

GENERAL TECHNICAL SPECIFICATIONS

FOR ROAD /BRIDGE WORKS

Name of Work-

કામનું નામ

Construction New Structure of Amreli District Package No.RPC-
2/AMR/MMGSY/Normal/2025-26/P.05 Ta.Savarkundala, Dist.; Amreli.

GENERAL TECHNICAL SPECIFICATIONS

1.0 General :

All Measurements shall be made in metric system. Different items of work shall be measured in accordance with the procedures set forth in relevant sections read in conjunction with General Conditions of contract. The same shall not however apply in the case of lump-sum items. All measurements and computations ; unless other wise indicated, shall be carried nearest to be following limits :

- (i) Length and breadth.....10mm
- (ii) Height, depth or thickness of earthwork,
Sub-base, bases surfacing, and structural members.....5mm
- (iii) areas..... 0.01 Sq.Metre.
- (iii) Cubic contents.....0.01 Cubic Metre.

In recording dimensions of work the sequence of length, width and height or depth or thickness shall be followed.

2.0. Measurement of lead for Materials :

Where lead is specified in the contract for construction materials, the same shall be measured as described hereunder.

Lead shall be measured over the shortest practicable route and not the one actually taken and the decision of the Engineer-in-charge in this regards shall be taken as final. Distance up to and including 100 Metres shall be measured in units of 50 Metres, exceeding 100 metres but exceeding 1 Km. in units of 100 Metres, and exceeding 1 Km. in units of 500 Metres. The half and greater than half of the units shall be reckoned as one and less than half of the units ignored. In this regard, the source of the materials shall be divided into suitable blocks and for each block the distance from the centre of the block to the centre of placing pertaining to that block shall be taken as the lead distance.

3.0 Surface Regularity of sub grade and Pavement courses :

The surface regularity of completed sub-base courses and wearing surface in the longitudinal and transverse direction shall be within the tolerances indicated in Table below. The longitudinal profile shall be checked with a 3 Metre long straight edge, at the middle of each traffic lane along a line parallel to the centre line of the road. The transverse profile shall be checked with a set for three camber boards at intervals of 10 Metres.

PERMITTED TOLERANCES OF SUB REGULARITY FOR PAVEMENT COURSE.

Sr.	Type of construction	Longitudinal Profile with 3 Metre straight edge.					Cross Profile
		Maximum permissible undulation in mm	Maximum number of undulation permitted in any 300 m. length exceeding in				Maximum permissible variation from specified profile camber themplate mm
1	2	3	4	5	6	7	8
1	Earth sub grade	36	30	-	-	-	15
2	Granular/lime Cement stabilized sub base.	23	-	30	-	-	12
3	Water Bound Macadam with nominal size metal (20-50)mm	18	-	-	30	-	8
4	Semi Dense carpet @ @	15	-	-	-	20	6

Notes:

1. These are for machine laid surfaces. If laid manually, due to unavoidable reason, tolerance up to 50 percent above these values in the columns may be permitted. However, this relaxation does not apply to the values of maximum undulation for longitudinal and cross profiles mentioned in columns 3 and 8 in the table.

2. Surface evenness requirements in respect of both the longitudinal and profiles should be simultaneously satisfied.

3. **Rectification** : Where the surface irregularity of sub grade and the various pavement courses fall outside the specified tolerances, the contractor shall be liable to rectify these in the manner described below and to the satisfaction of the Engineer- in-Charge at this own cost.

(I) **Sub grade**; Where the surface is high, it shall be trimmed and suitably compacted. Where the surface is low, the deficiency shall be corrected by adding fresh material. The degree of compaction and the type of material to be used shall conform to the specified requirements.

(ii) **Granular/Sub Base**: Same as at (i) above except that the degree of compaction and the type of material to be used shall conform to the specified requirements.

(iii) **Lime/Cement stabilized soil sub-Base**: For lime/ cement treated materials where the surface is high, the same shall be suitably trimmed while taking care that the material below is not disturbed due to this operation. However where the surface is low, the same shall be corrected as described here in below.

For cement treated material, when the time elapsed between detection of irregularity and the time of mixing of the material, is less than 2 hours, the surface shall be scarified to a depth of 50mm, supplemented with freshly mixed material as necessary and recomposed to the relevant specification. When this time is more than 2 hours, the full depth of the layer shall be removed from the pavement and replaced with fresh material, to specification. In either case, the area treated shall not be less than 5 Metres wide. This also applies to lime treated material except that the time criterion shall be 3 hours instead of 2 hours.

(iv) **Water Bound Macadam Base**. : Where the surface is high or low, that top 75mm shall be scarified, reshaped with added material as necessary and re compacted. The area treated at a place shall not be less than 5 Metres long and 2 Metres wide.

(v) **Bituminous Construction** : For bituminous construction other than wearing course, where the surface is low, the deficiency shall be corrected by adding fresh material and re compaction to specifications, Where this surface is high, the full depth of the layer shall be removed and replaced with fresh material and compacted to specifications. For wearing course, where the surface is high or low, the full depth of the layer shall be removed and replaced with fresh material and compacted to specifications in all cases where the removal and replacement of a bituminous layer is involved, the area treated shall not be less than 5 Metre long and not less than 1 lane wide.

4.0 Quality Control Test during Construction. :

The materials supplied and the works carried out by the Contractor shall conform to the enclosed relevant specifications. For ensuring the requisite quality of construction, the materials and works shall be subjected to quality control test as described hereinafter, by the Engineer-in-charge. The testing frequencies set forth are the desirable minimum and the Engineer-in-charge shall have the full authority to carry out test as frequently as he may deem necessary to satisfy that the materials at work comply with the appropriated specification. Test procedures for the various quality control tests are indicated in the respective sections of the specification or for certain tests within this section. Where no specific testing procedure is mentioned, the test shall be carried out as per prevalent accepted engineering practice to the directions of the Engineer-in-charge.

5.0 Tests of Earthwork for Embankment Construction :

5.1 Borrow Materials:

- (a) Sand content (IS: 2720 Part IV)
Two test per 8000 Cubic Metres of soil.
- (b) Plasticity Test (IS: 2720 Part-V)
Each type to be tested. Two tests per 8000 Cubic Metres of soil.
- (c) Density test (IS: 2720 part-VII)
Each soil type to be tested. Two test per 8000 Cubic Metres of Soil.
- (d) Moisture Content Test (IS: 2720 Part-II)
One test for every 250 Cubic Metres of soil.

5.2 Compaction Control :

Control shall be exercised by taking at least one measurement of density for each 1000 square Metres of compacted area, or closer as required to yield the maximum number of test results for evaluating day's work on statistical basis. The determination of density shall be accordance with IS: 2720 (Part XXVIII). Test locations shall be chosen only through random sampling techniques. Control shall be not being based on the result of any one test but on the mean value of set of 5-10 density determinations. The number of tests in one set of measurements shall be 5 as long as it is felt that sufficient control over borrow material and the method of compaction is being exercised. If considerable variations are observed between individual density results, the minimum number of tests in one set of measurement shall be increase to 10. The acceptance of work shall be subject to the condition that the mean dry density equals or exceeds the specified density and the standard deviation for any set of result is below 0.08 gm/cc. However for earthwork in shoulders and in top 500 mm portion of the embankment below the sub grade, at least one density measurement shall be taken for every 500 square Metres of the compacted area provided further that the number of the test in each set of measurement shall be at least 10. In other respects, the control shall be similar to that described earlier.

6. Following materials shall conform to the Indian Standards shown against them;

- | | | |
|-----|-----------------------------------|----------|
| (1) | Cement | IS: 269 |
| (2) | Sand for masonry | IS: 2116 |
| (3) | Sand for concrete | IS: 383 |
| (4) | Course aggregate. | IS: 383 |
| (5) | Mild Steel. | IS: 432 |
| (6) | High yield strength deformed bars | |
| | (a) Hot Rolled. | IS: 1139 |
| | (b) Cold Twisted. | IS: 1786 |

7. Barrel thickness of pipes of different class shall be under:

Sir No	Internal DiaMetre of pipes in MM	Barrel thickness (in mm)		
		NP1	NP2	NP3
1	80	25	25	-
2	100	25	25	-
3	150	25	25	-
4	250	25	25	-
5	300	30	30	-
6	350	32	32	75
7	400	32	32	75
8	450	35	35	75
9	500	-	35	75
10	600	-	40	80
11	700	-	40	80
12	800	-	45	90
13	900	-	50	100
14	1000	-	55	100
15	1100	-	60	115
16	1200	-	65	115

Item No. 1

Clearing and grubbing of road land incl. uprooting rank vegetation, grass, bushes, shrubs, saplings and trees girth upto 300mm removal of stumps of trees cut earlier and disposal of unserviceable materials © By mechanical means in area of Light jungle.

201. CLEARING AND GRUBBING

201.1. Scope

Clearing and grubbing shall be performed less than one month in advance of earthwork operations and shall consist of cutting, trimming, removing and disposing of all materials such as trees, tree branches, bushes, shrubs, stumps roots, grass, weeds, anthills, jungle top organic soil not exceeding 150 mm in thickness, rubbish, loose stones, boulders, etc. which are undesirable and unsuitable for use in the works, from the designated area of road land, embankment slopes, drains, cross-drainage structures and such other areas as specified on the drawings or from areas as directed by the Engineer. It shall include grubbing, necessary excavation, backfilling of pits resulting from uprooting of trees and stumps to required compaction, handling, salvaging, removal and disposal of cleared materials in accordance with the requirements of these Specifications.

Reclearing of the site of any vegetation, grass shrubs before commencement of work shall be carried out as directed by the Engineer and shall be incidental to the work of clearing and grubbing.

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 road which are not to be disturbed shall be protected from injury or damage by providing and installing suitable safeguards as shown in the drawing or as approved by the Engineer.

During clearing and grubbing the Contractor shall take all adequate precautions for preservation of all vegetation adjacent to road land against soil erosion, water pollution, etc. and where required, shall undertake additional works to that effect. 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 schedule for carrying out additional work where required.

201.3. Conservation of Top-soil

The top-soil removed during clearing and grubbing of site, if suitable for re-use shall be transported, conserved and stacked as directed by the Engineer. This shall be incidental to the work.

201.4. Methods, Tools and Equipments

Only such methods, tools and equipment as are approved by the Engineer shall be adopted for the work. If the area has thick vegetation/roots/trees, a crawler or dozer shall be used for clearance purposes. All trees, stumps, etc. falling within excavation and fill line shall be cut to such depth below ground level that in no case these fall within 500 mm of the sub grade. Also, all vegetation such as roots, under-growth, grass and other deleterious matter unsuitable for re-use in the embankment/sub grade shall be removed between fill lines to the satisfaction of the Engineer. On areas beyond these clearing limits trees and stumps required to be removed shall be cut down to 500 mm below ground level so that these do not present an unsightly appearance.

All branches of trees extending above the roadway shall be cut or trimmed so as to provide a clear height of 5 m above the road surface and shoulders.

All excavations below the general ground level arising out of the removal of trees, stumps etc. shall be filled with material conforming to prescribed requirements and compacted to specified density, given by the Engineer.

201.5. Removal of Ant-hills

Ant-hills both above and below the ground, as are liable to collapse and obstruct free subsoil water flow shall be removed by excavating to a suitable depth as directed by the Engineer. The excavated ant-hills material shall be carted away from the site. Cavities in the ground due to removal of ant-hills shall be filled with approved material and compacted to specified densities, as directed by the Engineer.

201.6 Disposal of Materials

All materials including trees, stumps, etc. arising from clearing and grubbing operations shall be the property of Government and shall be disposed off by the Contractor as here-in-after provided or as directed by the Engineer.

Trunks, branches and stumps of trees shall be cleaned of limbs and roots and stacked. Also boulders, stones and other materials usable in road construction shall be neatly stacked as directed by the Engineer. Stacking of stumps, boulders, stones etc. shall be done at specified spots with all lifts and upto a lead of 1000 m.

All products of clearing and grubbing which cannot be used or auctioned shall be cleared away from the roadside in a manner as directed by the Engineer. Care shall be taken to see that unsuitable waste materials are disposed off in such a manner that there is no likelihood of these getting mixed up with the materials meant for embankment, sub grade and road construction or cause undesirable environmental conditions.

201.7. Measurements for Payment

Clearing and grubbing for road embankment, drains and cross-drainage structures shall be measured on area basis in terms of hectares. Clearing and grubbing of borrow areas shall be incidental to embankment construction and the rates quoted for the embankment construction shall be inclusive of it.

Cutting of trees upto 300 mm in girth including removal of stumps and roots, and cutting/trimming of branches of trees extending above the roadway shall be considered incidental to the clearing and grubbing operations. Removal of stumps of trees upto 300 mm girth left over after trees have been cut by any other agency of the Contractor or Government shall also be considered incidental to the clearing and grubbing operations.

Cutting, including removal of stumps and roots of trees of girth above 300 mm and backfilling to required compaction and removal of stems and roots of trees of girth above 300 mm diaMetre left over after trees have been cut by any other agency or the government 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 to 2700 mm
- (v) Above 2700 mm to 4500 mm
- (vi) Above 4500 mm

For this purpose, 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 1 m from the ground.

Where the proposed work site passes through dense forest area, clearing and grubbing including cutting of trees of all girths and removal of their roots and stumps, etc. for construction of road embankment, drains and cross-drainage structures shall be measured on area basis.

201.8 Acceptance

Acceptance of clearing and grubbing shall be based on visual inspection of the work for compliance with the above specifications to the satisfaction of the Engineer.

201.9 Rate

201.9.1. The Contract unit rates for the various items of clearing and grubbing shall be paid/payable 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 and roots of trees less than 300 mm in girth as well as stumps left over after cutting of trees carried out by another agency of the Contractor or Government, excavation and backfilling to required density, where necessary, and handling, salvaging, piling and disposing of the cleared materials with all lifts and upto a lead of 1000 m.

201.9.2. The Contract unit rate for cutting (including removal of stumps and roots) of trees of girth above 300 mm and removal of stems and roots of trees of girth above 300 mm left over after trees have been cut by any other agency or the government shall include excavation and backfilling to required compaction, handling, salvaging, piling and disposing of the cleared materials with all lifts and upto a lead of 1000 m as directed by the Engineer.

201.9.3. 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

Earthwork for embankment including breaking clods, dressing with all lead and lift (Excluding watering and consolidation (A) From borrow area with all lead and lift. (Selected soil to be used for Earthwork shall be From BORROW AREA only having CBR not less than 6.00)

1. The land width on which the earth work is to be done shall be cleared of all trees having a girth of 30cm and loss, loose stones, vegetation, bushes, stumps and all other objectionable materials. All the materials cleared will be the property of Government. Useful material shall be arranged in convenient stack the road boundary or as directed at places within 50 Metres lead, and handed over to the department in convenient section. Unsuitable material shall be burnt or other wise disposed off by the contractor at own

cost without causing any nuisance inconvenience or damage to the works property or people in the neighborhood. In all cases the materials shall be disposed off in a neat manner.

2. After cleaning the site, the alignment of the road shall be properly set out true to line, curves, slopes grade sand sections as shown on then plan or directed by the Engineer-in-charge. The contractor shall provide all labors and materials such as lime, string, pegs, nails, bamboos, stones, mortar, concrete etc. Required for setting out, establishing. Bench Marks and giving profiles. The contractor shall be responsible for maintaining the B.M.S. profiles alignment and other marks long they are required for the work in the opinion of the Engineer-in-charge. If the contractor defaults in this respect they may be restored by the department at the cost of the contractor.

3. When an existing embankment is to be widened, continuous, horizontal benches, each at least 0.3 Metre wide shall be cut into the existing slope for ensuring adequate bond with the fresh embankment materials to be added. The material obtained from the cutting of benches can be utilized in the widening of the embankment. The dumping of material from trucks for widening operation shall be avoided except in difficult circumstances when the extra width is too narrow to permit the movement of any other type of hauling equipment.

4. The soil to be used for embankment shall be free from trees, stumps, root, rubbish or any other objectionable materials. Only materials considered suitable by the Engineer-in-charge shall be used for the construction and that considered unsuitable shall be disposed off as directed by him. The selection of materials to be used in the construction of embankment shall be made after soil survey and investigations are carried out by the Department. The embankment shall consist of earth available from road-side borrow pits on either side with all lead and lifts. And within land width in the manner specified in Para 11. Below. The road, if any required for the purpose of haulage of earth by men, animals or vehicles will be constructed. (If not existing) and maintained by the contractor at his own cost.

5. Department is extended all necessary co-operations in helping contractor to get borrow from near by Government or Panchayat land, if available. However department is not responsible if not such area is made available to the contractor and in the case, contractor will have to make his own arrangement to get borrow area for borrowing earth of the quantity even by making temporary arrangement with the private land owners.

6. The Embankment shall be constructed in uniform layer not exceeding 250mm in loose thickness. The soil shall be spread uniformly over the entire width of the embankment unless otherwise directed by the Engineer-in-charge. All clods of hard lumps of earth shall be broken to have maximum size of 15 cm. When being placed in the embankment a maximum of size 5 cm when being placed in the top 45 cm. of embankment. The work of next layer shall be allowed only after the first layer has been thoroughly compacted.

7. Where an embankment is to be placed on sloping ground shall be balanced in the step of trenches of broken up in such a manner that the new material shall have perfect bond with the existing surface. Where the embankment is to be placed over an existing road surface, the surface shall be scarified to minimum depth of a 5 cm. so as to provide ample bond between the old and new material. However when the embankment is to be placed over and old concrete pavement and lies within 1 Metre of new sub grade level, the pavement shall be broken up in pieces not to exceed 0.1 m and may be Metre of new sub grade left under the new embankment. If the existing road surface is of granular or bituminous type and lies within 1 mt. of the new sub grade level, the same shall be scarified to a depth of minimum 50mm. so as to provide ample bond between the old and the new material.

8. To avoid interference with contraction of abutment, wing walls or return walls of culvert/bridge structures, the contractor shall at point to be determined by the Engineer-in-charge, suspend work on embankment forming approaches to such structures, until such time as the construction of the latter is sufficiently advanced to permit the completion of approaches without the risk of interference of damage to the bridge work, unless directed otherwise the filling around culverts, bridge and other structures upto a

distance of twice the height of the embankment from the back of the embankment shall be carried out independent of the work on the main embankment. The fill material shall not be placed against any abutment or wing wall unless permission has been given by the Engineer-in-charge but in any case not until the concrete or masonry has been in position for 14 days, the embankment shall be brought up simultaneously in equal layer on each side of the structure to avoid displacement and unequal pressure. The sequence of work in this regard shall be got approved from the Engineer-in-charge. Where the provision of any filter medium is specified behind the abutment, the same shall be laid in layers with the laying of fill material. The material used for the filter shall conform to the requirements for filter medium and will be paid extra in the relevant item.

