires, becomes greater than 50 mm at any place along the panel width. The strength requirements of the jointed panels at failure shall be as shown in Table 5

Table 5 Minimum Strength Requirements of Mesh and Connections

Mesh Type	10x12		8x10		6x8	
Characteristics	Only Zn / Zn Al alloy	Zn / Zn Al alloy + Poly coated	Only Zn / Zn Al alloy	Zn / Zn Al alloy + Poly coated	Only Zn / Zn Al alloy	Zn / Zn Al alloy + Poly coated
Wire Mesh Dia (mm)	2.7	3.0	2.7	3.0	2.7	2.2
Tensile strength parallel to twist (kN/m)	32.0	40.0	32.0	51.1	42.3	33.6
Tensile strength perpendicular to twist (kN/m)	15.4	20.5	15.4	26.3	20.4	13.1
Connection to selvedges (kN/m)	10.2	11.22	10.2	20.4	16.32	10.2
Panel to panel connection using lacing wire or fasteners (kN/m)	10.2	11.22	10.2	20.4	16.32	10.2
Punch strength	17.8	19.58	17.8	26.7	21.36	17.8

(kN)							
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4.0 Fabrication

Gabions shall be manufactured with all components mechanically connected at the production facility. The front, base, back and lid of the gabions shall be woven into a single unit. The ends and diaphragm(s) shall be factory connected to the base. The lid may be a separate piece made of the same type mesh as the basket. All perimeter edges of the mesh forming the basket and top, or lid, shall be mechanically selvedge with wire having a larger diameter.

Gabion is divided into cells by means of diaphragms positioned at approximately 1m centres. The diaphragms shall be secured in position to the base so that no additional lacing is necessary at the jobsite.

5.0 Rocks for Filling the Gabion

An unweathered (sound) naturally occurring angular or crushed hard rock material can be used for filling. Stone for the Gabion facia shall be hard, angular to round, durable and of such quality that they shall not disintegrate on exposure to water or weathering during the life of the structure. The minimum size of the rock to be filled in the boxes is governed by the mesh opening "D" in the mesh as shown in Fig. 2b. The minimum and maximum size of the stone used for filling shall be 1.5 to 2.5 times the mesh opening. Each range of sizes may allow for a variation of 5% oversize rock by number of particles, or 5% undersize rock by number of particles, or both. The rock pieces should be properly hand-placed and packed with their larger dimensions in the horizontal position. The size of any oversize rock shall allow for the placement of minimum of three layers of rock must be achieved when filling the 1 m high units and a minimum of two layers for the 0.50 m high gabion units and 0.3m thick gabion mattress

Table 6 Properties of Rock to be fill in Gabion

Sr No.	Properties of Rockfill	Values
1	Minimum and Maximum size of stone	1.5 to 2.5 times mesh opening
2	Tolerance on size of stone	± 5%.
3	Minimum density	22kN/m ³
4	Los Angeles abrasion value	Not more than 45

Minimum density and Los Angeles abrasion can be changed by designer based on availability of the rock in the area. Stones shall be of approved quality and source as approved by the Engineer-in-Charge (EIC). **The rate shall include all costs** towards procurement, loading, unloading, transportation, lead, lift, handling, and placement of stones. No extra payment shall be made for any additional lead or transportation distance involved in bringing the stones to the work site.

6.0 Construction Requirements

Gabion filling and lacing and erection at site should be strictly as per the instruction of approved (by engineer) manufacturer's instructions as per the site-specific requirements. The manufacturer should satisfy the eligibility criteria

6.1 Assembly

Gabions are supplied folded flat and packed in bundles. Larger units may be supplied in rolls. The units are assembled individually by erecting the sides, ends, and diaphragms, ensuring that all panels are in the correct position, and the tops of all sides are satisfactorily aligned.

The four corners shall be connected first, followed by the internal diaphragms to the outside walls. All connections should use lacing wire as described in above section.

The procedure for using lacing wire consists of cutting a sufficient length of wire, and first looping and/or twisting the lacing wire to the wire mesh. Proceed to lace with alternating double and single loops through every mesh opening, pulling each loop tight and finally securing the end of the lacing wire to the wire mesh by looping and/or twisting.

6.2 Installation

After initial assembly, the gabions are carried to their final position and are securely joined together along the vertical and top edges of their contact surfaces using the same connecting procedure(s) described in Section 6.1. Whenever a structure requires more than one layer, the upper empty baskets shall also be connected to the top of the lower layer along the front and back edges of the contact surface using the same connecting procedure(s) described in Section 6.1

6.3 Filling

Gabions shall be filled with rock as specified in Section 5.0 . During the filling operation some manual stone placement is required to minimize voids. The exposed faces of vertical structures may be carefully hand placed to give a neat, flat, and compact appearance. The cells shall be filled in stages so that local deformation may be avoided. That is, at no time shall any cell be filled to a depth exceeding (0.30 m) higher than the adjoining cell. It is also recommended to slightly overfill the baskets to allow for settlement of the rock. Behind gabion walls, compact the backfill material simultaneously to the same level as the filled gabions

6.3.1 1m High Gabions

1-meter-high gabions shall be filled in three layers, 300 mm at a time. Connecting wires shall be installed after the placement of each layer, that is, at 300 mm high.