9. The embankment shall be finished in conformity with the alignment, level, cross section and dimensions shown on the plans or as directed by the Engineer-in-charge. Where the alignment of the road is in a curve, the top of the embankment shall be formed with the super elevation and the increased width shown on the drawing or as the Engineer-in-charge may direct. Finishing operation shall include the work of shaping and dressing the shoulder, road bed and the slopes to conform to the cross section.

10. The earthwork measurement shall be paid on cross sectional measurements and computing the volumes of earth work in cubic metres by average area method. The contractor shall sign day to day leveling work and also original cross sections, longitudinal section etc. in token of his acceptance. The working section both longitudinal and cross of the ground shall be taken by the Engineer-in-charge before the actual work has started. The contractor or his authorized representative shall attend day to day leveling work and sign with date the field book daily, in token of his acceptance, if there is any disagreement, the contractor shall inform of it in writing to the officer concerned with specific reference to the sections before starting further work. Once the work is started, no cognizance of any complaint will be taken merely not signing to level book shall not be deemed as disagreement. The Executive Engineer shall also verify leveling work to the extent of 5% before commencement of earth work and on finalization. The contractor shall maintain the embankment by filling in ruts, rain cuts, depression due to shrinkage etc. to proper formation and grade till this item is finally measured and accepted by the Department. The measurements shall be on compacted earth work. Deduction of 15% for shrinkage shall be made from gross measured quantity if measured before first monsoon and 10% if measured after one or more monsoon have been passed over the earth embankment. However the contractor shall have to bear loss of deformation etc. If any due to all settlements as well as other type of deformation etc. if any, that might have taken place at the time of taking measurement of the item.

11. If usable approved material is available within the land width of road, the same shall be permitted for use in the road embankment subject to the following conditions:-

- (i) The borrow pits will be so excavated as to form a road side longitudinal gutter to drain the water, interrupted by such gutter.
- (ii) The width of the drain shall be restricted to 1.5mts. only the depth will be restricted to such grade so as to drain the water efficiently. All balance quantity of earth shall be brought from distant borrow areas only.
- (iii) If there is top layer of black cotton or other objectionable soils, the same shall be removed and disposed off elsewhere and usable material found at the lower level will only be used in the earthen embankment, if the contractor chooses to utilize this material.
- (iv) the drain should be aligned along the boundary of the land width of the road. Not pit, other than this drain shall be dug within 5 metres of the toe to the final section of the road embankment.
- (v) No borrow pits shall be allowed in the length in which earth obtained for cutting from cutting is specified to be used in embankment.

12. The rate of earthwork includes cleaning jungles, dog belling fixing profiles, erecting necessary pillars or stones for bench mark for leveling purpose, excavating earth from borrow pits, bracking clods, conveying and spreading earth in layers with all lead and lift, finishing the entire embankment and incidentals necessary to complete the work to the specifications. The cutting stuff of cutting in ordinary soil,

soft murrum, soft rock, hard murrum and hard rock shall utilised in embankment costruction under this item within the lead specified in the particulars item. No Payment shall be made under this item for the cutting stuff used in embankment but labour for cutting will be paid as per specifications in the particulars item, and only balance quantity of earthwork from borrow areas will be pain in this item.

Item No.3

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

Specification No. 162 and 553 of P.W.D. Hand book volume II and the following additional specifications be applicable here.

1. Cutting shall be done in proper grade & camber as per measurements given, Care must be taken the tall slopes are evenly and truly dressed. Cutting shall be done to the exact depth required and shall be as per formation level in proper grade and the camber. If extra depth of cutting is done due to negligence of contractor the same shall be refilled with approved quality of materials duly consolidated to the satisfaction of the Engineer-in-charge (Without extra cost) Box cutting for soling and metalling in required width the depth shall be done

2. The stuff received from the cutting shall be utilized for filling cuts and correcting side slopes of bank with all lead and lift as directed. Useful stuff shall be careful stacked separately as directed.

3. The measurement shall be taken as per cross section measurement of the cutting based on length, breadth, depth measured with tape at every 25 metres interval.

4. The payment shall be made on cmt. basis.

Item No.4

Earthwork in cutting in all sorts of soil and soft Murrum including conveying and spreading the suff embankment as and where directed within 200 Metres from the end of the cutting with all required lead and lift.

1. The land width required for the roadway gutter side slopes and catch water gutters shall be cleared of all trees having a girth of 30 cms. and less loose stones. vegetation bushes stumps and all other objectionable materials. The roots of trees and stumps shall be removed to a depth of 30 cms below the grade information and slopes and excavation filled up with excavated materials and compacted. All the materials cleared will be the property of Government. Useful materials shall be arranged in convenient stuacks along the road boundary or a directed as places within 50 mts. lead, and handed over to the department in convenient sections. Unsuitable material shall be burnt or otherwise disposed off by the contractor at his own cost without causing any nuisance, inconvenience or damage to the work, property or people in the neighborhood. If the contractor and royalty etc. If any paid by him without claiming compensations. In all cases, the materials shall be disposed of in a neat manner.

2. After cearing the site, the alignment of the road shall be properly set out true to lines, curves slope, grades and section as shown on the plans or directed by the Engineer in charge. The contractor shall provide all labour and establishing bench marks and giving profiles. The contractor shall beresponsible for maintaninig the B.Ms profiles alignments and other stakes and marks as long as then are required for the work in the opinion of the Engineer, If the contractor defaults in this respet even after the direction by the Engineer within the specified time, they may be resored by the Engineer at the levels etc. If there is any disagreement the contractor shall inform of it in writing to the Officer concerned with the specific reference to the sections before starting futher work. Once the work has started, no cognizance of any complaint shall be taken Merely not signing of the book shall not be deemed as disagreement.

3. Profiles of the section including the road side gutters to be excavated shall be laid at suitable intervals of 10m to 50 m or other intervals as directed by Engineer to conform to the curved or straight alignment, sections grades and used shall be set up with the toe line marked on each side. The road way section shall first be excavated with vertical side for each lift and the sides slopes for that lift shall be excavated in steps. These steps shall be smoothened to the required slope when the excavation reaches the road formation. The contractor shall on no account excavate beyond the slopes or below the specified grade unless so directed by the Engineer in writing. If excavation is done below the specified level or out side the

section, it shall not be paid for and the contractor shall be required to fill up at his own cost such extra excavation in the road portion, with approved materials of the embankment grade in layers, watered and fully compacted to attain maximum density laid down for the embankment in its relevant item. The Engineer may require measurement ridges and dead man to be left at specified intervals or places and kept intact till order to be removed for the purpose to check measurements. The excavation shall be finished neatly smoothly and evenly to the correct lines, curves, grades. If loose shall be scarified, watered and compacted to the same density as the embankment, The section side slopes and catch water gutter shall be maintained by the contractor at his own cost in such a way that the formation and gutters will be drained by providing for necessary diversions etc. and not damaged due to obstruction of any drainage, Necessary passages shall be provided for leading away seepage, spring, surface flow or rainwater safely without damaging the work. If any damage occurs due to default of the contractor in this respect he shall make good the damage at his own cost, If it is necessary in the execution of the work to interrupt existing surface drainage, irrigation channels, sewers or under drainage, temporary arrangements shall be provided till such time as is necessary. The contractor at his own cost shall make the existing work or work in hand caused as a result of his operations or negligence shall be made good by the contractor at his own cost. Road side gutters shall be excavated to the specified sections and shall be measured along with the main cutting in cubic Metres.

4. If slides occur in the cutting they shall be removed as ordered by the Engineer. If finished slopes slide into the roadways before the final acceptance of the work. Such slides shall be removed by the contractor and shall be paid for at the contract rate for the class of excavation involved provided the slides are not due to any negligence of the contractor, The classification of the material in slides shall conform to its conditions at the time of removal and payment made accordingly regardless of its prior condition. Care shall be taken to see that excavation is arranged in a safe way so that there will be no risk to the workmen by slides, falling materials, boulders and collapsing sides etc.

5. If there is traffic nearby or if there are towns and villages in the neighborhood, barricades and or traffic, signals shall be provided day and night for the duration of the work in such a way as to prevent accidents. Warning signals shall be displayed at 7mt. from the danger point on both sides giving sufficient warning. If necessary, signalers shall be stationed at each end to regulate traffic where it is heavy. Measures shall be taken to see that the excavation does not affect or damage adjoining structures or property, If there is damage to property, injury to workers, the members of the public, animals etc., due to the negligence of the contractor, he will be responsible and liable to all the consequences including compensation.

6. All the excavated materials shall be property of Govt. When the useful excavated material is to be used in embankment within a lead of 200 metre an all lift, it shall be directly deposited at the required location in specified layers. No handling or conveyance charges shall be paid if the material is temporarily deposited elsewhere and the drainage in any way. If no Govt. land is available but the excavated useful stuff is to be stacked temporarily before use under the same agreement, the contractor shall make his own arrangements for the stacking of this material not required for use on embankment or unsuitable materials may be used on his own to uniformly widen embankment to flatten slopes and to fill low places in the road land, if so permitted by the Engineer. Material not required for any use whatsoever may be disposed of by the contractor at his own cost in manner approved by the Engineer. The excavated material shall not be deposited within 3 m. from the top edge of slope or toe of the bank. The lead shall be measured from the junction point of cutting and embankment up to 200 mt. on either side.

7. If the contractor does not wish to utilise the quantity of cutting within the specified lead for any reason, then he may do the embankment work with the earth from other sources (except borrow pits in the length of the road where cutting stuff is to be utilized) but in that case the full or part quantity of acceptable quality stuff for which payment is made or to be made will be deducted from the net quantity of the earth work in the embankment arrived at, within the chainage measured as above.

8. The contract rate shall be a unit of one cubic metre for the work mentioned in the wording of the item of excavation acceptably completed. limited to the dimensions shown on the plans or as directed by the Engineer. Excavation shall be measured in its original positions by taking cross sections before the work starts and after it is entirely completed. The quantity shall be worked by the average end area method.

When the classification of the strata changes, the contractor shall bring this to notice of the Engineer. who will then verify and if necessary take levels for the changed strata for purpose of measurement.

(b) In spoil Bank : Specification shall be as per Item 2(a) except that the excavated stuff shall be deposited in spoil Bank instead of using same in road embankment.

Item No.5

Supplying, stacking, spreading, rolling, watering and consolidation to desired density of quarry spall with all lead and lift.

1. The quarry spalls shall be approved quarry as approved by the Ex. Engineer prior to collection. Filling of boxes. shall not be allowed till the metal is broken to the specified size.
2. The quarry spall be as uniform in size as possible. The quarry spall shall be hard, tough, solid, durable of black trap quarry of close texture, free from decay and weathering. The stone shall be angular and roughly cubical in shape and round elongated or flaky materials shall be rejected . No sound or long rubble or angular chips smaller than specified size shall be allowed,
3. All unsound , whethered or disintegrated stone obtained from the under surface layer of the quarry of other layers of boulders shall be rejected.
4. Wherever any doubt as to whether above requirement are satisfied in whole or part of the collection it shall be got screened by the contractor if so ordered by the Executive Engineer, and for which no extra payment shall be claimed by the contractor.
5. Any collection which does not fully satisfy the above requirements is liable to be rejected all together.
6. Stacking shall be made by the contractor by steel pharas of 2 m x 1.5 m 0.5 m and no deduction of voids shall be made from the gross measurements.
7. Regular stack shall be made by the contractor on a fairly level ground. All the stack shall be marked by white wash immediately on being measured and recorded by the Engineer in charge.
8. The rate includes blasting the rock, if any breaking the quarry spalls, stacking measuring in pharas etc. complete.
9. The rate shall as per actual requirements and any materials in excess shall have to be transported by the contractor at the places directed by the Executive Engineer at the risk and cost of the contractor.
10. While stacking materials the depositing should commence at one end of the km, and carried continuously towards the other end unless the Executive Engineer shall direct otherwise and as a rule measurements shall be taken after metal for half kiloMetre or km, has been fully collected. Any fraction of these distance shall be not be measured up,
11. **The measurements shall be recorded in on Cum. basis & be paid accordingly.**
Spreading quarry spalls in grade & camber complete.

1. The quarry spalls shall be only be allowed to be spread after the written permission of the Executive engineer is obtained.
2. The permission for spreading the metal shall be given by the Executive Engineer if
 - (i) The full quantity of a particular mile (KiloMetre) is completely collected.
 - (ii) The collection of metal is also completed in the adjoining two miles (kiloMetres)
 - (iii) The measurements are recorded in the Measurement book.

3. Q.S. shall of required be screened, if containing rubbish dust, grass etc. it shall than be filled in basket & conveyed where required and spread evenly on the prepared surface be given twisting motion to the basket at the time of spreading. The surfac shall the (15mm) by means of templates and string as well as with camber boards and spirit level.

4. Between the straight length and cuves and at the meeting points of the convex and concave portion of the severse curveses, the change in camber of the road, dure to super evleations shall be made as well as with camber boards and spirit level.

5. At the time of sprreading Q.S. a small quantity (about 4 to 5 percent) of metal as directed, shall be retained at the first instance. It shall be spread later on after partial consolidated as required to rectity the camber and to fill up the hollows if any. No extra amount shall be paid for this.

6. Measurements shall be paid as per the measurements of collection less the quantity remained to be spread and on cubic metre basis.

7. The rate includes the cost of screening the Q.S. if any spreading , sectioning, with template and adding reserved quota of metal, while rolling is in progress for making good hollows and coamber.

8. The surface shall be brought to the required camber which shall be chacked at ever 50 ft. (15 m) by means of templates of while the necessary of the in between shall tested by strings and corrected as required.

9. The centre line shall bfirst be marked in the subgrade which is properly consolidated and has uniform camber and grade as required.

10. The Q.S. shall be laid for a small leangth on 25 ft. (8 M) and then the adge stones shall be laid.

11. Pegs shall be driven on either side of the road and joined with strings true and parallel with a distance between they equal to the width be laid with oversize metal similarly.

12. The Q.S. shall be laid as close as possible so as too leave minimum possible interstics and voids.

13. Before rolling is allowed on soling the side berm shall be filled upto the top of the soling and at least 3'-0" (1m) on either side so at to prevent metal layer getting disturbed at times during rolling. The rate is inclusive of all the operations as stated above.

Rolling and Consolidation of Quarry spall.

1. For spreading materials in layers and bringing the appropariate moisture content the embankment materials successive layers of embankment shall be spread uniformly over the entire which of the embankment in layer not exceeding 250mm in loose thickness successive layers of embankment shall not be placed untill the layer under construction has been throughly compacted to the requirements set down hereunder:

Mositure content of the materials shall be chaked at the source of supply and if found less. than thet specified for compaction. the same shall be made good either at the source or after speading the soll in loose thickness for compation. In the letter case. water shall be srinkled directly from a hoseline or from a truck mounted water tank, and flooding shall not be permitted under any circumstances.

If the materials delivered to the road bed is too wet it shall be dired by evaporation and exposure to the sun till the moisuure content is brought doen to acceptable standard for ompaction. Should circumstances arise where owing to wet weather, the moisture content cannot be reduced to the required level by the above procedure work of compaction shall be suspended.

Mositure content of each layer of soil shall be checked in accrodance with IST 2720(Part : II) and unless other wise mentioned shall be so adjusted, making dure allowance for evaporation losses that at the time of the compaction it is in the range of 1 percent to 2 percent below the optimum moisture content

determined in accordance with ISI (Part - VII) Highly expansive clays shall however be compacted at 2 to 4 percent above the optimum moisture content.

After adding the required amount of water, the soil shall be processed by mean of harrows rotary mixers or as otherwise aproved until the layer is uniformaly wet.

Clods or hard lumps of earth shall be broken to have maximum size of 150 mm when being placed in the lower layers of the emnankment and a maximum size of 60mm when being placed in the top 0.5 Metre protion of the minimise cutting of eneven compaction.

Hauling equipment shall be disperd uniformaly over entire surface of the previously constructed layer to minimise cutting of uneven compaction.

Where the embankment is to be constructed on low area groung that will not support the weight of truck of other hauling equipment, the lower part of the till should be constructed by dumping successive loads in a uniformal distributed layers of a thickness not greater than that necessary to support the hauling equipment while placing subsequent layers.

2. COMPACTION : Only compaction equipment approved by the Engineer in charge shall be employed to compact the materials. The contractor shall demonstrate the efficiency of the paints he intents to use for carring out compaction trials.

Each layer of the materials shall be thoroughly compacted to the densities specified in Table 1.2

Table 1.2 Compaction requirements for embankment.

Sr.No.	Type of Work/ Materials	Field dry density as percentage of maximum Laboratory dry density as per IS:2720 (Part - VII)
1.	Top 0.5 Metre portion of embankment below subgrade level and shoulders	Not less than 100
2.	Other portion of embankment.	Not less than 95
3.	Highly expensive Class.	85 to 90

Subsequent layers shall be placed only after finished layer has been tested accroding to M.O.S.T. specification clause 902 and accepted by the Engineer in charge.

When density measurements reveal any soft areas in the embankment further compaction shall be carried out as directed by the Engiveer in charge. If insite of that specifcated compaction is not achieved, the materials in the soft areas shall be removed and replaced by approved amterials and compacted to the density requirement to the satisfaction of the Engineer in charge,

3. Measurement for Payment : Consolidation of earth embankment construction shall be measured by taking cross section at interval in the original position before the work starts and after its completion and computing of the volume of earthwork in cubic Metres by the method of average and areas. The measurement of fill material from borrow are a shall be the difference between the net quantities of suitable materials brought from roadway and drainage exacvation. For this purpose it shall be assumed that one cubic Metre of suitable materials brought to site from roadway and drainage excavation froms one cubic Metre of compacted fill and all bulking or shrinkage shall be ignored.

Stripping including storing and reapplication of top soil shall be measured as volume in cubic Metre.

4. The contract unit rate include cost of mechanical roller required for consolidation including all labour. equipments fuel, hire chares, tolls and incidental necessary.

Item No.6

WBM Grading-1

Providing, laying, spreading and compacting stone agg. Of 90mm to 45mm size to water bound macadam specification including spreading in uniform thickness, hand packing, rolling with smooth wheel roller 80-100 KN in stage to proper grade and camber, applying and brooming, stone screening/binding material to fill-up the interstices of coarse agg., watering and compacting to the required density grading-1 as per Technical Specification Clasue.405 By manual means.

405. WATER BOUND MACADAM SUB-BASE/BASE/SURFACING

405.1. Scope

405.1.1. This work shall consist of clean, crushed aggregates mechanically interlocked by rolling and bonding together with screening, binding material where necessary, and water laid on a properly prepared subgrade-sub-base/base or existing pavement, as the case may be and finished in accordance with the requirements of these Specifications and in close conformity with the lines, grades, cross-sections and thickness as per approved plans or as directed by the Engineer.

405.2. Materials

405.2.1. Coarse aggregates: Coarse aggregates shall be either crushed or broken stone, crushed slag, overburnt (Jhama) brick aggregates or any other naturally occurring aggregates, such as, kankar and laterite of suitable quality. Materials obtained from rocks, such as, Phyllites, Shales or Slates, etc. shall not be permitted in WBM construction. Materials other than crushed or broken stone and crushed slag shall be used in sub-base courses only. If crushed gravel/shingle is used, not less than 90 per cent by weight of the gravel/shingle pieces retained on 4.75 mm sieve shall have at least two fractured faces. The aggregates shall conform to the physical requirements set forth in Table 400.7. The type and size range of the aggregate shall be specified in the Contract or shall be as specified by the Engineer. If the water absorption value of the coarse aggregate is greater than 2 per cent, the Soundness test shall be carried out on the material delivered to site as per IS:2386 (Part 5).

TABLE 400.7: PHYSICAL REQUIREMENTS OF COURSE AGGREGATES FOR WATER BOUND MACADAM FOR SUB-BASE/BASE/SURFACING COURSES

Test	Sub-base	Base	Surfacing
Aggregate Impact Test (IS:2386 Part 4 or IS:5640)	Less than 50	Less than 40	Less than 30
Flakiness Index Test (IS:2386 Part 1)	Less than 30	Less than 25	Less than 20
Soundness Test (IS:2386 Part 1)			
- Loss with Sodium Sulphate	Less than 12%	Less than 12%	Less than 12%
- Loss with Magnesium Sulphate	Less than 18%	Less than 18%	Less than 18%

405.2.2. Aggregates, like, brick bats, kankar, laterite, etc. which get softened in presence of water shall be tested for Aggregate Impact Value under wet conditions in accordance with IS:5640.

405.2.3. The requirement of flakiness Index shall be enforced only in the case of crushed or broken stone and crushed slag.

405.2.4. Crushed or broken stone: The crushed or broken stone shall be hard, durable and free from excess flat, elongated, soft and disintegrated particles, dirt and other deleterious material.

405.2.5. Crushed slag: Crushed slag shall be made from air-cooled blast furnace slag. It shall be angular shape, reasonably uniform in quality and density and generally free from thin, elongated and soft pieces, dirt or other deleterious materials.

405.2.6 Overburnt (Jhama) brick aggregates: Jhama brick aggregates shall be made from over burnt bricks or brick ballast and be free from dust and other objectionable and deleterious materials.

405.2.7. Grading requirement of coarse aggregates: The coarse aggregates shall conform to one of the Gradings given in Table 400.8 as specified, provided, however, the use of Grading No.1 shall be restricted to sub-base courses only.

TABLE 400.8 : GRADING REQUIREMENTS OF COARSE AGGREGATES

Grading No.	Size Range	IS Sieve Designation	Per cent by weight passing
(1)	90 mm to 45 mm	125 mm	100
		90 mm	90-100
		63 mm	25-60
		45 mm	0-15
		22.4 mm	0-5
(2)	63 mm to 45 mm	90 mm	100
		63 mm	90-100
		53 mm	25-75
		45 mm	0-15
		22.4 mm	0-5
(3)	53 mm to 22.4 mm	63 mm	100
		53 mm	95-100
		45 mm	65-90
		22.4 mm	0-10
		11.2 mm	0-5

Note: The compacted thickness for a layer with Grading 1 shall be 100 mm while for layer with other Gradings, i.e., 2 & 3, it shall be 75 mm.

405.2.8 Screenings: Screenings to fill voids in the coarse aggregate shall generally consist of the same material as the coarse aggregate. However, where economic considerations so warrant, predominantly non-plastic material (other than rounded river borne material) may be used for this purpose provided liquid limit and plasticity index of such material are below 20 and 6 respectively and fraction passing 75 micron sieve does not exceed 10 per cent. The Screenings shall not contain any of the undesirable constituents listed in Clause 301.2.3 which would render it unsuitable as a fill material.

Screenings shall conform to the grading set forth in Table 400.9. The consolidated details of quantity of screenings required for various grades of stone aggregates are given in Table 400.10. The Table also gives the quantities of materials (loose) required for 10 m² for sub-base compacted thickness of 100/75 mm.

TABLE : 400.9 : GRADING FOR SCREENING

Grading Classification	Size of Screenings	IS Sieve Designation	Percent by Weight Passing the IS Sieve
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A	13.2 mm	13.2 mm	100
		11.2 mm	95-100
		5.6 mm	15-35
		180 micron	0-10
B	11.2 mm	11.2 mm	100
		5.6 mm	90-100
		180 micron	15-35

The use of screenings shall be omitted in the case of soft aggregates, such as, brick metal, kankar, laterite, etc. as they are likely to get crushed to a certain extent under rollers.

405.2.9 Binding material: Binding material to be used for water bound macadam as a filler material meant for preventing raveling, shall comprise of a suitable material approved by the Engineer having a Plasticity Index (PI) value of less than 6 for sub-base/base course and 4 to 10 for surfacing course as determined in accordance with IS:2720 (Part 5).

The quantity of binding material where it is to be used, will depend on the type of screenings. Generally, the quantity required for 75 mm compacted thickness of water bound macadam will be $0.06-0.09 \text{ m}^3/10\text{m}^2$ and $0.08-0.10 \text{ m}^3/10 \text{ m}^2$ for 100 mm compacted thickness.

The above mentioned quantities should be taken as a guide only, for estimation of quantities for construction, etc.

Application of binding materials may not be necessary when the screenings used are of crushable type.

TABLE 400.10: APPROXIMATE QUANTITIES OF COARSE AGGREGATES AND SCREENINGS REQUIRED FOR 100/75 mm COMPACTED THICKNESS OF WATER BOUND MACADAM (WBM) SUB-BASE/ BASE/ SURFACING COURSE FOR 10 M² AREA.

Classification	Size Range	Compacted thickness	Loose Quantity	Stone Screenings		Crushable Screenings such as moorum or	
				Grading Classification & Size	For WBM Sub-base/ Base Course (Loose Quantity) m ³	Properties	Loose Quantity
Grading 1	90 to 45	100	1.21 to 1.43	Type A 13.2	0.27 to 0.30	LL<20, PI<6 percent passing 0.075 mm 10	0.30 to 0.32
Grading 2	63 to 45	75	0.91 to 1.07	Type A 13.2	0.12 to 0.15	-do-	0.22 to 0.24
Grading 2	63 to 45	75	0.91 to 1.07	Type B 11.2	0.20 to 0.22	-do-	-do-
Grading 3	53 to 22.4	75	0.91 to 1.07	Type B 11.2	0.18 to 0.21	-do-	-do-

405.3. Construction Operations

405.3.1. Preparation of base: The surface of the subgrade/sub-base/base to receive the water bound macadam course shall be prepared to the specified lines and crossfall (camber) and made free of dust and other extraneous material. Any ruts or soft yielding places shall be corrected in an approved manner and rolled until firm surface is obtained if necessary by sprinkling water. Any sub-base/base/surface irregularities, where predominant, shall be made good by providing appropriate type of profile corrective course (leveling course).

Laying water bound macadam course over an existing bituminous layer shall be avoided since it will cause problems of internal drainage of the pavement at the interface of two courses. It is desirable to completely pick out the existing thin bituminous wearing course where water bound macadam is proposed to be laid over it.

405.3.2. Inverted choke: Where the WBM layer is to be laid over the subgrade and the subgrade soil is fine-grained, it is advisable to lay 100 mm intervening layer of screening or coarse sand on top of the fine-grained soil.

405.3.3. Provision of lateral confinement of aggregates: While constructing water bound macadam, arrangement shall be made for the lateral confinement of the aggregate. This shall be done by laying materials in adjoining shoulders along with that of water bound macadam layer and following the sequence of operations described in Clause 407.4.1.

405.3.4. Spreading coarse aggregates: The coarse aggregates shall be spread uniformly and evenly upon the prepared subgrade/sub-base/base to proper profile by using templates placed across the road about 6 mm apart, in such quantities that the thickness of each compacted layer is not more than 100 mm for Grading 1 and 75 mm for Grading 2 and 3, as specified in Clause 405.2.5. Aggregates placed at locations which are inaccessible to the spreading equipment, may be spread in one or more layers by any approved means so as to achieve the specified results.

The spreading shall be done from stockpiles along the side of the roadway or directly from vehicles. No segregation of large or fine aggregates shall be allowed and the coarse aggregate as spread shall be of uniform gradation with no pockets of fine material.

The surface of the aggregates spread shall be carefully checked with templates and all high or low spots remedied by removing or adding aggregates as may be required. The surface shall be checked frequently with a straight edge while spreading and rolling so as to ensure a finished surface as per approved drawings.

The coarse aggregates shall not normally be spread more than 3 days in advance of the subsequent construction operations.

405.3.5. Rolling: Immediately following the spreading of the coarse aggregate, rolling shall be started with three wheeled power rollers of 80 to 100 kN capacity or tandem or vibratory rollers of 80 to 100 kN static weight. The type of roller to be used shall be approved by the Engineer based on trial run.

Except on superelevated portions where the rolling shall proceed from inner edge to the outer, rolling shall begin from the edges gradually progressing towards the centre. First the edge/edges shall be compacted with roller running forward and backward. The roller shall then move inward parallel to the centre line of the road, in successive passes uniformly lapping preceding tracks by at least one half width.

Rolling shall be discontinued when the aggregates are partially compacted with sufficient void space in them to permit application of screenings. However, where screenings are not to be applied, as in the case of crushed aggregates, like, brick metal, laterite and kanker, compaction shall be continued until the aggregates are thoroughly keyed. During rolling slight sprinkling of water may be done, if necessary. Rolling shall not be done when the subgrade is soft or yielding or when it causes a wave-like motion in the subgrade or sub-base course.

The rolled surface shall be checked transversely and longitudinally, with templates and any irregularities corrected by loosening the surface, adding or removing necessary amount of aggregates and re-rolling until the entire surface conforms to desired crossfall (camber) and grade. In no case shall the use of screenings be permitted to make up depressions.

Material which gets crushed excessively during compaction or becomes segregated shall be removed and replaced with suitable aggregates.

It shall be ensured that shoulders are built up simultaneously along with water bound macadam courses, in accordance with the procedure given in Clause 407.4.1.

405.3.6. Application of screenings: After the coarse aggregate has been rolled to Clause 405.3.4, screenings to completely fill the interstices shall be applied gradually over the surface. These shall not be damp or wet at the time of application. Dry rolling shall be done while the screenings are being spread so that vibrations of the roller cause them to settle into the voids of the coarse aggregate. The screenings shall not be dumped in piles but be spread uniformly in successive thin layers either by the spreading motions of hand shovels or by mechanical spreaders, or directly from tipper with suitable grit spreading arrangement. Tipper operating for spreading the screenings shall be so driven as not to disturb the coarse aggregate.

The screenings shall be applied at a slow and uniform rate (in three or more applications) so as to ensure filling of all voids. This shall be accompanied by dry rolling and brooming with mechanical brooms, hand brooms or both. In no case shall the screenings be applied so fast and thick as to form cakes or ridges on the surface in such a manner as would prevent filling of voids or prevent the direct bearing of the roller on the coarse aggregate. These operations shall continue until no more screenings can be forced into the voids of the coarse aggregate.

The spreading, rolling, and brooming of screenings shall be carried out in only such lengths of the road which could be completed within one day's operation.

405.3.7. Sprinkling of water and grouting: After the screenings have been applied, the surface shall be copiously sprinkled with water, swept and rolled. Hand brooms shall be used to sweep the wet screenings into voids and to distribute them evenly. The sprinkling, sweeping and rolling operation shall be continued, with additional screenings applied as necessary until the coarse aggregate has been thoroughly keyed, well-bonded and firmly set in its full depth and a grout has been formed of screenings. Care shall be taken to see that the base or subgrade does not get damaged due to the addition of excessive quantities of water during construction.

In case of lime treated soil sub-base, construction of water bound macadam on top of it can cause excessive water to flow down to the lime treated sub-base before it has picked up enough strength (is still "green") and thus cause damage to the sub-base layer. The laying of water bound macadam layer in such cases shall be done after the sub-base attains adequate strength, as directed by the Engineer.

405.3.8. Application of binding material: After the application of screenings in accordance with Clauses 405.3.5 and 405.3.6 the binding material where it is required to be used (Clause 405.2.7) shall be applied successively in two or more thin layers at a slow and uniform rate. After each application, the surface shall be copiously sprinkled with water, the resulting slurry swept in with hand brooms, or mechanical brooms to fill the voids properly, and rolled during which water shall be applied to the wheels of the rollers if necessary to wash down the binding material sticking to them. These operations shall continue until the resulting slurry after filling of voids, forms a wave ahead of the wheels of the moving roller.

405.3.9. Setting and drying: After the final compaction of water bound macadam course, the pavement shall be allowed to dry overnight. Next morning hungry spots shall be filled with screenings or binding material as directed, lightly sprinkled with water if necessary and rolled. No traffic shall be allowed on the road until the macadam has set. The Engineer shall have the discretion to stop hauling traffic from using the completed water bound macadam course, if in his opinion it would cause excessive damage to the surface.

The compacted water bound macadam course should be allowed to completely dry and set before the next pavement course is laid over it.

405.4. Surface Finish and Quality Control of Work

405.4.1. The surface finish of construction shall conform to the requirements of Clause 1802.

405.4.2. Control on the quality of material and works shall be exercised by the Engineer in accordance with Section 1800.

405.4.3. The water bound macadam work shall not be carried out when the atmospheric temperature is less than 0° C in the shade.

405.4.4. Reconstruction of defective macadam: The finished surface of water bound macadam shall conform to the tolerance of surface regularity as prescribed in Clause 1802. However, where the surface irregularity of the course exceeds the tolerances or where the course is otherwise defective due to subgrade soil mixing with the aggregates, the course to its full thickness shall be scarified over the affected area, reshaped with added material or removed and replaced with fresh material as applicable and recompacted. In no case shall depressions be filled up with screenings or binding material.

405.5. Arrangement for Traffic

During the period of construction, the arrangement of traffic shall be done as per Clause 111.

405.6. Measurements for Payment

Water bound macadam shall be measured as finished work in position in cubic metres.

405.7. Rate

The Contract unit rate for water bound macadam sub-base/base course shall be payable in full for carrying out the required operations including full compensation for all components listed in Clause 401.9 (i) to (v) including arrangements of water used in the work as approved by the Engineer.

Item No.7

Rolling and Watering of earthwork in layers with vibratory roller including filling in depression which occur during the process as directed.

1. For spreading materials in layers and bringing the appropriate moisture content the embankment materials successive layers of embankment shall be spread uniformly over the entire width of the embankment in layer not exceeding 250mm in loose thickness successive layers of embankment shall not be placed until the layer under construction has been thoroughly compacted to the requirements set down hereunder:

Moisture content of the materials shall be checked at the source of supply and if found less than that specified for compaction, the same shall be made good either at the source or after spreading the soil in loose thickness for compaction. In the latter case, water shall be sprinkled directly from a hose line or from a truck mounted water tank, and flooding shall not be permitted under any circumstances.

If the materials delivered to the road bed is too wet it shall be dried by evaporation and exposure to the sun till the moisture content is brought down to acceptable standard for compaction. Should circumstances arise where owing to wet weather, the moisture content cannot be reduced to the required level by the above procedure work of compaction shall be suspended.

Moisture content of each layer of soil shall be checked in accordance with IST 2720 (Part : II) and unless otherwise mentioned shall be so adjusted, making due allowance for evaporation losses that at the time of the compaction it is in the range of 1 percent to 2 percent below the optimum moisture content determined in accordance with ISI (Part - VII) Highly expansive clays shall however be compacted at 2 to 4 percent above the optimum moisture content.

After adding the required amount of water, the soil shall be processed by means of harrows rotary mixers or as otherwise approved until the layer is uniformly wet.

Clods or hard lumps of earth shall be broken to have maximum size of 150 mm when being placed in the lower layers of the embankment and a maximum size of 60mm when being placed in the top 0.5 Metre portion of the embankment to minimise cutting of uneven compaction.

Hauling equipment shall be dispersed uniformly over entire surface of the previously constructed layer to minimise cutting of uneven compaction.

Where the embankment is to be constructed on low area ground that will not support the weight of truck or other hauling equipment, the lower part of the fill should be constructed by dumping successive loads in a uniform distributed layers of a thickness not greater than that necessary to support the hauling equipment while placing subsequent layers.

2. COMPACTION : Only compaction equipment approved by the Engineer in charge shall be employed to compact the materials. The contractor shall demonstrate the efficiency of the plant he intends to use for carrying out compaction trials.

Each layer of the materials shall be thoroughly compacted to the densities specified in Table 1.2

Table 1.2 Compaction requirements for embankment.

Sr.No.	Type of Work/ Materials	Field dry density as percentage of maximum Laboratory dry density as per IS:2720 (Part - VII)
1.	Top 0.5 Metre portion of embankment below subgrade level and shoulders	Not less than 100
2.	Other portion of embankment.	Not less than 95
3.	Highly expansive Class.	85 to 90

Subsequent layers shall be placed only after finished layer has been tested according to M.O.S.T. specification clause 902 and accepted by the Engineer in charge.