6.3.2 0.5m High Gabions

0.5-meter-high gabions do not require connecting wires unless the baskets are used to build vertical structures. In some cases, these units shall be filled in two layers 250mm at a time. Connecting wires shall be installed after the placement of the first layer, which is at 250mm high.

6.3.3 Internal Connecting Wires

Internal connecting wires should be used when a structure requires layers of gabions to be stacked on top of each other. Internal Connecting Wires shall connect the exposed face of a cell to the opposite side of the cell. An exposed face is any side of a gabion cell that will be exposed or unsupported after the structure is completed. Lacing wire or prefabricated internal connecting wires may be used.

6.3.4 Lid Closing

Once the gabion baskets are completely full, the lids will be pulled tight until the lid meets the perimeter edges of the basket. The lid must then be tightly laced and/or fastened along all edges, ends and tops of diaphragm(s) in the same manner as described in above section.

6.3.5 Mesh cutting and folding

Where shown on the drawings or otherwise directed by the engineer, the gabions shall be cut, folded and fastened together to suit existing site conditions. The mesh must be cleanly cut and surplus mesh either folded back or overlapped so that it can be securely fastened together with lacing wire or fasteners in the manner described in above section. Any reshaped gabions shall be assembled, installed, filled and closed as specified in the previous sections.

No separate or extra payment shall be made on account of any additional lead, lift, loading, unloading, transportation, handling, stacking, re-handling, crane operation, or movement of materials including stones, gabion boxes, or any other material required for completion of the work. The contractor shall be deemed to have inspected the site conditions and considered all such costs while quoting the rate for the item.

The measurement and payment shall be in **Cu.m** basis.

ITEM No 10 Providing & fixing of polyester needle punched non-woven geotextile as separator/filter media below replaced fill and behind gabion as per MoRTH 700 Type-III geotextile. The width of geotextile roll shall not be less than 4.5 m, at easily accessible location including top and bottom, with all leads and lifts, manpower and machinery, materials, labour etc. complete and as directed by Engineer - In - Charge and approved drawings. (Maccaferri or Techfeb or Equivalent)

701.1 Application and General Requirements

The specification covers the various applications of geosynthetic materials for use in road and bridge works including supplying and laying as per contract specifications.

Geosynthetic is a general classification for all synthetic materials used in geotechnical engineering application. It includes geotextiles, geogrids, geo-strips, geomembranes, geonets, geo composites, geocells, geosynthetic mats, paving fabric and glass grid etc. Geo fabrics made from natural fibres such as jute, and coir referred to herein under natural geotextiles may also be used in different geotechnical engineering applications.

Geotextiles: Any permeable synthetic textile used with foundation, soil, rock, earth, or any other geotechnical engineering-related material as an integral part of a human-made project, structure, or system. The geotextile fabric shall be a non-woven fabric consisting of long-chain polymeric filaments or yarns such as polypropylene, polyethylene or polyester or any combination thereof, formed into a stable network such that the filaments or yarns retain their relative position to each other. There are several application areas for geotextiles requiring specific functions namely separation, filtration, drainage, reinforcement or a combination thereof.

701.2 Testing, Certification and Acceptance

701.2.1 Geosynthetic Materials Shall be Tested and Certified in the Following Manner.

- a) The manufacturer shall have ISO or CE certification for manufacturing process and quality control.
- b) The manufacturer shall provide manufacturer's test certificate for every lot supplied from the factory.
- c) The supplier shall provide third party test reports from an independent laboratory with valid accreditation for all the test values in Manufacturer's test certificate.

701.2.2 Geosynthetics shall be tested in accordance with tests prescribed by BIS. In absence of IS codes, tests prescribed either by ASTM, EN, BS or ISO shall be conducted.

701.2.3 The material shall meet the requirements as specified in the contract.

701.3 Marking

Geosynthetic rolls shall be marked with the following information:

- a) Manufacturer's name
- b) Roll number
- c) Grade
- d) Length
- e) Date of manufacture; and
- f) Product identification details

701.4 Packing, Storage and Handling

701.4.1 Each geosynthetic roll shall be wrapped with a material that will protect the geosynthetic from damage due to shipment, water, sunlight and contaminants. The protective wrapping with a tarpaulin or opaque plastic sheet shall be maintained during periods of

shipment and storage. During storage, geosynthetic rolls shall be elevated off the ground and adequately covered to protect from site construction damage, precipitation, prolonged ultra-violet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 71 °C, and any other environmental condition that may damage the physical properties of the geosynthetics.

701.4.2 If the outer layer of the geosynthetic is damaged, or exposed to sunlight for a period beyond that is permitted the outermost wrap of the rolls shall be discarded, and only the remaining undamaged/unexposed material shall be used. If the geosynthetic rolls become wet, the water proof cover shall be removed, the rolls shall be elevated off the ground and exposed to wind in order to dry the fabric. The paving fabric used with bitumen overlays shall be completely dry prior to installation

702.1 Scope

The work covers the use of geotextile materials for drainage, separation/filtration and erosion control works including supplying and laying as per design, drawing and these specifications. For drainage/filtration function, geotextile shall be able to convey water across the plane of the fabric throughout its design life.