When density measurements reveal any soft areas in the embankment further compaction shall be carried out as directed by the Engineer in charge. If in spite of that specified compaction is not achieved, the materials in the soft areas shall be removed and replaced by approved materials and compacted to the density requirement to the satisfaction of the Engineer in charge,

3. **Measurement for Payment :** Consolidation of earth embankment construction shall be measured by taking cross section at interval in the original position before the work starts and after its completion and computing of the volume of earthwork in cubic Metres by the method of average and areas. The measurement of fill material from borrow are a shall be the difference between the net quantities of suitable materials brought from roadway and drainage excavation. For this purpose it shall be assumed that one cubic Metre of suitable materials brought to site from roadway and drainage excavation froms one cubic Metre of compacted fill and all bulking or shrinkage shall be ignored.

Stripping including storing and reapplication of top soil shall be measured as volume in cubic Metre.

4. The contract unit rate include cost of mechanical roller required for consolidation including all labour. equipments fuel, hire chares, tolls and incidental necessary.

Item No. 8

Excavation for foundation upto 1.5m depth including sorting out and stacking of useful materials and disposing of the excavated stuff upto all lead. Dense or hard soil.

1. Excavation for structures shall consist of the removal of material for the construction of foundations for culverts, retaining walls, cut of walls pipe culverts and other similar structures, in accordance with the requirements of these specification and the lines and dimensions shown on the drawing or as indicated by the Engineer in charge. The work shall include all necessary sheeting shorting. bracing draining an pumping and the removal of all logs stumps ,grubs and other deleterious matter and obstructions necessary for placing the foundations, trimming bottoms of excavations backfilling and clearing up the site and the disposal of all surplus material.

2. After the site has been cleared the limits of excavation shall be set out true to lines, curves and slopes.

3. Excavation shall be taken to the width of the lowest step of th footing. The contractor at his own expense shall put up necessary shoring, trutting and planking or cut slopes to a safer angle or both with due-regard to the safety of persons and works and to the satisfaction of the enginner in charge.

4. The depth to which the excave on is to be carried out shall be as shown, on the drawings. unles the type of material encounted is such as to require changes. in which case the depth shall be as ordered by the Engineer in charge.

5. Where waters is met with in excavation due to stream flowm seepage springs , raing or ther reasons, the contractor shall take adequate measures such as bailing pumping , constructing , diversion channels drainage channels and other necessary work to keep the foundation trenches dry when so required and to protect green concrete/masonry against damage by erosion or sudden rising of wate level. The method to be accepted in the regard and other details there of shall be left to the choice of the contractor but subject of approval of the engineer in charge. Approval of the Engineer in charge shall, however not relieve the contractor of the responsibility for the adequacy of dewatering and protection arragements and for the quality an safety of the work.

6. Pumping from the interior of any foundation enclosures shall be done in such manner as to preclude the possibility of the movement of water through anyfresh concrete. No pumping shall be permitted durring the placing of concrete or for any period of at least 24 hours thereafter, unless it is done from a sitable sump separated from the concrete work by a water tight wall or other similar means.

7. The botton of the foundation shall be leveled both longitudinally and transversely or stepped as directed by the Engineer in charge. Before footing is laid, the surface shall be slightly watered and remmed. In the event of excavation having been made deeper than that shown on the drawings or as otherwise ordered by the Engineer in charge, the extra depth shall be made up with concrete or masonry of the foundation grade at the cost of the contractor , Ordinary filling shall not be used for the purpose of bringing the foundation oto level. If there are any slip or blows in the excavation these shall be removed by the contractor at his own cost.

8. Near towns , villages and all frequented places , trenches and foundation pits shall be securely fenced, provided with proper caution signs and marked with red lights at night to avoid accidents. The contractor shall be required to take adequate protective measures to see that the excavation operation do not affect or damage adjoining structures.

9. Backfilling shall be done with approved material after concrete or masonry is full set and carried out in such a way as not to cause under thrust on any part of the structure. All space between foundation masonry or concrete and the sides of excavation shall be refilled to the original surface, making due allowance for settlement in 250 mm loose layers. Which shall be watered and compacted.

10. All the excavated materials shall be the property of the Government where the excavated material is directed to be used in the construction of embankment , it shall be directly deposited at the required locations.

11. All useful materials, not intended for use in the bank, shall be stacked neatly on Government land as directed by the Engineer in charge within 50 metres lead. Unsuitable and surplus materials not intended for use in any part of the road shall be disposed off as directed by the Engineer in charge.

12. Excavation for structures shall be measured in cubic metres for each class of material encountered , limited to the dimensions shown on the drawings or as directed by the Engineer in charge. Excavation over increased width , cutting of slopes, shoring , shattering and planking shall be deemed as convenience for the contractor in executing the work and shall not be measured and paid for separately.

13. The contract unit rate for the items for excavation for structures shall be paid in full for carrying out the required operations including.

(1) Setting out

(2) Construction of necessary shoring and bracing and their subsequent removal :

(3) Removal of all logs stumps , grubs and other deleterious matter and obstructions for piling the foundations including trimming of bottoms of excavation :

(4) Foundation sealing dewatering including pumping.

(5) Backfilling clearing up the site and disposal of all surplus material within all lifts and leads upto 100 metres :

(6) All labour, material, tools, equipment, safeguards and incidentals necessary to complete the work to the specification .

14. Excavation shall be for ordinary soil such as vegetable or organic soil, turf slit, and loam , clay mud, plat, black cotton soil, soft shale or soft murrum a mixture of these and similar material which yields other ordinary application of pick and shovel rake or other ordinary digging equipment. Removal of gravel or any other nodular material having diameter in any one direction not exceeding 75 mm occurring in such strata shall be deemed to be covered under this category. The classification of excavation shall be decided by the Engineer in charge and his decision shall be final and binding on the contractor,

(B) -DO- in dense or hard soil

Specifications shall be same except that the work shall be carried out in strata like dense or hard soil. The work shall be carried out in workmanship like manner.

Useful material available from excavation should be stacked properly and reused as directed and remaining materials should be disposed as directed. [Rate should be paid on cubic Metre basis.](#)

Item No. 9

Excavation for foundation upto 1.5m depth including sorting out and stacking of useful materials and disposing of the excavated stuff upto all lead. Hard Murrum

1. Excavation for structures shall consist of the removal of material for the construction of foundations for culverts, retaining walls, cut of walls pipe culverts and other similar structures, in accordance with the requirements of these specifications and the lines and dimensions shown on the drawing or as indicated by the Engineer in charge. The work shall include all necessary sheet piling, shoring, bracing, draining and

pumping and the removal of all logs stumps ,grubs and other deleterious matter and obstructions necessary for placing the foundations, trimming bottoms of excavations backfilling and clearing up the site and the disposal of all surplus material.

2. After the site has been cleared the limits of excavation shall be set out true to lines, curves and slopes.

3. Excavation shall be taken to the width of the lowest step of th footing. The contractor at his own expense shall put up necessary shoring, trutting and planking or cut slopes to a safer angle or both with due regard to the safety of persons and works and to the satisfaction of the enginner in charge.

4. The depth to which the excave on is to be carried out shall be as shown, on the drawings. unless the type of material encountered is such as to require changes. in which case the depth shall be as ordered by the Engineer in charge.

5. Where waters is met with in excavation due to stream flowm seepage springs , raing or ther reasons, the contractor shall take adequate measures such as bailing pumping , constructing , diversion channels drainage channels and other necessary work to keep the foundation trenches dry when so required and to protect green concrete/masory against damage by erosion or sudden rising of wate level. The method to be accepted in the regard and other details there of shall be left to the choice of the contractor but subject of approval of the engineer in charge. Approval of the Engineer in charge shall, however not relieve the contractor of the responsibility for the adequacy of dewatering and protection arragements and for the quality an safety of the work.

6. Pumping from the interior of any foundation enclosures shall be done in such manner as to preclude the prossibility of the movement of water through anyfresh concrete. No pumping shall be permitted durring the placing of concrete or for any period of at least 24 hours thereafter, unless it is done from a sitable sump separated from the concrete work by a water tight wall or other similar means.

7. The botton of the foundation shall be leveled both longitudinally and transversely or stepped as directed by the Engineer in charge. Before footing is laid, the surface shall be slightly watered and remmed. In the event of excavation having been made deeper than that shown on the drawings or as otherwise ordered by the Engineer in charge, the extra depth shall be made up with concrete or masonry of the foundation grade at the cost of the contractor , Ordinary filling shall not be used for the purpose of bringing the foundation oto level. If there are any slip or blows in the excavation these shall be remioved by the contractor at his own cost.

8. Near towns , villages and all frequented plances , trenches and foundation pits shall be securely fenced, provided with proper caution signs and marked with red lights at night to avoid accidents. The contractor shall gbe required to take adequate protective measures to see that the excavation operation do not affect or damage adjoining structures.

9. Backfilling shall be done with approved material after concrete or masonry is full set and carried out in such a way as not to cause under thrust on any part of the structure. All space btween foundation masonry or concrete and the sides of excavation shall be refilled to the original surface, maing due allowance for settlement in 250 mm loose layers. Which sahil be watered and compacted.

10. All the excavated materials shall be the property of the Govtrnment where the excavated material is directed to be used in the construction of embankment , it shall be directly deposied at the required locations.

11. All useful materials, not intended for use in the bank, shall bestacked neatly on Government land as directed by the Engineer in charge within 50 metres lead. Unsuitable and surplus materials not intended for use in any part of the road shall be disposed off as directed by the Engineer in charge.

12. Excavation for structures shall be measured in cubic metres for each class of material encontered , limited to the dimensions shown on the drawings or as directed by the Engineer in charge Excavation over

increased width , cutting of slopes, shoring , shattering and planking shall be deemed as convenience for the contractor in executing the work and shall not measured and paid for separately.

13. The contract until rate fore for the items for excavation for structures shall be paid in full for carrying out the required operations including.

- (1) Setting out
- (2) Construction of necessary shoring and bracing and their subsequent removal :
- (3) Removal of all long stumps , grubs and other deleterious matter and obstructions for pacing the foundations including trimming of bottoms of excavation :
- (4) Foundation sealing dewatering including pumping.
- (5) Backfilling clearing up the site and disposal of all surplus material within all lifts and leads upto 100 metres :
- (6) All labour, material, tools, equipment, safeguards and incidentals necessary to completed the work to the specification .

14. Excavation shall be in hard soil such as stiff heavy clay, hard shale or compact murrum requiring grafting tool or pick or both and shovel close applied and gravel and rubble stone having maximum diametre in any onedirection between 75 and 300 mm and soft conglomerate. The classification of excavation shall be decided by the engineer in charge and his deccision shall be final and binding on the Contractor.

Payment shall be made on Cum basis

Item No. 10

Excavation of foundation in Sand graval clay soft soil and murrum etc. including shoring, strutting dewatering as necessary and disposing of the excavated stuff as directed. Depth upto 3.00mt.

1. Excavation for structures shall consist of the removal of materials for the construction of foundations for bridges, culverts, retaining walls, headwalls, cut of walls, pipe culverts and other similar structures, in accordance with the requirements, of these specifications and the lines and dimensions shown on the drawings or as indicated by the Engineer-in-charge. The work sall be include all necessary sheeting, shorting, bracing, draining and pumping and the removal of all logs, stumps, sbrubs, and other deleterious matter and obstruction necessary for the foundations, trimming bottoms of excavations; back filling and clearing up the site and the disposal of all surplus materials.

2. After the site has been cleared the limits of excavations shall be set out true to lines, curves, slopes, grades and sections as shown on the drawings or as directed by the Engineer-in-charge. The contractor shall provide all labour, survey instruments and materials such as stirrings, pegs nails bamboos, stones, lime, mortar, concrete etc. required in connection with the sitting out of works and the establishment of bench mark, center line stones and other marks and stakes as long as in the opinion of the Engineer-in-charge, they are required for the work.

3. Excavation shall be taken to the with of the step of the footing. The contractor at his own expense shall put up necessary shoring, strutting, and planking or cut slopes to a safer angle or both with due regard to the safety of personal and works and to the satisfaction of the Engineer-in-charge.

4. The depth to which the excavation is to be carried out shall be is shown on the drawings, unless the type of materials encountered is such as to require changes, in which case the depth shall be as ordered by the Engineer-in-charge.

5. Where water is met with in excavation due to stream flow, seepage, rain or other reasons, the contractor shall take adequate measure such as bailing pumping, to keep the foundation trenches dry when so required and to protect the green concrete/masonry against damage by erosion of sudden rising of water level.. the methods to be adopted in this regard and other details thereof shall be left to eht choie of the contractor but subject to approval of the engineer-in-charge. Approval of the Engineer-in-charge shall, however not relieve the contractor of the responsibility for the adequacy of dewatering, and production arrangements and for the quality and safety of the works.

6. Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of movement of water through any fresh concrete. No pumping shall be permitted during the placing of concrete or for any period of at least 24 hours thereafter, unless iot is done from a suitable sump separated from the concrete work byu a wter tight wall or other similar means.

7. The bottom of the foundation shall be leveled both longitudinally and transversely or stepped as directed by the Engineer-in-Charge. Before footing is laid, the surface shall be slightly watered and rammed. In the event of excavation having been made deeper than that shown on the drawing or as otherwise ordered by the Engineer-in-charge, the extra depth shall be made up with concrete or masonry of the foundation grade at the cost of the contractor. Ordinary filling shall not be used for the purposes to bring the foundation to level. If there are any slips or blows in the excavation, these shall be removed by the contractor at his own cost.

8. Near towns, villages and all frequented places, trenches and foundation pits shall be securely fenced, provided with proper caution signs and marked with red light at night to avoid accidents. The contractor shall take adequate protective measures to see that the excavation operations do not affect or damage adjoining structures.

9. Backfilling shall be done with approved materials after concrete or masonry is fully set and carried out in such a way as not to cause undue thrust on any part of the structure. All space between foundation masonry or concrete and the sides of excavation shall be refilled to the original surface, making due allowance for settlement in 20mm loose layers, which shall be watered and compacted.

10. All the excavated materials shall be the property of the Government. Where the excavated materials are to be used in the construction of embankment, it shall be directly deposited at the required location within 100 metres lead.

11. All useful materials not intended for use in the bank, shall be stacked neatly on Government land as directed by the Engineer-in-charge within 100 metres lead. Unsuitable and surplus materials not intended for use shall be disposed off as directed by the Engineer-in-charge.

12. Excavation for structures shall be measured in cubic metres for each class of materials encountered, limited to the dimensions shown on the drawing or as directed by the Engineer-in-charge. Excavation over increased width cutting of slopes, shoring, shuttering and planking shall be deemed as convenience for the contractor in executing the work and shall not be measured and paid for separately.

13. The contract unit rate for the items of excavation for structures shall be paid in full for carrying out the required operations including:

1. Setting out and fixing bench marks and center line stones.
2. Construction of necessary shoring and bracing and their subsequent removal.
3. Removal of all logs, stumps, Grubs, and other deleterious matter and obstruction for placing the foundations including trimming of bottoms of excavations.
4. Foundation sealing, dewatering including pumping.
5. Backfilling, Clearing up the site and disposal of all surplus materials within all lifts and lead up to 100 metres.

6. All labour, materials, tools, equipment, safeguards and incidentals necessary to complete the works to the specification.

14. Excavation shall be for ordinary soil such as vegetation or organic soil, turf, sand, silt, loam, clay, mud, black cotton soil, soft shale or soft murrum, a mixture of these and similar materials which yield to the ordinary application of pick and shovel, or other ordinary digging equipment. Removal of gravel or any other nodular material having in any one direction exceeding 75mm occurring in such strata shall be deemed to be covered under this category. The classification of excavation shall be decided by the Engineer-in-charge and his decision shall be final and binding on the contractor.

15. Payment shall made on Cum basis

Item No. 11

Excavation of foundation in hard murrum and boulders and very stiff or sticky clays and other similar strata including shorting out and strutting and dewatering as necessary and disposing of the excavated stuff as directed.

1. Excavation for structures shall consist of the removal of materials for the construction of foundations for bridges, culverts, retaining walls, headwalls, cut off walls, pipe culverts and other similar structures, in accordance with the requirements, of these specifications and the lines and dimensions shown on the drawings or as indicated by the Engineer-in-charge. The work shall include all necessary sheeting, shorting, bracing, draining and pumping and the removal of all logs, stumps, shrubs, and other deleterious matter and obstruction necessary for the foundations, trimming bottoms of excavations; back filling and clearing up the site and the disposal of all surplus materials.

2. After the site has been cleared the limits of excavations shall be set out true to lines, curves, slopes, grades and sections as shown on the drawings or as directed by the Engineer-in-charge. The contractor shall provide all labour, survey instruments and materials such as stirrings, pegs, nails, bamboos, stones, lime, mortar, concrete etc. required in connection with the sitting out of works and the establishment of bench mark, center line stones and other marks and stakes as long as in the opinion of the Engineer-in-charge, they are required for the work.

3. Excavation shall be taken to the width of the step of the footing. The contractor at his own expense shall put up necessary shoring, strutting, and planking or cut slopes to a safer angle or both with due regard to the safety of personal and works and to the satisfaction of the Engineer-in-charge.

4. The depth to which the excavation is to be carried out shall be as shown on the drawings, unless the type of materials encountered is such as to require changes, in which case the depth shall be as ordered by the Engineer-in-charge.

5. Where water is met with in excavation due to stream flow, seepage, rain or other reasons, the contractor shall take adequate measure such as bailing, pumping, to keep the foundation trenches dry when so required and to protect the green concrete/masonry against damage by erosion of sudden rising of water level. The methods to be adopted in this regard and other details thereof shall be left to the choice of the contractor but subject to approval of the engineer-in-charge. Approval of the Engineer-in-charge shall, however, not relieve the contractor of the responsibility for the adequacy of dewatering, and production arrangements and for the quality and safety of the works.

6. Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of movement of water through any fresh concrete. No pumping shall be permitted during the placing of concrete or for any period of at least 24 hours thereafter, unless it is done from a suitable sump separated from the concrete work by a water-tight wall or other similar means.

7. The bottom of the foundation shall be leveled both longitudinally and transversely or stepped as directed by the Engineer-in-Charge. Before footing is laid, the surface shall be slightly watered and rammed. In the event of excavation having been made deeper than that shown on the drawing or as otherwise ordered by the Engineer-in-charge, the extra depth shall be made up with concrete or masonry of the foundation grade at the cost of the contractor. Ordinary filling shall not be used for the purposes to bring the foundation to level. If there are any slips or blows in the excavation, these shall be removed by the contractor at his own cost.