For separation function the geotextile shall prevent intermixing of two layers of dissimilar materials, throughout the design life of the structure shall be as specified in Table 7.

Table 7 Minimum Geotextile Strength of Geotextile in Terms of MARV under different Installation

Installation condition	Type	Strength property requirements (MARV)							
		Grab strength in Newton(N) as per ASTM D 4632/IS 13162 Part 5		Tear Strength in Newton (N) as per ASTM D 4533/IS 14293		Puncture Strength in Newton (N)as per IS 13162 Part 4		Burst Strength in Newton (N) as per ASTM D 3786/IS 1966	
		Elongation at failure							
		<50%	<50%	<50%	<50%	<50%	<50%	<50%	<50%
Harsh installation condition	Type 1	1400	900	500	350	500	350	3500	1700
Moderate installation condition	Type 2	1100	700	400	250	400	250	2700	1300
Less severe installation condition	Type 3	800	500	300	180	300	180	2100	950

- (1) All numeric values in the above table represent Minimum Average Roll Value (MARV) in weaker principal direction. The MARV is derived statistically as the average value minus two standard deviations.
- (2) When the geotextiles are joined together by field sewing, the seam strength shall be at least 60 percent of the material's tensile strength. All field seams shall be sewn with

thread as strong as the material in the fabric.

- (3) The puncture strength if determined in accordance with ASTM D 6241, the minimum requirement in terms of “Newton (N)” shall be as follows:

Table 8 Minimum requirement of Puncture Strength in different Condition

Installation condition	Strength property requirement (MARV)	
	Puncture Strength in Newton (N) as per ASTM D 6241.	
	Elongation at Failure	
	< 50 %	< 50 %
Harsh installation condition	2800	2000
Moderate Installation condition	2250	1400
Less Severe Installation condition	1700	1000

702.2.2 Ultraviolet Stability Requirements

The material shall satisfy the ultraviolet stability requirements specified in Table:700-2.

Table:700-2. Requirements for Ultra Violet Stability

Sr. No.	Properties of Fabric	Requirements (Retained Strength)
1	Grab Strength	Not less than 70% after 500 hours of exposure
2	Tear Strength	
3	Puncture Strength	
4	Burst Strength	

Construction: -

After preparation of foundation for gabion structure as per the specifications along the road alignment geotextile shall be rolled out as indicated in the drawings. The entire roll shall be placed on surface of Gabion structure which comes in contact with earth. Wrinkles and folds in the fabric shall be removed by stretching as required. Adjacent rolls of geotextiles shall be overlapped, sewn, or joined as required. For curves, the geotextile shall be folded or cut and overlapped in the direction of construction. Folds in the geotextile shall be stapled or pinned approximately 0.6 m centre-to-centre. Before covering, the condition of the geotextile shall be checked for damage (i.e., holes, nips, tears, etc) by the Engineer. The geotextile shall be placed in intimate contact of soil ensuring slight tension, to avoid wrinkles or folds and shall be anchored on a properly shaped surface as indicated in drawings and approved by the Engineer. It shall be ensured that the placement of the overlying material be placed in such a manner that it does not tear/puncture the geotextile. Anchoring of the terminal ends of the geotextile shall be accomplished as per drawings through the use of key trenches or aprons at the crest and toe of slope.

702.2.3 Measurement for Payment: -

The geotextile for separation and for filter layer shall be measured in **square metres** as per planned dimensions with no allowance for overlapping at transverse and longitudinal joints.

Excavation, back fill, bedding and cover material shall be measured separately as per relevant items of the contract.

ITEM NO 11 Providing & laying 230 mm thick pucca rubble pitching in cement mortar 1:5 proportion with surface pointed with cement mortar of 1:3 proportion including curing etc. complete for all leads & lifts

1. The relevant specifications as per relevant MORTH specification Section no. 2503 & 2506.
2. The measurement and payment shall be in **Sqm** basis.

ITEM No 12 Type - A, "W" : Metal Beam Crash Barrier (Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete as per clause 811)

1. The relevant Specification for item description shall apply to this item.
2. The mode of payment for this item shall be on **Rmt.** Basis

ITEM No 13 Providing and fixing in position FE 500D TMT bar reinforcement including cutting, bending and tying complete as per detailed drawings. (A) R.C.C. Kerb (B) Temperature reinforcement for Trimix

1. The relevant specifications as per IS 1786 Specification & as per relevant MORT&H fifth revision section 1600 shall apply to this item.
2. The measurement shall be in **MT.** basis.
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, forming the cage and lowering it in position in pile bore 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 **MT.** basis.

ITEM No 14: Providing and casting in situ-controlled cement concrete M-200 for Kerb/kerb blocks including formwork curing and finishing, complete

The relevant specification of MORT&H Section – 409 shall apply to this item.

409 CEMENT CONCRETE KERB AND KERB WITH CHANNEL

409.1 Scope

This work shall consist of constructing cement concrete kerbs and kerbs with channel in the central median and/or along the footpaths or separators in conformity with the lines, levels and dimensions as specified in the drawings or as directed by the Engineer.

409.2 Materials

Kerbs and kerb with channel shall be provided in cement concrete of Grade M30 in accordance with Section 1700 of these specifications.