8. Near towns, villages and all frequented places, trenches and foundation pits shall be securely fenced, provided with proper caution signs and marked with red light at night to avoid accidents. The contractor shall take adequate protective measures to see that the excavation operations do not affect or damage adjoining structures.

9. Backfilling shall be done with approved materials after concrete or masonry is fully set and carried out in such a way as not to cause undue thrust on any part of the structure. All space between foundation masonry or concrete and the sides of excavation shall be refilled to the original surface, making due allowance for settlement in 20mm loose layers, which shall be watered and compacted.

10. All the excavated materials shall be the property of the Government. Where the excavated materials are to be used in the construction of embankment, it shall be directly deposited at the required location within 100 metres lead.

11. All useful materials not intended for use in the bank, shall be stacked neatly on Government land as directed by the Engineer-in-charge within 100 metres lead. Unsuitable and surplus materials not intended for use shall be disposed off as directed by the Engineer-in-charge.

12. Excavation for structures shall be measured in cubic metres for each class of materials encountered, limited to the dimensions shown on the drawing or as directed by the Engineer-in-charge. Excavation over increased width cutting of slopes, shoring, shuttering and planking shall be deemed as convenience for the contractor in executing the work and shall not be measured and paid for separately.

13. The contract unit rate for the items of excavation for structures shall be paid in full for carrying out the required operations including:

14. Excavation shall be in hard soil such as stiff heavy clay, hard shale or compact murrum requiring grafting tool or pick or both and shovel, closely applied and gravel and rubble stone having maximum diameter in any one direction between 75 and 300mm and soft conglomerate. The classification of

excavation shall be decided by the Engineer-in-charge and his decision shall be final and binding on the contractor.

15. Payment shall made on Cum basis

Item No.12

Excavation in large boulders and soft rock by wedging including shoring, strutting and dewatering as necessary and disposing of the excavated stuff as directed,

1. Excavation for structures shall consist of the removal of materials for the construction of foundations for bridges, culverts, retaining walls, headwalls, cut of walls, pipe culverts and other similar structures, in accordance with the requirements, of these specifications and the lines and dimensions shown on the drawings or as indicated by the Engineer-in-charge. The work shall include all necessary sheeting, shoring, bracing, draining and pumping and the removal of all logs, stumps, shrubs, and other deleterious matter and obstruction necessary for the foundations, trimming bottoms of excavations; back filling and clearing up the site and the disposal of all surplus materials.

2. After the site has been cleared the limits of excavations shall be set out true to lines, curves, slopes, grades and sections as shown on the drawings or as directed by the Engineer-in-charge. The contractor shall provide all labour, survey instruments and materials such as stirrings, pegs nails bamboos, stones, lime, mortar, concrete etc. required in connection with the sitting out of works and the establishment of bench mark, center line stones and other marks and stakes as long as in the opinion of the Engineer-in-charge, they are required for the work.

3. Excavation shall be taken to the width of the step of the footing. The contractor at his own expense shall put up necessary shoring, strutting, and planking or cut slopes to a safer angle or both with due regard to the safety of personal and works and to the satisfaction of the Engineer-in-charge.

4. The depth to which the excavation is to be carried out shall be as shown on the drawings, unless the type of materials encountered is such as to require changes, in which case the depth shall be as ordered by the Engineer-in-charge.

5. Where water is met with in excavation due to stream flow, seepage, rain or other reasons, the contractor shall take adequate measure such as bailing pumping, to keep the foundation trenches dry when so required and to protect the green concrete/masonry against damage by erosion of sudden rising of water level.. the methods to be adopted in this regard and other details thereof shall be left to the choice of the contractor but subject to approval of the engineer-in-charge. Approval of the Engineer-in-charge shall, however not relieve the contractor of the responsibility for the adequacy of dewatering, and production arrangements and for the quality and safety of the works.

6. Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of movement of water through any fresh concrete. No pumping shall be permitted during the placing of concrete or for any period of at least 24 hours thereafter, unless it is done from a suitable sump separated from the concrete work by a water tight wall or other similar means.

7. The bottom of the foundation shall be leveled both longitudinally and transversely or stepped as directed by the Engineer-in-Charge. Before footing is laid, the surface shall be slightly watered and rammed. In the event of excavation having been made deeper than that shown on the drawing or as otherwise ordered by the Engineer-in-charge, the extra depth shall be made up with concrete or masonry of the foundation grade at the cost of the contractor. Ordinary filling shall not be used for the purposes to bring the foundation to level. If there are any slips or blows in the excavation, these shall be removed by the contractor at his own cost.

8. Near towns, villages and all frequented places, trenches and foundation pits shall be securely fenced, provided with proper caution signs and marked with red light at night to avoid accidents. The contractor shall take adequate protective measures to see that the excavation operations do not affect or damage adjoining structures.

9. Backfilling shall be done with approved materials after concrete or masonry is fully set and carried out in such a way as not to cause undue thrust on any part of the structure. All space between foundation masonry or concrete and the sides of excavation shall be refilled to the original surface, making due allowance for settlement in 20mm loose layers, which shall be watered and compacted.

10. All the excavated materials shall be the property of the Government. Where the excavated materials is to be used in the construction of embankment, it shall be directly deposited at the required location within 100 metres lead.

11. all useful materials not intended for use in the bank, shall be stacked neatly on Government land as directed by the Engineer-in-charge within 100 metres lead. Unsuitable and surplus, materials not intended for use shall be disposed off as directed by the Engineer-in-charge.

12. Excavation for structures shall be measured in cubic metres for each class of materials encountered, limited to the dimensions shown on the drawing or as directed by the Engineer-in-charge. Excavation over increased width cutting of slopes, shoring, shuttering and planking shall be deemed as convenience for the contractor in executing the work and shall not be measured and paid for separately.

13. The contract unit rate for the items of excavation for structures shall be paid in full for carrying out the required operations including:

14 excavation shall be in soft rock or such as lime stone, sand stone, laterite, hard conglomerate or other soft or disintegrated rock which may be quarried or spilt with crow bars, boulders which do not require blasting having diameter in any direction of more than 300mm. and any rock which in dry state may be hard, requiring blasting but which when wet become soft and manageable means other than blasting. The classification of excavation shall be decided by the Engineer-in-charge and his decision shall be final and binding on the contractor.

15. Payment shall made on Cum basis

Item No.13

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

1. Excavation for structures shall consist of the removal of materials for the construction of foundations for bridges, culverts, retaining walls, headwalls, cut of walls, pipe culverts and other similar structures, in accordance with the requirements, of these specifications and the lines and dimensions shown on the drawings or as indicated by the Engineer-in-charge. The work shall include all necessary sheeting, shoring, bracing, draining and pumping and the removal of all logs, stumps, shrubs, and other deleterious matter and obstruction necessary for the foundations, trimming bottoms of excavations; back filling and clearing up the site and the disposal of all surplus materials.

2. After the site has been cleared the limits of excavations shall be set out true to lines, curves, slopes, grades and sections as shown on the drawings or as directed by the Engineer-in-charge. The contractor shall provide all labour, survey instruments and materials such as stirrings, pegs nails bamboos, stones, lime, mortar, concrete etc. required in connection with the setting out of works and the establishment of bench mark, center line stones and other marks and stakes as long as in the opinion of the Engineer-in-charge, they are required for the work.

3. Excavation shall be taken to the width of the step of the footing. The contractor at his own expense shall put up necessary shoring, strutting, and planking or cut slopes to a safer angle or both with due regard to the safety of personal and works and to the satisfaction of the Engineer-in-charge.

4. The depth to which the excavation is to be carried out shall be as shown on the drawings, unless the type of materials encountered is such as to require changes, in which case the depth shall be as ordered by the Engineer-in-charge.

5. Where water is met with in excavation due to stream flow, seepage, rain or other reasons, the contractor shall take adequate measure such as bailing pumping, to keep the foundation trenches dry when so required and to protect the green concrete/masonry against damage by erosion of sudden rising of water level.. the methods to be adopted in this regard and other details thereof shall be left to the choice of the contractor but subject to approval of the engineer-in-charge. Approval of the Engineer-in-charge shall, however not relieve the contractor of the responsibility for the adequacy of dewatering, and production arrangements and for the quality and safety of the works.

6. Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of movement of water through any fresh concrete. No pumping shall be permitted during the placing of concrete or for any period of at least 24 hours thereafter, unless it is done from a suitable sump separated from the concrete work by a water tight wall or other similar means.

7. The bottom of the foundation shall be leveled both longitudinally and transversely or stepped as directed by the Engineer-in-Charge. Before footing is laid, the surface shall be slightly watered and rammed. In the event of excavation having been made deeper than that shown on the drawing or as otherwise ordered by the Engineer-in-charge, the extra depth shall be made up with concrete or masonry of the foundation grade at the cost of the contractor. Ordinary filling shall not be used for the purposes to bring the foundation to level. If there are any slips or blows in the excavation, these shall be removed by the contractor at his own cost.

8. Near towns, villages and all frequented places, trenches and foundation pits shall be securely fenced, provided with proper caution signs and marked with red light at night to avoid accidents. The contractor shall take adequate protective measures to see that the excavation operations do not affect or damage adjoining structures.

9. Backfilling shall be done with approved materials after concrete or masonry is fully set and carried out in such a way as not to cause undue thrust on any part of the structure. All space between foundation masonry or concrete and the sides of excavation shall be refilled to the original surface, making due allowance for settlement in 20mm loose layers, which shall be watered and compacted.

10. All the excavated materials shall be the property of the Government. Where the excavated materials are to be used in the construction of embankment, it shall be directly deposited at the required location within 100 metres lead.

11. All useful materials not intended for use in the bank, shall be stacked neatly on Government land as directed by the Engineer-in-charge within 100 metres lead. Unsuitable and surplus, materials not intended for use shall be disposed off as directed by the Engineer-in-charge.

12. Excavation for structures shall be measured in cubic metres for each class of materials encountered, limited to the dimensions shown on the drawing or as directed by the Engineer-in-charge. Excavation over increased width cutting of slopes, shoring, shuttering and planking shall be deemed as convenience for the contractor in executing the work and shall not be measured and paid for separately.

13. The contract unit rate for the items of excavation for structures shall be paid in full for carrying out the required operations including:

14. Excavation shall be in any rock or boulders having diameter in any one direction of more than 300 mm. for which the use of mechanical plant or blasting is required. The classification of excavation shall be decided by the Engineer-in-charge and his decision shall be final and binding on the contractor. Merely the use of explosive in excavation will not be considered as a reason for higher classification unless blasting is clearly necessary in the opinion of the Engineer-in-charge.

15. Where blasting is prohibited for any reason, excavation shall be carried out by chiseling, wedging or any other approved method.

16. Blasting shall be carried out only with the written permission of the Engineer-in-charge. All the statutory laws, regulations, rules etc pertaining to the acquisition, transport, storage, handling and use of explosive shall be strictly followed.

17. The contractor may adopt any method or methods of blasting consistent with the safety and job requirements, after approval from the Engineer-in-charge.

18. The magazine for the storage of explosive shall be built to the design and specifications of the Explosives Department concerned and located at the approved site. No unauthorized person shall be admitted into the magazine which when not in use shall be kept securely locked. No matches or inflammable materials shall be allowed in the magazine. The magazine shall have an effective lightning conductor. The following shall be hung in the lobby of magazine.

(a) A copy of the relevant rules regarding safe storage both in English and in the language with which the workers concerned are familiar.

(b) A statement of up-to-date stock in the magazine.

(c) A certificate showing the last date of testing of the lightning conductor.

(d) A notice that smoking is strictly prohibited.

19. In addition to these, the contractor shall also observe the following instructions and any further additional instructions which may be given by the Engineer-in-charge and shall be responsible for damage to property and any accident which may occur to workmen or the public on account of any operations connected with the storage, handling or use of explosive and blasting. The Engineer-in-charge shall frequently check the contractor's compliance with these precautions.

20. All the materials, tools and equipment used for blasting operations shall be approved type. The Engineer-in-charge may specify the type of explosive to be allowed in special cases. the fuse to be used in wet locations shall be sufficiently water-resistant as to be unaffected when immersed in water for 30 minutes. The rate of burning of the fuse shall be uniform and definitely known to permit such a safe length being cut as will permit sufficient time to time firer tom reach to place of safety before explosion takes place. Detonators shall be capable of giving effectives blasting of the explosives. The blasting powder, explosive detonators, fuses, etc. shall be fresh and not damaged due to damp, moisture or, any other cause. They shall be inspected totally and removed immediately if found unsuitable.

21. The blasting operation shall remain in charge of competent and experienced supervisory staff and worken who are thoroughly acquainted with the details of handling explosives and blasting operators.

22. The blasting shall be carried out during fixed hours of the day preferably during the mid-day luncheon hour or at the close of the work as ordered in writing by the Engineer-in-charge. The hours shall be made known to the people in the vicinity. All the charges shall be prepared by the man in charge only.

23. Red danger flags shall be displayed permanently in all directions during the blasting operations. People, except those who actually light the fuse, shall be prohibited from entering this area. The flags shall be planted 200 Metres from the blasting site in all directions and all persons including workmen shall be excluded from the flaged area at least 10 minutes before the firing a warning whistle being sounded for the purpose.

24. The charge holes shall be drilled in suitable places to required depths. Blasting should be as light as possible consistent with thorough breakage of the materials necessary for economic loading and hauling. Any method of blasting which leads to over-shooting shall be discontinued.

25. When blasting is done with powder, the fuse cut to the required length shall be inserted into the hole and the powder dropped in. The powder shall be gently tamped with copper rods with rounded ends. The explosive powder shall then be covered with tamping materials whih shall be tamped light but firmly.

26. When blasting is done with dynamite and other high explosives, dynamite, cartridges shall be prepared by inserting the square cut end of a fuse into the detonator and finishing it with nippers at the open end., the detonator gently pushed into the primer leaving 1/3rd of copper tube exposed outside. The paper of the cartridge shall then be closed up and securely bound with wire, or twine. The primer shall be housed into the explosive. Bore holes shall be of such size that the cartridge can easily go down. The holes shall be cleared of all debirs and explosive inserted. The space of about 20 cm. above the charge shall then be gently filled with dry clay, passed home & the rest of the temping formed of any convenient materials gently packed with a wooden rammer.

27. At a time, not more than 10 such charges will be prepared and fired. The man incharge shall blow a whistle in a recognized manner or cautioning the people. All the people shall then be required to more to safe distance. The charge shall be lighted by the man in charge only, the main in charge shall count the number of explosions. He shall satisfy himself that all the charges have been exploded before allowing the workmen to go back to the work site.

28. In case of a misfire, the following procedure shall be observed:

(1) sufficient tie shall be allosed to account for the delayed blast. The man in charge shall inspect all the charges and determine the missed charges.

(2) If it is blasting powder charge it shall be completely flooded with water. A new hole shall be drilled at about 45cm. from the old hole and fired. This should be repeated till the old charge is blasted.

(3) In case of charges of gelatine, dynamite etc. the man in charge shall gently remove the temping and the primer with the detonator. A fresh detonator and primer shall then be used to blast the charge.

Alternatively, the hole may be cleared of 30cm. of temping and the direction then ascertained by placing a stick in the hold. Another hole may than be drilled 15cm. away and parallel to it. This hole shall that be charged and fired when the misfired hole should explode at the same time. The man in charge shall at once report to the contractor's Officer and Engineer-in-charge all cases of misfire, the cause of the same and what steps were taken in connection therewith.

29. If a misfire has been found to be due to defective detonator or dynamite, the whole quantity in the box from which defective article was taken must be sent to the authority directed by the Engineer-in-charge for inspection to ascertain whether all the remaining materials in the box are also defective.

30. A careful and day to day account of the explosive shall be maintained by the contractor in an approved manner in a register which shall be open to inspection by the Engineer-in-charge, at all times.

31. Excavation shall be measured after removal of overburden by taking cross-sections at suitable intervals in the original position before the work starts and after its completion and computing the volumes in cubic metres by the method of average and areas. Where it is not feasible to compute volumes by this method because of erratic location of isolated deposits, the volumes shall be computed by other accepted methods. At the option of the Engineer-in-charge, the contractor shall leave depth indicators during excavations of such shape and size, and in such positions as directed so as to indicate the original ground level as accurately as possible. The contractor shall see that these remain intact till the final measurements are taken. Where cross-sectional measurements could not be taken due to irregular configuration, or where the rock is admixed with other classes of materials, the volumes shall be computed on the basis of stacks of excavated rubble after making 40 per cent deduction therefrom.

32. Payment shall made on Cum basis

Item No. 14

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

1. For mild steel, specification as per item No. 60 for MS reinforcement shall apply.

2. The M.S. Dowel bars shall be provided and anchored in foundation / sub structure as directed by Engineer-in-charge or as per drawing shall be provided as approved by Engineer-in-charge.

3. The payment shall be per Rmt of dowel bars in anchored condition.

4. Unit rate included cost of all materials, labour, and equipment to complete the job.

Item No. 15

Providing and laying rubble for apron (Each stone weighting not less than 40kg) including and packing and filling in the interstices with quarry spall.

1. The work shall consist of laying boulders directly on the prepared surface for protection against scour.

2. The stones used in apron shall be sound, hard, durable & fairly regularly in shape, Stone subject to marked deterioration by water or weather shall not be used. The thickness and shape of apron shall be as indicated on the drawings or as directed by the Engineer-in-charge. The surface on which the apron is to be laid shall be leveled and prepared for the length and width as shown on the drawings. The size of stone shall be as large as possible & weight shall be as specified in the item but in no case any fragment shall weight less than 40kg. The specific gravity of stone shall be as high as possible and it shall not be less than 250. To ensure regular and orderly disposition of the full intended quantity of stone in the apron, template cross walls in dry masonry shall be built about a metre wide and to the full height of the specified thickness of the apron at intervals of 30 metres and all along the length and width of the apron. Within these walls, the stone then shall be hand-packed.

3. Payment shall be made on CMT basis of chata, the materials shall have to be stacked at site before laying. Preparation of base for laying bedding shall be deemed incidental to the work Nothing shall deducted for voids.

4. The rate shall include cost of materials, labour & tools to complete the job.

Item No. 16

Providing and casting in situ ordinary cement concrete M-150 mix and providing necessary pin headers including shuttering, scaffolding, laying vibrating, curing and finishing complete Without V-Grooves For all Height.

And

Item No. 17

Providing and filling in foundation with ordinary cement concrete M-10/M-100 mix and providing necessary vertical pin headers incl. Formwork, vibrating, ramming and curing complete.

And

Item No. 18

Providing and casting in situ Ordinary cement concrete- M-200 for average 75/150mm thick wearing coat laid as directed including, tamping, vibrating, finishing, curing and filling in joints with bitumen complete.

1. In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportion of cement, fine aggregate and coarse aggregates are specified by volume as given in table below for different grades of concrete designed as ordinary M. 100. , M. 150, M.200 and M.250.

2. In the designation of a concrete mix, letter “M” refers to the mix and the number the specified 28 days works cube compressive strength of that mix on 150mm cubes expressed in kg./ cm².

3. The ordinary concrete mix shall generally be specified by volume. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50kg. of cement as 0.035 cubic metre in volume. While measuring aggregate by volume, shaking, ramming or hammering shall not be done. Proportioning of sand shall be as per its dry volume. In case it is dump, allowance for “bulking” shall be made as per IS: 2386 (Part-III).

4. Ingredients required for ordinary concrete containing one 50 kg bag of cement of different proportions of mix shall be as given in Table below.

TABLE

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

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

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

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

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

Sr. No.	Item of Construction	Maximum nominal size of coarse aggregate
(i)	R.C.C. well curb, R.C.C. well steining and R.C.C. Piles	40mm
(ii)	R.C.C. well steining	63mm
(iii)	Well cap or pile cap; solid type piers, abutment and wing-walls, and their pier caps	40mm
(iv)	R.C.C. Works in cross girders deck slab, wearing coars, kewrb, light posts, blast walls, approach slab etc. and hollow type piers, abutments, wing-walls and their pier caps.	20mm
(v)	R.C.C. bearings	20mm
(vi)	For any other item of construction not covered by item (i) to (v)	As specified on the drawing or as desired by the Engineer-in-charge in case it is not specified on drawing.

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

6. Fine aggregate shall be clean, hard, coarse sand, It shall be free from dust and such other substances. The sand be got approved by the Engineer-in-charge.

7. All materials shall be stored as to prevent their deterioration or instruction of their quality and fitness for the work. Any material which has deteriorated or has been damaged or is otherwise considered defective by the Engineer-in-charge shall not be used in the works.

8. Cement shall be stored above the ground level in perfectly and water tight shed. Wherever bulk storage containers are used, their capacity should be sufficient to cater to the requirements at site and should be cleaned at least once every 3 to 4 months. The aggregate shall be stored in such a way as to prevent admixture of foreign materials. Different size of fine or coarse aggregate shall be stored in separate stock-piles sufficiently away from the each other to prevent intermixing the materials.

9. The water for mixing shall be potable water to satisfaction of the Engineer-in-charge. The quantity of water shall be just sufficient to produce a dense concrete of required workability for the job.

10. For all work concrete shall be mixed in a mechanical mixer which along with other accessories shall be kept in first class working condition and so maintained through the construction. Mixing shall be continued till materials are uniformally distributed and uniform colour of the entire mass is obtained and each individual particle of the coarse aggregate show complete coating of mortar containing its proportionate amount of cement, In no case shall the mixing be done for less than 2 minutes after all ingredients have been put into the mixer.

11. When hand mixing is permitted by the Engineer-in-charge for small jobs or for certain other reasons. It shall be done on a smooth watertight platform large enough to allow efficient turning over of the ingredients of concrete before and after adding water. Mixing platform shall be so arranged that no foreign materials shall get mixed with concrete nor does the mixing water flow out. Cement in required number of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregate, which shall also be spread in a layer of uniform thickness on the mixing platform. Dry coarse and fine aggregate and cement shall then be mixed thoroughly by turning over to get a mixture of uniform colour. Enough water shall then be added gradually through a rose can and the mass turned over till a mix of required consistency is obtained. IN hand mixing quantity of cement shall be increased by 10 per cent above that specified.

12. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed to be the Engineer-in-charge, the first batch of concrete from the mixer shall contain only two thirds of normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

13. The method of transporting and placing concrete shall be approved by the Engineer-in-charge. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent materials takes places. All form work and reinforcement contained in it shall be cleaned and made free from standing water, dust, snow or ice immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the Engineer-in-charge has been obtained.

14. If concreting is not started within 24 hours of the approval given, it shall have to be obtained again from the Engineer-in-charge. Concreting being given, it shall proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly design agitators, operating continuously, when this time shall be with 2 hours of the addition of cement to the mix and within 30 minutes of its discharge from the agitator. Except where otherwise agreed to be the Engineer-in-charge, concrete shall be deposited in horizontal layers to a compacted depth of not more than 0.45 metre when internal vibrators are used and not exceeding 0.30 metre in all other cases.

15. Unless otherwise agreed to by the Engineer-in-charge concrete shall not be dropped into place from a height exceeding 2 metres. When trunking or chutes are used they shall be kept clean and used in such a way as to avoid segregation. When concreting has to be resumed on a surface which has hardened, it shall be roughened, swept, clean, thoroughly wetted and covered with a 13 mm thick layer of mortar composed of cement and sand in the same ratio as in the concrete mix itself. This 13mm layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened, all laitance shall be removed by scrubbing the well surface with wire or bristle brushes, care being taken to avoid dislodgement of any particles of coarse aggregate. The surface shall then be thoroughly wetted, all free water removed and then coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 150mm in thickness, and shall be well rammed against oldwork particular attention being given to corners and close spots.

16. All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrators, unless otherwise permitted by the Engineer-in-charge for exceptional cases, such as concreting under water, where vibrators can not be used, Sufficient vibrators in serviceable condition shall be kept at site so that spare equipment is always available in the event of break downs.

17.. immediately after compaction, concrete, shall be protected against harmful effects of weather, including rain, running water, shocks, vibration, traffic, rapid temperature changes, frosts and driving out process. It shall be covered with wet sacking, hessian or other similar absorbent material approved by the Engineer-in-charge soon after the initial set, and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonary work over the foundation concrete may be started after 48 hours of its laying but the curing of concrete shall be continued for a minimum period of 14 days.

18. Formwork shall include all temporary or permanent forms required for forming the concrete, together with all temporary construction required for their support. Formwork shall however be divided into following two distinct categories:-

- (1) Shuttering i.e. form work required for forming the concrete.
- (2) Scaffolding i.e. form work required for supporting shuttering.

Forms for shuttering shall be constructed only in metal suitable lined. Forms for scaffolding shall be constructed for metal or timber. Both shuttering and scaffolding shall be of substantial rigid construction and shuttering shall be true to shape and dimensions shown on the drawings. All bolts and rivets shall be counter-sunk and well ground to provide a smooth, level surface.

19. Forms shall be mortar-tight and shall be made sufficiently rigid by the use of ties and bracings to prevent any displacement or sagging between supports. They shall be strong enough to withstand all pressure, ramming and vibration, without deflection from the prescribe line occurring during and after placing the concrete. Screw jacks or hard wood wedges where required shall be provided to make up any settlement in the form work either before or during the placing of concrete. Suitable camber shall be provided in horizontal members of structure, specially in long spans to counteract the effects of any fixed as to provide such camber. Forms shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections. Unless otherwise specified or directed, chambers or fillets of sizes 25mm x 25mm shall be provided at all angles of formwork to avoid sharp corners.

20. The inside surface of shuttering shall, except in the case of permanent form work or where otherwise agreed to by the Engineer-in-charge, be coated with an approved materials to present adhesion of concrete to the for work. Releases agents shall be applied strictly in accordance with the manufacturer's instructions and shall not be allowed to come into contact with any reinforcement or prestressing tendons and anchorages. Different release agents shall not be used in form work for concrete which will be visible in the finished works.

21. Special measures shall be taken to ensure that the form work does not hinder the shrinkage of concrete because without these cracking could before the form work is removed. Wherever applicable arrangements must be made to ensure that the form work does not restrain the shortening and hogging of the beams or slabs during tensioning of the tendons. The form work should take due account of the calculated amount of positive or negative camber so as to ensure the correct final shape of the structures having regard to the deformation of a false work, scaffolding or propping and the instantaneous or deferred deformation due to various causes affecting prestressed structures. Where there are re-entrant angles in the concrete sections the form work should be removed at those sections as soon as possible after the concrete has set in order to avoid cracking due to shrinkage of concrete. Form work shall be tight enough to prevent any appreciable loss of cement during vibrations, suitable tolerances should be provided in the formwork. Immediately before concreting all forms shall be thoroughly cleaned. Contractor shall give the Engineer-in-charge due notice before placing any concrete in the forms to permit him to inspect and accept the false work and forms as to their strength alignment and general fitness, but such inspection shall not relieve the contractor of his responsibility for safety of men, machinery, materials and or results obtained.

22. The Engineer-in-charge shall be informed in advance by the contractor of his intention to strike any formwork. While fixing the time for removal of formwork, due consideration shall be given to local conditions, character of the structure, the weather and other conditions that influence the setting of concrete and of the materials used in the mix. Where field operations are controlled by strength tests of concrete, the removal of the load-supporting or soffit forms may commence when concrete has attained strength equal to at least twice the stress to which the concrete will be subjected at the time of striking props including the effect of any further addition of loads. When field operations are not controlled by strength tests of concrete the vertical forms of beams, columns and walls may be removed after 2 days. The props of slabs and beams may be removed after 14 and 21 days respectively. All formwork shall be removed without causing any damage to the concrete. Centering shall be gradually and uniformly lowered in such a manner as to permit the concrete to take stresses due to its own weight uniformly and gradually. Where internal metal ties are permitted, they or their removable parts shall be extracted without causing any damage to the concrete and remaining holes filled with mortar. No permanently embedded metal part shall have less than 25 mm. cover to the finished concrete surface. Where it is intended to reuse the formwork, it shall be cleaned and made good to the satisfaction of the Engineer-in-charge.

23. Immediately after the removal of forms, all exposed bars or bolts passing through the concrete member and used for shuttering or any other purposes shall be cut inside the concrete member to a depth of at least 25mm. below the surface of the concrete and the resulting holes be filled by cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties and all other holes and depressions, honey comb spots, broken edges or corners and other defects, shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry as consistency as is possible to use, considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids, surface which have been pointed shall be kept moist for a period of

twenty four hours. If rock pockets/ honeycombs, in the opinion of the Engineer-in-charge are of such an extent or character as to affect the strength of the structure materially or to endanger the life of the steel reinforcement, he may declare the concrete defective and require the removal and replacement of the portions of the structure affected.

24. In the case of reinforced concrete work workability shall be such that the concrete surrounds and properly grips all reinforcement. The degree of consistency, which shall depend upon the nature of work and methods of vibration of concrete shall be determined by regular slump tests. Following slump shall be adopted for different types of works.

Type of work		Where vibrators are used	Slumps Where vibrators are not used
(i)	Mass concrete in R.C. C. foundations, footings and retaining walls	10mm to 25mm	80mm
(ii)	Beams, slabs and columns simply reinforced	25mm to 40mm	100mm to 120mm
(iii)	Thin R.C.C. section or section with congested steel	40mm to 50mm	125mm to 150mm

25. Works strength tests shall be made in accordance with IS:516. Each test shall be conducted on ten specimens, five of which shall be tested at seven days and the remaining five at 28 days. The samples of concrete shall be taken on each day of concreting and cubes shall be made at the rate of one for every 5 cubic metre of concrete or a part thereof. However, if concreting done in a day in less than 15 cubic Metree, the minimum number of cubes can be reduced to 6 with the specific permission of the Engineer-in-charge, similar works tests shall be carried out whenever the quality and grading of materials is charged irrespective of the quantity of concrete poured. The number of specimens may be suitably increased as deemed necessary by the Engineer-in-charge when procedure of tests given above reveal a poor quality of concrete and in other special cases.

26. The average strength of the group of cubes cast for each day shall not be less than the specified works cube-strength. 20 per cent of the cubes cast for each day may have values less than the specified strength, provided the lowest value is not less than 85 per cent of the specified strength.

27. R.C.C. work shall have exposed concrete surface. Centering design and its erection shall approved by the Engineer-in-charge. One carpenter with helper will invariably be kept present throughout the period of concreting. Movement of labour and other persons shall be totally prohibited over reinforcement laid in position. For access to different parts, suitable mobile platforms shall provided so that steel reinforcement in position is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, kapchi, or metal pieces shall not be used for this purpose. Concreting of important structural members shall always be done in the presence and under the supervision of department person not below the rank of Asst. Engineer/ Addl-Asst. Engineer Overseer or as instructed by the Engineer-in-charge. After removal of form work checks that concrete produced is of good quality. Plastering shall not be allowed to the exposed faces of concrete.

28. In reinforced concrete the volume occupied by reinforcement shall not be deducted. The slab shall be measured as running continuously through and the beam as the portion below the slab.

29. All necessary labour, materials equipment, etc. for sampling, preparing test cubes, curing etc., shall be provided by the Contractor. Testing of the materials and concrete may be arranged by Engineer-in-charge in an approved laboratory at the cost of the contractor.

30. The payment will be made on cmt. basis of the finished work.

31. The unit rate for concrete shall include the cost of all materials, labour, tools and plan required for mixing, placing in position, vibrating and compacting finishing as per directions of the Engineer-in-charge, curing and all other incidental expenses for producing concrete of specified strength to complete the structure or its components as shown on the drawings and according to these specifications. The rate shall also include the cost of making/ fixing and remixing of all centers and forms required for the work.

Item No. 19

Construction of concrete road using tremix system with 20cm/15cm thick controlled M-250 concrete mixing conplast P-211 water reduction admixture @ 100ml/bag of cement and hardner 62.50ml. /bag using fixing and removing "C" channels of required road depth levelling if placed concrete with surface vibrator, finishing the surface with power floater and towel tight brooming as directed with providing expansion joints 20x200mm and contraction joints 20x20mm using concrete cutter machine etc. complete.

MATERIALS :

Water:

- 1.1 Water shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil and injurious alkalis, salts, organic matter and other deleterious material which will either weaken the mortar or concrete or cause efflorescence or attack the steel in R.C.C. Container for transport, storage and handling of water shall be clean. Water shall conform to the standards specified in LS. 456-1978.
- 1.2. If required by Engineer-in-charge it shall be tested by comparison with distilled water. Comparison shall be made by means of standard cement tests for soundness, time of setting and mortar strength as specified in LS. 269-1976. Any indication of unsoundness, change in time of setting by 30 minutes or more or decrease of more than 10 per cent in strength of mortar prepared with water sample when compared with the results obtained with mortar prepared with distilled water shall be sufficient cause for rejection of water under test.
- 1.3. Water for curing mortar, concrete or masonry should not be too acidic or too alkaline. It shall be free of elements which significantly affect the hydration reaction or otherwise interfere with the hardening of concrete during curing or those which produce objectionable stains or other unsightly deposits on concrete or mortar surfaces.
- 1.4. Hard and bitter water shall not be used for curing.
- 1.5. Potable water will be generally found suitable for curing mortar or concrete.

Cement:

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

Sand:

- 1.1 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.
- 1.2 Coarse Sand:
The fineness modulus of coarse sand shall not be less than 2.5 and shall not exceed 3.0. The sieve analysis of coarse shall be as under:

I. S. Sieve Designation	Percentage by weight passing Sieve	I. S. Sieve Designation	Percentage by weight passing Sieve
4.75 mm	100	600 micron	30-10
2.36 mm	90 to 100	300 micron	5-70
1.18 mm	70 to 100	150 micron	0-50

- 1.3 Fine Sand:

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

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

Stone Grit:

- 1.1 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.

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

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

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

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

Stone Aggregate for Concrete:

1.1 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.

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

TABLE

I.S. Sieve	Percentage passing for single sized aggregates of Nominal size			I.S. Sieve	Percentage passing for single sized aggregates of Nominal size		
	40 mm	20 mm	10 mm		40 mm	20 mm	10 mm
80 mm	-	-	-	12.50 mm	-	-	-
63 mm	100	-	-	10 mm	0.5	0.02	0.30
40 mm	85-100	100	-	4.75 mm	-	0.5	0.5
20 mm	0-20	85-100	100	2.35 mm	-	-	-
16 mm	-	-	85-100				

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

1.3 The grading test shall be taken in the beginning and at the change of source of materials. The necessary test indicated in I.S. 383-1970 and I.S. 456-1978 shall have to be carried out to ensure the acceptability. The aggregates shall he 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

CONPLAST-P.211 water reducing concrete admixture & Recron-35 fibbers shall be of approved quality. Colpor-200 expansion joints materials shall be of approved quality.

WORKMANSHIP

- [i] 200mm/150mm thicker M-250 grade concrete is being placed over the prepared sub-base Conplast P.211 (Water reducing concrete admixture) @ 100 Mt. per bag of cement and Racron-3s fibers Polyester fibre of Reliance or equivalent make at 125 Gms per bag of cement shall be used in M-250 concrete mix. [The specification of concrete is as per controlled C.C. of road specification Booklet]
- [ii] Leveling of the surface is done using TREMIX surface vibrator. The vibrator runs over channels, placed as per required level and slope and simultaneously level surface of the concrete.

- [iii] Vacuum dewatering follows the leveling of concrete. The purpose of vacuum processing is to provide quicker setting and high early strength by removing surplus water from the concrete. The process follows as per instruction of site Engineer in charge & attached guide line.
- [iv] Immediately after dewatering, the surface is floated with a skim power floater as per instruction of Engineer-in-charge. The surface shall be prepared as per requirements and instructions. For smoother surface requirement, the surface is trowel with same machine mounted with trowel ling blades. If required floor hardener "Nitoflor Hardtop" a Fostoc product shall be used at the rate of 3 to 5 Kg/Sqm to get hard wearing surface.
- [v] Construction joints upto 1/4 of the slab depth are cut afterwards. They give clear and straighter theoretical cracking line in the case of unexpected stresses. m Groove cutting is done within 48 hours from casting at the floor.
- [vi] After surface vibrator and finishing the surface with power floater and trowel light brooming on the surface, expansion joint size 20 x 200 MM shall be provided with filling the expansion joints having size 20 x 20 MM by using COLPOR-200 as per manufacturers specification and directed by Engineer-in-charge. The expansion joints filled with Nitoseal-200.
- [vii] Making a construction joints by cutting of joints of size 3 MM x 20 MM by using of concrete cutter machine construction joint are filled with "MITOSEAL-280" an esoteric cold applied joint sealant, which ensures performance of expected functions at the joints.
- [viii] Concrete should be cured in normal way (Water pending) or the surface is covered with a plastic sheet or gunny bags. In any method, the surface should be always kept wet with water. Curing must be done for atleast 14 days or as per directed by Engineer-in-charge.
- [ix] The machineries used for the above process shall be of standard technical specification attached separately herewith. (i.e. surface vibrator, vacuum pump,suction mat top cover, filter pad, skim floater etc.)
- [x] The Workmanship and process for vacuumed dewatering, water cement ratio concrete placing, surface vibration and vacuum processing floating. Trowel ling and curing shall be carried out as per attached literatures and as per instruction of Engineer-in-charge.
- [xi] The dowel bars of 30mm CRS reinforcement bars of 450mm long shall be field in 32mm dia G.I. pipe cap at free end with filling grade etc. in longitudinal joints at 30cm centre to centre and transverse joints at 30 mt. interval as directed engineer in charge.