409.3 Type of Construction

These shall be cast-in-situ construction with suitable kerb casting machine in all situations except at locations where continuous casting with equipment is not practicable. In those locations precast concrete blocks shall be used.

409.4 Equipment

A continuous kerb casting equipment of adequate capacity and controls, capable of laying the kerbs in required cross-sections and producing a well-compacted mass of concrete free of voids and honeycombs, shall be used.

409.5 Construction Operations

409.5.1 Kerb shall be laid on firm foundation of minimum 150 mm thickness of cement concrete of M 15 grade cast in-situ or on extended width of pavement. The foundation shall have a projection of 50 mm beyond the kerb stone. Before laying the foundation of lean concrete, the base shall be levelled and slightly watered to make it damp.

409.5.2 In the median portions in the straight reaches, the kerb shall be cast in continuous lengths. In the portions where footpath is provided and/or the slope of the carriageway is towards median (as in case of superelevated portion), there shall be sufficient gap/recess left in the kerb to facilitate drainage openings.

409.5.3 After laying the kerbs and just prior to hardening of the concrete, saw cut grooves shall be provided at 5 m intervals up to finished road level or as specified by the Engineer.

409.5.4 Kerbs on the drainage ends such as along the footpath or the median in superelevated portions shall be cast with monolithic concrete channels as indicated in drawings. The slope of the channel towards drainage pipes shall be ensured for efficient drainage of the road surface.

409.6 Measurements for Payment

Cement concrete kerb/kerb with channel including foundation shall be measured in **Cum** for the complete item of work.

409.7 Rate

The Contract unit rates for cement concrete kerb/kerb with channel including foundation for kerb shall be payment in full compensation for furnishing all materials, labour, tools, equipment for construction and other incidental cost necessary to complete the work.

ITEM NO: 15 Construction of granular sub-base (Grade - III) by providing coarse graded material, spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method with rotavator at OMC, and compacting with vibratory roller to achieve the desired density, complete as per MoRTH clause 401.

401 GRANULAR SUB-BASES

401.1 Scope

This work shall consist of laying and compacting well-graded material on prepared subgrade 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-base hereinafter) as necessary according to lines, grades and cross-sections shown on the drawings or as directed by the Engineer.

401.2 Materials

- 401.2.1 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 gradings given in Table 400-1 and physical requirements given in Table 400-2. Gradings III and IV shall preferably be used in lower sub-base. Gradings 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.
- 401.2.2 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 400-1: Grading for Granular Sub-base Materials

IS Sieve Designation	Percent by Weight Passing the IS Sieve					
	Grading I	Grading II	Grading III	Grading IV	Grading V	Grading VI
75.0mm	100	-	-	-	100	-
53.0mm	80-100	100	100	100	80-100	100
26.5mm	55-90	70-100	55-75	50-80	55-90	75-100
9.50mm	35-65	50-80	-	-	35-65	55-75
4.75mm	25-55	40-65	10-30	15-35	25-50	30-55
2.36mm	20-40	30-50	-	-	10-20	10-25
0.85mm	-	-	-	-	2-10	-
0.425mm	10-15	10-15	-	-	0-5	0-8
0.075mm	<5	<5	<5	<5	-	0-3

Table 400-2: Physical Requirements for Materials for Granular Sub-base

Aggregate Impact value (A.I.V)	IS:2386(Part4) or IS:5640	40 maximum
Liquid Limit	IS:2720(Part5)	Maximum 25
Plasticity Index	IS:2720(Part5)	Maximum 6
CBR at 98% dry density 401.3 Construction Operations (at IS:2720-Part 8) 401.3.1 Preparation of Sub-grade	IS:2720(Part5)	Minimum 30 unless otherwise Specified in the Contract

Immediately prior to the laying of sub-base, the subgrade 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.

401.3.2 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 subgrade 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 crossfall or on super-elevation. For carriageway having crossfall 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 crossfall (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.

401.4 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.

401.5 Arrangements for Traffic

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

401.6 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.

401.7 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;
- v) carrying out the required tests for quality control.

ITEM NO: 16 Providing and casting in situ Ordinary cement concrete M-150 for R.C.C. Raft and cut-off walls including necessary shuttering laying, vibrating, ramming and curing complete.

1. The relevant specifications given for machine mixed plain cement concrete M15 grade as per Section -1500, 1700 & 2100 of MORT&H fifth revision specification.
2. The measurement & payment 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.

ITEM NO: 17 Providing and casting in situ controlled trimix cement concrete M-300 for 200 mm thick Wearing Coats as directed including providing and laying M.S. side rail of road thickness with necessary nut bolts plates fixing as per width applying plate vibrator (electric or diesel on channel compressor with vacuum dewatering system by using all necessary equipment and materials and machinery such running erected vibrator on prelaid M.S. channel for levelling vacuum pump floating and power travelling using Floor hardener of Approved make, cutting the joints at regular interval and with filling the joints with bitumen as directed by Engineer In charge

The relevant Specification given in Section- 1000,1500, 1700 & 2700 of MoRTH Fifth revision specification shall apply to this item.

This work shall consist of furnishing and laying controlled cement concrete M- 300 for C.C. road made by trimix system of the shape and dimensions shown on the drawings and conforming to these Specifications or as approved by the Engineer in charge.