ATTACHED ADDED TECHNICAL SPECIFICATION

A. SURFACE VIBRATOR

Beam Lengths (metres) :4.2 metres

Weights (Kgs) : 41 Kgs

Beam Spacing (mm) : 300

Beam Height (mm) : 100

Vibrator Unit : Electrically operated on 3 Phase V, 415V, 50Hz. A.C. Supply

Power input (Watts) : 450

Vibrator (Vib/min) : 2860

Rated current (Amp.) :1.5

Centrifugal Force (N) : 1350-4600

Weight (Kg) :19

B. VACUUM PUMP

Drive : Electrically operated on 3 Phase V, 415V,50Hz. A.C. Supply

Power (Kw) : 4

Current : 7.5

Pump Capacity (Lit/Min) : 1850

Max. Vacuum(mm Hg) : 680(90%)

Overall Length (mm) : 1300

Overall Width (With empty Tank): 125

C. SUCTION MAT TOP COVER

Length : 6

Width : 4

Weight (Kg) : 31

D. FILTER PAD

Length / Pieces (Mt.) : 6

Width : 1.2

Weight (Kg) : 4

E. SKIM FLOATER

Supply : 3 Phase V, 415V, 50 Hz. A.C. Supply

Power (Kw) : 2.1/1.8

Current (Amp.) : 6/4

Motor Speed (rpm) : 3000/1500

Final Speed (rpm) : 115/57

Working Diameter (mm) : 1000

Max. Reach (Metre) : 3

Diameter of Floating Disc (mm) : 985

Weight of Floating Disc (Kg) : 16

MODE OF MEASUREMENT :

[i] The rate shall include all materials, formworks, machineries and labour charges.

[ii] **The rate shall be for a unit of One Cumt.**

Item No. 20

Construction of concrete road using tremix system with 20cm/15cm thick controlled M-200 concrete mixing conplast P-211 water reduction admixture @ 100ml/bag of cement and hardner 62.50ml. /bag using fixing and removing "C" channels of required road depth levelling if placed concrete with surface vibrator, finishing the surface with power floater and towel tight brooming as directed with providing expansion joints 20x200mm and contraction joints 20x20mm using concrete cutter machine etc. complete.

MATERIALS :

Water:

- 1.1 Water shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil and injurious alkalis, salts, organic matter and other deleterious material which will either weaken the mortar or concrete or cause efflorescence or attack the steel in R.C.C. Container for transport, storage and handling of water shall be clean. Water shall conform to the standards specified in LS. 456-1978.
- 1.2. If required by Engineer-in-charge it shall be tested by comparison with distilled water. Comparison shall be made by means of standard cement tests for soundness, time of setting and mortar strength as specified in LS. 269-1976. Any indication of unsoundness, change in time of setting by 30 minutes or more or decrease of more than 10 per cent in strength of mortar prepared with water sample when compared with the results obtained with mortar prepared with distilled water shall be sufficient cause for rejection of water under test.
- 1.3. Water for curing mortar, concrete or masonry should not be too acidic or too alkaline. It shall be free of elements which significantly affect the hydration reaction or otherwise interfere with the hardening of concrete during curing or those which produce objectionable stains or other unsightly deposits on concrete or mortar surfaces.
- 1.4. Hard and bitter water shall not be used for curing.
- 1.5. Potable water will be generally found suitable for curing mortar or concrete.

Cement:

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

Sand:

- 1.1 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.

1.2 Coarse Sand:

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

I. S. Sieve Designation	Percentage by weight passing Sieve	I. S. Sieve Designation	Percentage by weight passing Sieve
4.75 mm	100	600 micron	30-10
2.36 mm	90 to 100	300 micron	5-70
1.18 mm	70 to 100	150 micron	0-50

1.3 Fine Sand:

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

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

Stone Grit:

- 1.1 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.

- 1.2 The grit shall conform to the following gradation as per sieve analysis:

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

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

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

Stone Aggregate for Concrete:

- 1.1 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.

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

TABLE

I.S. Seive	Percentage passing for single sized aggregates of Nominal size			I.S. Seive	Percentage passing for single sized aggregates of Nominal size		
	40 mm	20 mm	10 mm		40 mm	20 mm	10 mm

80 mm	-	-	-	12.50 mm	-	-	-
63 mm	100	-	-	10 mm	0.5	0.02	0.30
40 mm	85-100	100	-	4.75 mm	-	0.5	0.5
20 mm	0-20	85-100	100	2.35 mm	-	-	-
16 mm	-	-	85-100				

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

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

CONPLAST-P.211 water reducing concrete admixture & Recron-35 fibbers shall be of approved quality. Colpor-200 expansion joints materials shall be of approved quality.

WORKMANSHIP

- [i] 200mm/150mm thicker M-200 grade concrete is being placed over the prepared sub-base Conplast P.211 (Water reducing concrete admixture) @ 100 Mt. per bag of cement and Racron-3s fibers Polyester fibre of Reliance or equivalent make at 125 Gms per bag of cement shall be used in M-200 concrete mix. [The specification of concrete is as per controlled C.C. of road specification Booklet]
- [ii] Leveling of the surface is done using TREMIX surface vibrator. The vibrator runs over channels, placed as per required level and slope and simultaneously level surface of the concrete.
- [iii] Vacuum dewatering follows the leveling of concrete. The purpose of vacuum processing is to provide quicker setting and high early strength by removing surplus water from the concrete. The process is follows as per instruction of site Engineer in charge & attached guide line.
- [iv] Immediately after dewatering, the surface is floated with a skim power floater as per instruction of Engineer-in-charge. The surface shall be prepared as per requirements and instructions. For smoother surface requirement, the surface is trowel with same machine mounted with trowel ling blades. If required floor hardener "Nitoflor Hardtop" a Fostoc product shall be used at the rate of 3 to 5 Kg/Sqm to get hard wearing surface.
- [v] Construction joints upto 1/4 of the slab depth are cut afterwards. They give clear and straighter theoretical cracking line in the case of unexpected stresses. m Groove cutting is done within 48 hours from casting at the floor.
- [vi] After surface vibrator and finishing the surface with power floater and trowel light brooming on the surface, expansion joint size 20 x 200 MM shall be provided with filling the expansion joints having size 20 x 20 MM by using COLPOR-200 as per manufacturers specification and directed by Engineer-in-charge. The expansion joints filled with Nitoseal-200.
- [vii] Making a construction joints by cutting of joints of size 3 MM x 20 MM by using of concrete cutter machine construction joint are filled with "MITOSEAL-280" an esoteric cold applied joint sealant, which ensures performance of expected functions at the joints.
- [viii] Concrete should be cured in normal way (Water pending) or the surface is covered with a plastic sheet or gunny bags. In any method, the surface should be always kept wet with water. Curing must be done for atleast 14 days or as per directed by Engineer-in-charge.
- [ix] The machineries used for the above process shall be of standard technical specification attached separately herewith. (i.e. surface vibrator, vacuum pump, suction mal top cover, filter pad, skim floater etc.)
- [x] The Workmanship and process for vacuumed dewatering, water cement ratio concrete placing, surface vibration and vacuum processing floating. Trowel ling and curing shall be carried out as per attached literatures and as per instruction of Engineer-in-charge.
- [xi] The dowel bars of 30mm CRS reinforcement bars of 450mm long shall be field in 32mm dia G.I. pipe cap at free end with filling grade etc. in longitudinal joints at 30cm centre to centre and transverse joints at 30 mt. interval as directed engineer in charge.

ATTACHED ADDED TECHNICAL SPECIFICATION

A. SURFACE VIBRATOR

Beam Lengths (metres) :4.2 metres

Weights (Kgs) : 41 Kgs

Beam Spacing (mm) : 300

Beam Height (mm) : 100

Vibrator Unit : Electrically operated on 3 Phase V, 415V, 50Hz. A.C. Supply

Power input (Watts) : 450

Vibrator (Vib/min) : 2860

Rated current (Amp.) :1.5

Centrifugal Force (N) : 1350-4600

Weight (Kg) :19

B. VACUUM PUMP

Drive : Electrically operated on 3 Phase V, 415V,50Hz. A.C. Supply

Power (Kw) : 4

Current : 7.5

Pump Capacity (Lit/Min) : 1850

Max. Vacuum(mm Hg) : 680(90%)

Overall Length (mm) : 1300

Overall Width (With empty Tank): 125

C. SUCTION MAT TOP COVER

Length : 6

Width : 4

Weight (Kg) : 31

D. FILTER PAD

Length / Pieces (Mt.) : 6

Width : 1.2

Weight (Kg) : 4

E. SKIM FLOATER

Supply : 3 Phase V, 415V,50 Hz.A.C.Supply

Power (Kw) : 2.1/1.8

Current(Amp.) : 6/4

Motor Speed (rpm) : 3000/1500

Final Speed (rpm) : 115/57

Working Diameter (mm) : 1000

Max.Reach (Metre) : 3

Diameter of Floating Disc(mm):985

Weight of Floating Disc(Kg) :16

MODE OF MEASUREMENT :

[i] The rate shall be include all materials, formworks, machineries and labour charges.

[ii] **The rate shall be for a unit of One Cumt.**

Item No. 21

Providing and casting in situ Controlled cement concrete M-200 for R.C.C. work in Piers, abutment, returns and riding returns as per drawing including centering, shuttering, scaffolding where necessary laying, vibrating curing and finishing complete (A) For all Height

And

Item No. 22

Providing and casting in situ Controlled Cement Concrete M-250 for R.C.C. Raft and cut-off walls including necessary shuttering laying, vibrating ramming of curing complete.

And

Item No. 23

Providing and cast in situ Controlled cement concrete M 20 mix for R.C.C. works in pier cap, abutment cap, and dirt wall including controlled cement concrete M 25 bed block or pedestals for

required size below bearings as per detailed drawings, centering, shuttering, scaffolding wherever necessary laying, vibrating, curing and finishing complete.

And

Item No. 24

Providing and cast in situ Controlled Cement Concrete M 25 for R.C.C. Solid slab including centering, scaffolding, curing and finishing complete.

And

Item No. 25

Providing and cast in situ Controlled Cement Concrete M-150 for average 75/150mm thick wearing coat laid as directed including. tamping, vibrating, finishing, curing and filling in joints with bitumen complete.

And

Item No. 26

Providing and cast in situ Controlled Cement Concrete M-25 for average 75/150mm thick wearing coat laid as directed including. tamping, vibrating, finishing, curing and filling in joints with bitumen complete.

And

Item No. 27

Providing and casting in situ Controlled cement concrete- M-200 for average 75/150mm thick wearing coat laid as directed including. tamping, vibrating, finishing, curing and filling in joints with bitumen complete.

And

Item No. 28

Providing and casting in situ Controlled cement concrete- M 20 mix for Approach slab including formwork, curing and finishing complete.

And

Item No. 29

Providing and cast in situ Controlled Cement Concrete M-20 for kerbs/Kerb blocks including formwork, curing and finishing complete.

1. For controlled concrete, design of the mix shall be approved after preliminary tests and all necessary precautions shall be taken in its production to ensure that the required works cube strength is attained and maintained. The controlled concrete shall be in eight grades designed as M.100, M. 150, M.200, M.250, M.300, M.350, M.400, M.450 with the suffix 'controlled' added to it.

2. In the designation of a concrete mix, letter 'M' refers to the mix and the number to the specified 28 days works cubes compressive strength of that mix on 150 m. cubes, expressed in kg/cm. where ordinary. Portland cement conforming to IS:269 or Portland blast furnace cement conforming to IS:455 is used. the compressive strength requirements for various grades of concrete shall be as given below on the next page:

Grade of Concrete	Compressive works test strength in Kg. / cm ² on 150mm, cubes, conducted in accordance with IS: 516	
	Min. at 7 days	Min. at 28 days
M 100 ...	70	100
M 150 ...	100	150
M 200 ...	135	200
M 250 ...	170	250
M 300 ...	200	300
M 350 ...	235	350
M 400 ...	270	400
M 450 ...	300	450

NOTE: In cases the 28 days compressive strength specified in the above. Table shall alone be the criterion for acceptance or rejection of the concrete.

Where the strength of a concrete mix, as indicated by tests, lies in between the strength for any two grades specified in the above. Table such concrete shall be classified for all purposes as a concrete belonging to the lower or the two grades between which its strength lies.

3. Concrete mix shall be designed on the basis of preliminary tests so as to attain a strength at least 33 per cent higher than that required on work tests. The proportions for ingredients chosen shall be such that concrete has adequate workability for conditions prevailing on the work in question and can be properly compacted with the 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 should be controlled by obtaining the coarse aggregates in different sizes and bleeding them in the right proportions as required. Aggregates of different size shall be stocked in separate stock piles. Required quantity of material shall be stock piled several hours, preferably a day, before use. Grading of coarse and fine aggregate shall be checked as frequently as possible, frequency for a given job being determined by the Engineer-in-charge to ensure that the suppliers are maintaining the uniform grading as approved for samples used in the preliminary tests.

4. 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 major weight per bag, a reasonable number of bags shall be weighed separately to check the net weight. Where cement is weighed from bulk stocks at site and not by bags, it shall be weighed separately from the aggregates. Water shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in a clean, and serviceable condition. Their accuracy shall be periodically checked.

5. 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 aggregate 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 IS: 2386 (Part-III) shall be referred to. Suitable adjustment shall also be made in the weights of aggregates to allow for the variation in 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 210 Kg. per cubic metre in plain concrete and not less than 300 kg/per cubic metre in reinforced concrete structural members. The minimum quantity of cement for professed concrete work shall not be less than 360 kg/per cubic metre of concrete nor shall it be more than 540 kg/per cubic metre of concrete.

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

Sr. No.	Item of construction	Maximum nominal size of Coarse aggregate
(i)	R.C.C. well curb, R.C.C. well steining and R.C.C. Piles	40mm
(ii)	P.C.C. well steining.	63mm
(iii)	Well cap or pile cap, solid type piers, abutments and wing- walls, their pier caps.	40mm
(iv)	R.C.C. works in cross girders, deck slab, wearing coarse, kerb, light posts, blast, walls approach slab etc. and hollow type piers, abutments wing-walls and their pier caps.	20mm
(v)	R.C.C. bearings	20mm
(vi)	For any other item of construction covered by items (i) to (v) above	As specified on the drawing or as desired by the Engineer-in-charge in case it is not specified on drawing.

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

7. Fine aggregate shall be clean, hard, coarse sand. It shall be free dust and such other substances. The sand be get approved by the Engineer-in- charge.

8. All materials shall be stored as to prevent their deterioration of there quality and fitness for the work. Any materials which has deteriorated or has been damaged or is otherwise considered defective by the Engineer-in- charge shall not be used in the works.

9. Cement shall be stored above the ground level in perfectly dry and watertight sheds. Wherever bulk storage containers are used, their capacity should be sufficient to cater to the requirements at site and should be cleaned atleast once every 3 to 4 months. the aggregates shall be stored in such a way as to prevent admixture of foreign materials. Different sizes of fine or coarse aggregate shall be stored in separate stock piles sufficiently away from such other to prevent intermixing the materials.

10. the water for mixing shall be potable water to satisfaction of the Engineer-in- charge. The quantity of water shall be just sufficient to produce a dense concrete of required workability for the job.

11. For all work concrete shall be mixed in a mechanical mixer which alongwith other accessories shall be kept in first class working condition and so maintained throughout the construction Mixing shall be continued till materials are uniformly distributed and uniform colour of the entire mass is obtained and each indiua particle of the coarse aggregate shows complete coating of mortar containing its proportionate amount of cement. In no case shall the mixing be done for less than 2 minutes after all ingredients have been put into the mixer.

12. Mixer which have been out of use more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed toi be the Engineer-in- charge, the first batch of concrete from the mixer shall contain only two thirds of normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

13. The method of transporting and placing concrete shall be approved by the Engineer-in- charge. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent materials takes place. All form work and reinforcement contained in it shall be cleaned and made free from standing water, dust, snow or ice immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the Engineer-in- charge has been obtained.

14. If concreting is not started within 24 hours of the approval being given. It shall have to be obtained again from the Engineer-in- charge. Concreting then shall proceed continuously over the area between construction joints. FResh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer-unless carried in properly design agitators, operating continuously when this time shall be within hours of the addition of cement to the mix an within minutes of its discharge from the agitator. Except where otherwise agreed to be the. Concrete shall be deposited in horizontal layers to a compacted depth of not more than .5 metre when internal vibrator are used not exceeding . metre in all other cases.

15. Unless otherwise agreed to be the Engineer-in-charge concrete shall not be dropped into place from a height exceeding metres. When trunking or chutes are used they shall be kept clean and used in such a way as to avoid segregation. When concreting has to be resumed on a surface which has hardened, it shall be roughened, swept clean, thoroughly wetted and covered with a 13mm. thick layer or mortar composed of cement and sand in the same ratio as in the concrete mix itself. This 13mm layers of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgement of any particles of coarse aggregate. The surface shall then be thoroughly wetted, all free water removed and then coated with neat cement grout. The first layers of concrete to be placed on this surface shall not exceed 150mm. in thickness and shall be well rammed against old particular attention being to comers and close sports.

16. All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrators, unless otherwise permitted by the Engineer-in-charge for exceptional cases, such as concreting under water, where vibrators can not be used. Sufficient vibrator in serviceable condition shall be kept at site so that spare equipment is always available in the event break downs.