Prior to the start construction the contractor shall design the mix in case of design mix concrete or propose nominal mix in case of nominal mix concrete and submit to the Engineer in charge for approval the proportions of materials including admixtures to be used water reducing admixtures (including plasticizers or super plasticizers) may be used at the contractors option

subject to the approval of Engineer in charge Other types of admixtures shall be prohibited unless specifically permitted by the Engineer in charge.

For Cement Concrete Grade M-300

1.0. Materials

1.1. Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Grit shall conform to M-8. Coarse aggregate shall conform M-12.

1.2. The shuttering to be provided shall be of ordinary timber plank and shall conform to M-26.

1.3. The dimensions of scantlings and battens shall conform to the design. The strength of the wood shall not be less than that assumed in the design.

2.0. General

2.1. The concrete mix shall be designed from preliminary tests. The proportion of the concrete mix shall be 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm. nominal size) by volume concrete work shall have exposed concrete surface or as specified in the item.

2.2. The proportioning of cement and aggregates shall be done by weight and necessary precautions shall be taken in the production to ensure that the required work cube strength is attained and maintained. The controlled concrete shall be in grades of M-100, M-150, M-200, M-250, M-300, M-350 & M-400 with prefix controlled added to it. The letter M refers to mix and the numbers specify 28 days works cube compressive strength. cubes of the mix expressed in Kg. /cm.

2.3. The proportion of cement, sand and coarse aggregate shall be determined of weight. The weigh batch machine shall be used for maintaining proper control over the proportion of aggregates as per mix design. The strength requirements of different grades of concrete shall be as under:

Grade of Concrete	Compressive strength of 15 cms. cubes in kg/cmt. at 28 days, conducted in accordance with I.S. 516-1959.	
	Preliminary test Min.	Work Test Min.
M 150	200	150
M 200	260	200
M 250	320	250
M 300	380	300
M 350	440	350
M 400	500	400

In all cases, the 28 days compressive strength specified in above the criteria for acceptance or rejection of the concrete. Where the strength of a concrete mix as indicated by tests, lies in between the strength of any two grades specified in the above table, such concrete shall be classified in for purpose as concrete belonging to the lower of the grades between which its strength lies.

3.0. Workmanship

3.1. The proportions for ingredients chosen shall be such that concrete has adequate workability for conditions prevailing on the work question and can be property compacted with means available except where it can be shown to the satisfaction of the Engineer-in-charge, that supply of properly graded aggregate of uniform quality can be maintained till the

completion of work, grading of aggregate shall be controlled by obtaining the coarse aggregates in different sizes and bending them in the right proportions as required. Aggregates of different sizes shall be stocked in separate stock piles. The required quantity of material shall be stock piled several hours, preferably a day before use. The grading of coarse and fine aggregate shall be checked as frequently as possible, the frequency for a given job being determined by Engineer-in-charge to ensure that the suppliers are maintaining the uniform grading as approved for samples used in the preliminary tests.

3.2. In proportioning concrete, the quantity of both cement and aggregate shall be determined by weight. Where the weight of cement is determined by accepting the maker's weight per bag, a reasonable number of bags shall be weighted separately to check the net weight. Where cement is weighted from bulk stocks at site and not by bags, it shall be weighed separately from the aggregate. Water, shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in clean and serviceable condition. Their accuracy shall be periodically checked.

3.3. It is most important to keep the specified water cement ratio constant and at its correct value. To this end, moisture content in both fine and coarse aggregates shall be determined by the Engineer-in-charge according to the weather conditions. The amount of mixing water shall then be adjusted to compensate for variations in the moisture content. For the determination of moisture content in the aggregates I.S. 2386 (Part-III) shall be referred to. Suitable adjustments shall also be made in the weights of aggregates due to variation in their moisture content. Minimum quantity of cement to be used in controlled concrete shall not be less than 220 kg./m³ in plain concrete and not less than 250 kg/m³ in reinforced concrete.

The form work shall conform to the shape lines and dimensions as shown on the plans and be constructed as to remain sufficiently rigid during the placing and compacting of the concrete. Adequate arrangements shall be made by the contractor to safe-guard against any settlement of the form-work during the course of concreting and after concreting. The form work of shuttering, centring, scaffolding, bracing etc. shall be as per design.

4. Mode of Measurement & Payment

4.1 The payment will be made on **Cum** basis of the finished work.

4.2 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.

4.3 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.

4.4 The unit rate concrete shall include the cost of all materials, tools and plant required for mixing, placing in position, compacting, and cost water reducing concrete and mixture at 100 ml per bag of cement and making channel 75 mm x 75 mm required to level and slope and thickness of the concrete road levelling of placed concrete with surface vibrator and finishing with power floater and trowel light booming the surface and cutting Expansions joints by machine as directed by The Engineer in charge and finishing as per direction 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 shown on the drawings and according to these specifications. They shall also include the cost of making, fixing and removing of all centering and forms required for the work.

4.5 The concrete shall be measured for its length breadth limiting dimensions to those specified on plan or as directed.

4.5 The rate shall be for a unit of one **Cum.**

Scope of Work

The work shall consist of providing, laying, compacting, finishing, curing, and protecting in-situ machine-laid Trimix Concrete Flooring/Pavement of M-30 grade and 200 mm thickness complete in all respects as per approved drawings, specifications, and directions of the Engineer-in-Charge.

Applicable Codes and Standards

The work shall conform to the latest editions and amendments of the following standards:

IS 456 – Plain and Reinforced Concrete – Code of Practice.

IS 10262 – Concrete Mix Proportioning.

IS 383 – Coarse and Fine Aggregates for Concrete.

IS 516 – Methods of Tests for Strength of Concrete.

IS 1199 – Methods of Sampling and Analysis of Concrete.

IS 9103 – Concrete Admixtures.

IS 269 / IS 8112 / IS 12269 – Ordinary Portland Cement.

IRC:15 – Standard Specifications and Code of Practice for Construction of Concrete Roads.

IRC:SP:62 – Guidelines for Cement Concrete Pavements.

MORTH Specifications (Latest Revision) wherever applicable.

Materials

Cement: Ordinary Portland cement conforming to IS 269/8112/12269 of approved make and source shall be used.

Fine Aggregate: Fine aggregate shall conform to IS 383 and shall be clean, hard, durable, and free from deleterious materials.

Coarse Aggregate: Coarse aggregate shall conform to IS 383 and consist of crushed stone of approved quality, properly graded.

Water: Water used for mixing and curing shall conform to IS 456 requirements.

Admixtures: Chemical admixtures, if used, shall conform to IS 9103 and shall be approved by the Engineer-in-Charge.

Floor Hardener: Dry shake floor hardener shall be of approved make and shall be applied as per manufacturer's recommendations.

Concrete Mix

Grade of Concrete: M-30

Minimum Cement Content: As per approved mix design.

Maximum Water-Cement Ratio: As per IS 456 and approved mix design.

Concrete shall be produced through weigh batching.

The design mix for M-30 grade concrete shall be prepared and tested in accordance with IS 10262 and IS 456. The proposed mix design shall be got tested and approved from a

Government Engineering Laboratory, Government-approved Material Testing Laboratory, or Gujarat Engineering Research Institute (GERI), before commencement of concreting work.

Preparation of Surface

The sub-grade/sub-base shall be prepared, compacted, and approved before laying concrete.

The surface shall be cleaned of all dust, debris, loose particles, oil, grease, and standing water.

Proper line, level, and slope shall be established before concreting.

Side Forms / M.S. Channels

M.S. side rails/channels of suitable section shall be fixed accurately to line and level.

Side forms shall be rigid enough to prevent displacement during concreting.

Necessary nuts, bolts, plates, supports, and fixing arrangements shall be provided.

Laying of Concrete

Concrete shall be placed continuously to avoid cold joints.

The concrete shall be spread uniformly between side forms.

Concrete shall be compacted using screed vibrators, plate vibrators, and other approved equipment.

Vacuum Dewatering Process

The Trimix process shall include:

Vacuum pump.

Vacuum mats.

Filter pads.

Suction hoses.

Vacuum tank.

Power trowels and finishing equipment.

The vacuum dewatering shall be carried out immediately after vibration and levelling to remove excess water from concrete.

Finishing Operations

After vacuum dewatering: Surface shall be levelled using vibrating screeds.

Mechanical floater shall be used for initial finishing.

Power trowel finishing shall be carried out to obtain a dense, smooth, and abrasion-resistant surface.

Required surface texture and finish shall be achieved.

Application of Floor Hardener

Approved floor hardener shall be applied uniformly over the fresh concrete surface.

Application rate shall be as recommended by the manufacturer or as directed by the Engineer-in-Charge.

The surface shall be finished using power trowels after application.

Construction and Expansion Joints

Contraction joints shall be saw-cut at specified intervals or as shown in drawings.

Joint depth shall generally be one-fourth of slab thickness.

Expansion joints, where required, shall be provided as per drawings.

Joints shall be cleaned and sealed with approved bituminous sealant.

Curing

Concrete shall be cured for a minimum period of 14 days.

Curing shall be carried out by ponding, wet hessian, curing compounds, or approved methods.

No traffic shall be allowed during curing period.

No separate payment shall be made for side forms, vacuum dewatering, floor hardener, joint cutting, bitumen filling, curing, testing, machinery deployment, lead, lift, loading, unloading, or any incidental operation required for completion of the item.

ITEM NO: 18 Paver Block Providing and laying shot blasted Non -interlocking, Paver blocks 80 mm thick M-45 grade of specified thickness, size, grade of concrete and colour machine made and blasting by automatic shot blasting machine and high density of as per approved sample of approved make for footpath, parking areas, service lanes, crossover and other areas as mentioned in the drawing. Including providing and laying 50 to 80 mm thick average bedding layer of coarse sand below paver block as per required grading and specification. Laid paver block shall be mechanically compacted. The work of the paving blocks shall be executed in line and level by skilled mason of flooring work only. Small size of paver block with same specification shall be used at residue or at end. It should be laid in such a way that the no cutting of the paver block to be necessary. If cutting of paver block shall be required, than cut by machine only and laying to be done by skilled flooring mason. The finished surface of the paver block shall have coarse sand Texture Finish. Pave blocks shall be compacted and shall be re-laid if necessary. Actual laid area shall be measured and paid without any wastage.(A) 80 mm thick M-45 grade Grey Paver block of size 200mm x200 mm and 200 x 100 (as per Direction of Engineer In-Charge/Architect)

1.0 The scope of work: It includes supplying and laying of Precast shot blasted by automatic shot blasting machine in factory (not on site) paver blocks at footpath, parking area, service lane and other areas.

The work includes:

- 1.1 Paver block should be laid over prepared sub grade.
- 1.2 Clearing the site by removing all obstacles such as stones, debris etc. for laying of paver blocks.
- 1.3 Manufacturing of paver blocks by one of the approved suppliers as per requirements in technical specification enclosed.
- 1.4 Supplying of paver blocks at site, including handling at both ends. The type of paver block may be interlocking or non-interlocking.
- 1.5 Providing and laying average 50 mm coarse sand bedding for laying blocks.
- 1.6 Laying of paver blocks at site as per requirement in technical specification, within shortest possible time.
- 1.7 Testing of paver blocks through reputed Govt. Test house and submission of test results as per requirements in Technical Specifications. Client reserves the right to carryout test at random. Cost for such tests to be borne by contractor.

1.8 The contractor shall guarantee that all material and components designed, fabricated, supplied and laid by him shall be free from any type of defect due to faulty material and/or workmanship/erection for a period of five year from the date of completion of work at individual sites.

However, the contractor for five years shall render free maintenance.

2.0 Technical Specifications:

2.1 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 by application of hydraulic compaction and also by high intensity vibration to the moulds. The machine should have automatic control panel for uniformity in strength. Concrete Batching & Mixing Plant: (Not essential) The concrete Mix Design should be followed for each batch of materials. The concrete ingredient should be mixed in concrete Batching & Mixing plant with minimum capacity of 30 cum/hour. The plant should be equipped with automatic control panel for maintaining water cement ratio from batch to batch to obtain concrete of uniform quality and strength. The plant should be equipped with adequate mechanism for mechanized loading of raw materials into mixer and conveyor belt for transportation of concrete from mixer to concrete block making machine to maintain quality of wet cement.

Curing:

The factory should have well designed curing area to ensure adequate curing of paver blocks. Steam curing facility of the paver blocks is preferable.

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.

2.4 Paver Block Dimensions:

Thickness	80 mm
Layers	Double layered, top layer minimum 8 to 10 mm
Shape	Irregular (Uniform Shape with no Hollow or Cracks)/as per drawing
Chamfer	4mm to 6mm along top edges
Colour	Natural cement grey Colour without use of any pigment. For Colour pavers refer “specifications for Colour pavers”
Dimensional	(+/-) 2mm for length & width,
Tolerance	(+/-) 3mm for Height (Thickness)

2.5 Testing of Paver Blocks:

* Sampling and testing procedure as per enclosed specifications

3.0 Sampling & Testing Procedures for Paver Blocks:

3.1 Sample Size:

INTERNAL – Average of minimum 3 samples per 10000 Blocks for compressive strength and water absorption.

EXTERNAL – Minimum 2 Blocks per 10000 blocks for abrasion and flexure.

3.2 **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 45/50 N/Sq.mm as per thickness.

Abrasion Resistance: Testing for abrasion shall be in accordance with IS 1237 (Specifications for Cement Concrete Floor Tiles).

Flexural Strength: Testing for flexural shall be in accordance with IS 1237 (Specifications for Cement Concrete Floor Tiles).

Water Absorption: Testing for water absorption shall be in accordance with IS 2185:1979: Part I (Specifications for Concrete Masonry Units).

APPENDIX A

Method of sampling: Before laying paver blocks, each designated section comprising not more than 10000 blocks, shall be divided into five approximately equal groups. One block shall be drawn from each group i.e. 3 for internal testing and 2 for external testing.

Marking and identification: All samples shall be clearly marked at the time of sampling in such a way that the designated sections of part thereof, and the consignment represented by the sample, are clearly defined. The sample 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 for 24 hours prior to testing.

SR.NO.	* TEST	SPECIFICATION Average Values (Average of Minimum Five Samples/Site)
1.	Compressive Strength	Min. 45 N/Sq.mm for 80mm thick
2.	Flexural Strength	4.5 N/ Sq. mm for 80 mm thick paver block.
3.	Abrasion Resistance	Maximum 1.5
4.	Water Absorption	Maximum 5.80%
5.	Minimum Cement Content	450 Kg/Cum for M 45 concrete

APPENDIX B

Test For Compressive Strength:

Testing Machine: The testing machine shall be of suitable capacity for the test and capable of applying the load of the rate specified. It shall comply, as regards repeatability and accuracy, with the requirements of clause 2.1 of BS: 1881-Part 4.

Procedure: The sample specimen shall be tested in a wet condition after being stored for at least 24 hours in water maintained at a temperature of 20 °C + or – 5 °C. Before the specimens are submerged in water, the necessary area shall be determined. The plates for testing machines shall be wiped clean and any loose grit or other material removed from the contact faces of the specimen. Plywood, nominally 4 mm thick shall be used as packing between the upper and lower faces of the specimen and the machine plates and these boards shall be larger than the specimen by the margin of at least 5 mm at all points. Fresh Packing shall be used for every specimen tested. The specimen shall be placed in the machine with the wearing surface in the horizontal plane and in such a way that the axes of the specimen are aligned with those of the machine plates. The load shall be applied without shock and increased continuously at the rate of approximately 15 N/ Sq.mm per minute until no greater load can be sustained. The maximum load applied to the specimen shall be recorded.

Calculation of corrected strength for individual Blocks: The compressive strength of each block specimen shall be calculated by dividing the maximum load by full cross section area of the block and multiplying with an appropriate factor of: - For 80 mm thick blocks – 1.18

Compressive Strength Calculation: The average corrected compressive strength for the designed block section shall be calculated.

4.0 Method of laying:

Blocks shall be placed on the sand bedding etc. which were well rammed so as to act as firm bed. Blocks shall be laid in such manner that no gap shall be left in between. Blocks so laid shall be compacted by means of mechanical compactor or equivalent compacting method so as to obtain required finished surface. All the joints shall be matched and if any manufacturing defect is detected the lot shall be replaced and relaying shall be done without any extra cost up to satisfaction of Engineer in charge. 50 mm thick coarse sand shall be laid as cushioning layer for arranging the paver blocks. Joints of the paver blocks shall be filled with the sand.

The paver blocks shall be laid properly on the prepared sub-base as per manufacturer's specification and as per Architect and Engineer-in-charge's instruction.

5.0 Mode of Measurement and payment:

Measurement shall be done as per actual area laid without considering any wastage.

The Measurement of the item shall be in **Sqmt** basis.

ITEM NO 19: Hazard Marker Sign: -Providing and fixing sign boards made out of 1.5mm aluminium sheet / 3mm ACP (Aluminium composite Panel); size 90x30 cms. rectangular as per design of IRC-67-2012. Pretreated with phosphating 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; 1.8mtr 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 foreach board shall be as per the instruction 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 given in Section – 800 of MORT&H fifth revision specification shall apply to this item.
2. The measurement shall be in **Nos.** basis
3. The mode of payment shall be in **Nos** basis.

ITEM NO 20: Regulatory / Mandatory Sign: -Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminium composite Panel); size 60 cms Dia Circle as per design of IRC-67-2012. Pretreated with phosphating 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 foreach 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 given in Section – 800 of MORT&H fifth revision specification shall apply to this item.
2. The measurement shall be in **Nos.** basis
3. The mode of payment shall be in **Nos** basis.

ITEM NO 21: Distance Informatory / Destination Sign: -Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminium composite Panel); size 180x120 cms. rectangular as per design of IRC-67-2012. Pretreated with phosphating 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 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 given in Section – 800 of MORT&H fifth revision specification shall apply to this item.
2. The measurement shall be in **Nos.** basis
3. The mode of payment shall be in **Nos** basis.

ITEM NO 22 Diversion Ahead Sign: -Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminium composite Panel); size 180x60 cms. rectangular as per design of IRC-67-2012. Pretreated with phosphating 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; 3.1 mtr long stand post (2 Nos.) of 50 x 50 x 5mm / 50NB 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 given in Section – 800 of MORT&H fifth revision specification shall apply to this item.
2. The measurement shall be in **Nos.** basis
3. The mode of payment shall be in **Nos** basis.

**ITEM NO 23: Men at work (2' x 2') sign: -Providing and fixing sign boards made out of 2.0 mm aluminium sheet / 4 mm ACP (Aluminium composite Panel); size 60cm x 60cm square as per design of IRC-67-2012. Pretreated with phosphating 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; 3.3 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 best quality 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**

1. The relevant specifications given in Section – 800 of MORT&H fifth revision specification shall apply to this item.
2. The measurement shall be in **Nos.** basis

3. The mode of payment shall be in **Nos** basis.

For Electric Work ITEM No : 25 To Item No 39:

Make List

For

Supply, installation, Testing and commissioning of Street/flood light work including all necessary equipment's.

Sr No.	Items	Approved Make
1	WIRING ACCESSORIES, SWIRCH, PLUG, SOCKET, ETC	ANCHOR HAVELLS GREATWHITE LEGRAND
2	LED IN DOOR/OUT DOOR FIXTURE	PHILIPS CROMPTON WIPRO HAVELLS BAJAJ SURYA NEXTRAY
3	MCB/RCCB/ELCB/RCBO/SFU/CHANGE OVER SWITCH	HAVELLS INDOASIAN L & T C & S SIEMENS SCHNEIDER ANCHOR LEGRAND ABB GREATWHITE
4	MOULDED CASE CIRCUIT BREAKERS	HAVELLS INDOASIAN L & T C & S SIEMENS SCHNEIDER CROMPTON LEGRAND ABB
5	CABLES & WIRES	RRKABLE POLYCAB ANCHOR HAVELLS FINOLEX KEI KENTER
6	SMC PRESS MOULDED BOX FOR STREET LIGHTS	SINTEX EVEREST ESCO NATIONAL EPP
7	HIGH MAST/OCTAGONAL STREET LIGHTS POLES	BAJAJ IMPRESSION UTKARSH AMBICA

		TRANSRAIL VALMONT JETCOTECH
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- For this Project work only above makes are valid & considered for supply
- All the LED Product has A Warranty of 3 Years.
- In Case of Items where no make is provided in make list, the approval make need to be taken from Engineer in Charge.