17. Immediately after compaction, concrete shall be protected against harmful effects of weather including rain, running water, shocks, vibration, traffic, rapid temperature changes, frost and drying out process. It shall be covered with wet sacking, hessian or other similar absorbant materials approved by the Engineer-in-charge soon after the initial set, and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonry work over the foundation concrete may be started after 48 hours of its laying but the curing of concrete shall be continued for a minimum period of 14 days.

18. Form work shall include all temporary or permanent forms required for forming the concrete, together with all temporary construction required for their support. Formwork shall however be divided into following two distinct categories:

(1) Shuttering i.e. form work required for forming the concrete.

(2) Scaffolding i.e. form work required for supporting shuttering.

Forms for shuttering shall be constructed only, in metal suitably lined. Forms for scaffolding shall be constructed of metal or timber. Both shuttering and scaffolding shall be substantial rigid construction and shuttering shall be true to shape and dimensions shown on the drawings. All bolts and rivets shall be counter-sunk and well ground to provide a smooth, plane surface.

19. Forms shall be mortar-tight and shall be made sufficiently rigid by the use of ties and bracings to prevent any displacement or sagging between supports. They shall be strong enough to withstand all pressure ramming and vibration, without deflection from the prescribed lines occurring during and after placing the concrete. Screw jacks or hardwood wedges where required shall be provided to make up any settlement in the formwork either before or during the placing of concrete. Suitable camber shall be provided in horizontal members of structure specially in long spans to counteract the effects of any deflection. The formwork shall be so fixed as to provide for such camber, forms shall be so constructed as to be removable in sections in the desired sequence. Without damaging the surface of concrete or disturbing other sections. Unless otherwise specified or directed, chamfer or fillet of sizes 25mm x 25mm shall be provided at all angles of form work to avoid sharp corners.

20. The inside surface of shuttering shall, except in the case of permanent form work or where otherwise agreed to be the Engineer-in-charge, be coated with an approved material to prevent adhesion of concrete to the form work. Release agents shall be applied strictly in accordance with the manufacturer's instructions and shall not be allowed to come into contact with any reinforcement or prestressing tendons and anchorages. Different release agent shall not be used in form work for concrete which will be visible in the finished works.

21. Special measures shall be taken to ensure that the form does not hinder the shrinkage of concrete because without these cracking could occur before the form work is removed. Wherever applicable arrangements must be made to ensure that the form work does not restrain the shortening and hogging of the beams or slabs during tensioning of the tendons. The form work should take due account of the calculated amount of positive or negative camber so as to ensure the correct final shape of the structure having regard to the deformation due to false work, scaffolding or propping and the instructure or deferred deformation due to various causes affecting prestressed structures. Where there are re-entrant angles in the concrete sections the form work should be removed at these sections as soon as possible after the concrete has set in order to avoid cracking due to shrinkage of concrete. Form work shall be tight enough to prevent any appreciable loss of cement during vibrations. Suitable tolerance should be provided in the formwork, immediately before concreting all forms shall be thoroughly cleaned. Contractor shall give the Engineer-in-charge due notice before placing any concrete in the forms to permit him to inspect and accept the false work notice before placing any concrete in the forms to permit him to inspect and accept the false work and forms as to their strength, alignment and general fitness, but such inspection shall not relieve the contractor of his responsibility for safety of men, machinery, materials and for results obtained.

22. The Engineer-in-charge shall be informed in advance by the contractor of his intention to strike any formwork. While fixing the time for removal of formwork, due consideration shall be given to local conditions that influence the setting of concrete and of concrete and of the materials used in the mix. Where field operations are controlled by strength tests of concrete the removal of the load supporting of soffit forms may commence when concrete has attained strengthening props including the effect of any further additional loads. When field re-operations are not controlled by strength tests of concrete the vertical forms, beams, columns and walls may be removed after 2 days, The props of slabs and beams may be removed after 14 and 21 days respectively. All formwork shall be removed without causing any damage to the concrete. Centering shall be gradually and uniformly lowered in such a manner as to permit the concrete

to take stresses due to its own weight uniformly and gradually. Where internal metal ties are permitted, they or their removable parts shall be extracted without causing any damage to the concrete. and remaining holes filled with mortar. No permanently embedded metal part shall have less than 25mm. cover to the finished concrete surface. Where it is intended to be cleaned and made good to the satisfaction of the Engineer-in-charge.

23. Immediately after the removal of forms, all exposed bars or bolts passing through the Cement concrete member to a depth of at least 25mm, below the surface of the concrete and the resulting holes be filled by cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties and all other holes and depressions, honey comb spots, broken edges or corners and other defects, shall be thoroughly cleaned saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregated mixed in the proportions used in the grade of concrete that is being finished and of as dry a consistency as is possible to use. Considerable pressure shall be applied in filing and pointing to ensure thorough filling in all voids. Surface which have been pointed shall be kept moist for a period of twenty four hours. If rock pockets / honey-combs, in the opinion of the Engineer-in-charge are of such an extent or character as to effect the strength of the structure materially or to endanger the life of the steel reinforcement, he may declare the concrete defective and require the removal and replacement of the portions of the structure affected.

24. In the case of reinforced concrete work, workability shall be such that the concrete surrounds and properly grips all reinforcement. The degree of consistency, which shall depend upon the nature of work and methods of vibration of concrete shall be determined regular slump tests. Following slump shall be adopted for different types of works.

Type of Work		Slumps	
		Where vibrators are used	where vibrators are not used
(i)	Mass concrete in R.C.C. Foundations footings and retaining walls	10mm to 25mm	80mm
(ii)	Beams, slabs and columns simply reinforced	25mm to 40mm	100mm to 120mm
(iii)	Thin R.C.C. section or section with congested steel	40mm to 50mm	125mm to 150mm

25. For controlled concrete preliminary tests shall consist of three sets of separate tests, and in each set, tests shall be conducted on six specimens. Not more than one set of six specimens shall be made on any particular day. Of the six specimens in each set, three shall be tested at seven days and the remaining three at 28 days. The preliminary tests at 27 days are intended only to indicate the strength likely to be attained at 28 days. Work strength tests shall be made in accordance with IS: 516 EACH test shall be conducted on ten specimens five of which shall be tested at seven days and the remaining five at 28 days. The samples of concrete shall be taken on each day of concreting and cubes shall be made at the rate of one for every 5 cubic metre of concrete or a part thereof. However, if concreting done in a day is less than 15 cubic metre, the minimum number of cubes can be reduced to 6 with the specific permission of the Engineer-in-charge. Similar work tests shall be carried out whenever the quality and grading of materials is changed irrespective of the quantity of concrete poured. The number of specimens may be suitably increased as deemed necessary by the Engineer-in-charge when procedure to tests given above reveals a poor quality of concrete and in other special cases.

26. The average strength of the group of cubes cast for each day shall not be less than the specified work cube strength 20 per cent of the cubes cast each day may have values less than the specified strength, provided the lowest value is not less than 85 per cent of the specified strength.

27. R.C.C. work shall have exposed concrete surface. Centering design and its erection shall be approved by the Engineer-in-charge. One carpenter with helper will invariably be kept throughout the period of concreting. Movement of labour and other persons shall be totally prohibited over reinforcement laid in position. For access to different parts, suitable mobile platforms shall be provided so that steel reinforcement in position is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, kapachi or metal pieces shall not be used for this purpose. Concreting of important structural members shall always be done in the presence and under the supervision of department person not below the rank of Asst. Engineer/Addl. Asst. Engineer/ Overseer or as instructed by the Engineer-in-charge. After removal of formwork and setting, the Executive Engineer

shall inspect the work and satisfy by random checks that concrete produced is of good quality. Plastering shall not be allowed to the exposed faces of concrete.

28. In reinforced concrete the volume occupied by reinforcement shall not be deducted. The slab shall be measured as running continuously through and the beam as the portion below the slab.

29. All necessary labour, materials, equipment, etc., for sampling, preparing test cubes, curing etc. shall be provided by the contractor. Testing of the materials and concrete may be arranged by the Engineer-in-charge in an approved laboratory at the cost of the contractor.

30. The payment will be made on cmt. basis of the finished work.

31. The unit rate for concrete shall include the cost of all materials labour, tools and plant required for mixing, placing in position, vibrating and compacting finishing as per directions of the Engineer-in-charge, curing and all other incidental expenses for producing concrete of specified strength to complete the structure or its components as shown on the drawings and according to these specifications. The rate shall also include the cost of making fixing and removing of all centers and forms required for the work.

Item No. 30

Construction brick masonry road gully chamber 1100mm x 775mm including 500mm x 450mm (CI horizontal grating with frame and vertical grating complete)

1.0. Materials & Workmanship : The relevant specifications of item 24.40 shall be followed except that the size of road gully chamber shall be 1100 mm. x 500 mm. x 775 mm. incl. .500 mm. x 450 mm. C. I. horizontal grating with frame and vertical grating complete.

2.0. Mode of measurements & payment:

2.1. The relevant specifications of item 24.40 shall be followed.

2.2. The rate shall be for a unit of one Nos.

Item No. 31

Providing and laying @weep hole in Abutment and returns by using A.C pipe of 100mm. Incl. fixing in proper grade and jointing the complete as per detailed specification.

614. WEEP HOLES

Weep holes as shown on the drawings shall be provided in the masonry structures with height more than 2 m to drain moisture from the backfilling. Weep holes shall be provided with 100 mm dia AC pipes and shall extend through the full width of the masonry with slope of about 1 vertical to 20 horizontal towards the draining face.

The weep hole shall be suitably staggered and the spacing of weep holes shall not exceed 2 m in horizontal and 1 m vertical direction with the lowest one at about 150 mm above the low water level or bed level which ever is higher or as directed by the Engineer.

The payment will be made on Nos. basis of the finished work.

Item No. 32

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

1. Well graded pebbled or metal of 40mm. to 63mm. size shall be used. The grading and tolerances of metal of pebbles shall be as under :-

Sr. No.	No. of Size Range	Sieve Designation	Percentage by weight passing through the sieve.
1	63mm. to 40mm.	90mm	100-00
		63mm	85-100
		50mm	35-70

		40mm	00-15
		20mm	00-05

The size shall be 40mm. to 63mm. where in tolerance limit for over size shall be upto 15% and that for lower size should be upto 15% and below 20mm. it shall be allowable upto 5% the filter Materials shall be tightly placed to a thickness of not less than 600mm. and provided over the entire surface behind abutments, wings or return walls to the full height.

2. Materials shall be first stacked in boxes of 2 m 1.1/2m x 0.5 m. size on fairly level ground and measured.

3. The measurement for payment shall be made on sq.mt basis of finished No deduction shall be made for voids.

4. The unit rate includes the cost of materials, scaffolding labour and tools to complete the work.

Item No. 33

Providing and fixing in position Mild steel dowel bars in pier cap or abutment caps for anchorage in fixed end as per detailed drawings including cutting bending and welding complete.

And

Item No. 34

Providing and fixing in position Mild steel dowel bars in pier cap or abutment caps for anchorage in free end as per detailed drawings including cutting bending and welding complete.

1. For Mild Steel, specification for Ms reinforcement shall apply.

2. The M.S. dowel bars shall be provided and anchored in pier caps. abutment caps and super-structure as per detailed drawings for free ends and fixed ends. G.I. Pipes and other, materials such as mastic asphalt as directed by Engineer-in-charge or as per drawing shall be provided G.i. pipes shall be as approved by Engineer-in-charge.

3. The payment shall be made per number of dowel bars in anchored condition.

4. Unit rate shall include cost of all materials, labour, and equipments to complete the job.

Item No. 35

Providing and laying in Position FE -500/500D TMT bar reinforcement including cutting, bending, hooking and tying complete as per detailed drawings for the following (A) Piers (B) Abutments © R.C.C. Returns /Walls / Caps / Copings etc.

And

Item No. 36

Providing and placing in position FE-500/500D TMT bar reinforcement including cutting, bending, hooking, and tying complete as per detailed drawing (A) Solid Slab/ App. Slab / Wearing coat.

2.00 Materials :- T.M.T. shall conform to IS : 1789-FE 500/500D Mild steel binding wires shall conform to the specification.

2.1 The work shall consist of furnishing and placing reinforcement of the shape and dimensions shown on the drawing or as directed by the Engineer-in-charge.

2.2 Steel shall be clean and free from loose rust mill scale at the time of fixing in position and subsequent concreting.

2.3 Reinforcing steel shall conform accurately to the dimensions given iron bar bending schedules shown on relevant drawing. Bar shall be bent cold to the specified shape and dimensions or as directed by the Engineer-in-charge using a proper bar bender, operated by hand or power to attain proper radius of bends. Bars shall not be bent or straightened in manner that will injure the material. Bars bend during transporting or handling shall be straightened before use on work ; they shall not be invariably be provided. The radius of the bend shall not less than twice the diameter of the round bar and length of the straight part of the beyond the end of the curve shall be at least four times the diameter of the round bar. In the case which are not round and in the case of deformed bars, the diameter shall be taken as the diameter of a circle having a equivalent effective area. The work shall be suitably encased to prevent any splitting of the concrete.

2.4 All reinforcement bars shall be accurately placed in exact on the drawings, and shall be securely held in position during placing of concrete by annealed binding wire not less than 1mm, in size and confirming to IS : 280 and by using stay blocks or metal chairs, spacer, metal hangers, supporting wires or other approved device at sufficiently close intervals. Bars will not be allowed to sag between supports or displaced during concreting or any of their operations over the work. All devices used for positioning shall be non-corrodible material. Wooden and metal supports will not extend to the surface of concrete except where shown on the drawings. Placing bars on layers of freshly laid concrete as the work progress or adjusting bar will not be allowed. Pieces of broken stone or brick and wooden blocks shall not be used. Layers of bars shall be separated by spacer bars, precast mortar block, or other approved device. Reinforcement after being placed in position shall be maintained in clean condition until completely embedded in concrete. Special care shall be exercised to prevent any displacement of reinforcement in concrete already placed. To protect reinforcement from corrosion, concrete cover shall be provided as indicated on the drawing. All bars protruding from concrete and to which other bars are to be spliced and which are likely to be exposed for an indefinite period shall be protected by a thick coat of neat cement grout.

2.5 Bars crossing each other, where required shall be secured by binding wire (annealed) of size not less than 1 mm. in such a manner that they do not slip over each other at the time of fixing and concreting.

2.6 As far as possible, bars of full length shall be used. In case this is not possible, overlapping of bars shall be done as directed by the engineer-in-charge. When practicable, overlapping bar shall not touch each other, but be kept apart by 25mm or 1.25 times the maximum size of the coarse aggregate whichever is greater, by concrete between them, Where not feasible, overlapping bars shall be bound with annealed steel wire, not less than 2mm thickness twisted right. The overlaps shall be staggered for different bars and located at points, along the span where neither shear nor bending movement is maximum.

2.7 Whenever indicated on the drawings or desired by the Engineer-in-charge, bar shall be joined by couplings which shall have a cross-section sufficient to transmit the full strength of bars. The end of the bars that are joined by coupling shall be upset for a sufficient length so that the effective cross-section at the base of threads shall be standard with the threads. Steel for coupling shall conform to IS : 226.

2.8 When permitted or specified on the drawings joints of reinforcement bars shall be but welded so as to transmit their full strength. Welded joints shall preferably be located at points where steel will not be subject to more than 75 per cent of the maximum permissible stresses and so staggered that at any one section not more than 20 per cent of the rods are welded. Only electric arc welding shall be used. The process which excludes air from the molten metal and conforms to any or all the special provisions for the work will be accepted. Suitable means shall be provided for holding the bars securely in position during welding. It must be ensured that no voids are left in welding and when welding is done in 2 or 3 stages, previous surface shall be cleaned properly. Ends of the bars shall be cleaned of all loose scale, rust, grease, paint and other foreign matter before welding. Only competent welders shall be employed on the work. The M.S. electrodes used for welding shall conform to IS : 814 welded pieces of reinforcement shall be tested. Specimen shall be taken from the actual site and their number and frequency to test shall be as directed by the Engineer-in-charge.

MEASUREMENTS FOR PAYMENT

Reinforcement shall be measured in length including hooks, if any, separately for different diameters as actually used in work, excluding overlaps. From the length so measured, the weight of reinforcement shall be calculated in tonnes on the basis of IS: 1732. Wastage, overlaps, couplings, welded joints, spacer bars, chairs, stays, hangers and annealed steel wire or other methods for binding and placing shall not be measured and cost of these items shall be deemed to be included in the rates for reinforcement.

RATE

The contract unit rate for coated/uncoated reinforcement shall cover the cost of material, fabricating, transporting, storing, bending, placing, binding and fixing in position as shown on the drawings as per these specifications and as directed by the Engineer, including all labour, equipment, supplies, incidentals, sampling, testing and supervision.

The unit rate for coated reinforcement shall be deemed to also include cost of all material, labour, tools and plant, royalty, transportation and expertise required to carry out the work. . The rate shall also cover sampling, testing and supervision required for the work.

Mode of Measurement and Payment

The rate shall be for a unit of One M.T

Item No. 37

Construction of Precast R.C.C. railing of M 30 grade concrete having 2-tire (Raw) of hand pail dimension as shown on detail drawing and vertical posts not to exceed 2.0m including necessary TMT steel, formwork, painting with weather proof paint, supplying of all material, labour etc. complete as per instruction of Engineer-in-charges,

1208. RAILINGS/PARAPETS

1208.1. General

- (a) Bridge railing includes the portion of the structure erected on and above the kerb for the protection of pedestrians and traffic
- (b) Railings shall not be constructed until the centering for falsework for the span has been released and the span is self-supporting.
- (c) The type of railing shall be carefully erected true to line and grade. Posts shall be vertical with a tolerance not to exceed 6 mm in 3 m. The pockets left for posts shall be filled up with cement mortar.
- (d) The type of railing to be constructed shall be as shown on the drawing
- (e) Care shall be exercised in assembling expansion joints in the railings to ensure that they function properly.
- (f) The design of bridge railings shall be such which is amenable to quick repairs.
- (g) Railing materials, particularly metal railings, shall be handled and stored with care, so that the material and parts are kept clean and free from damage. Railing materials shall be stored above the ground on platforms, skids, or other supports and kept free from grease, dirt and other contaminants.

Any material which is lost, stolen or damaged after delivery shall be replaced or repaired by the Contractor. Methods of storage, etc. or repairs shall not damage the material or protective coating.

1208.2. Metal Railings

All pipes and steel elements used for railings shall be mild steel conforming to IS: 1239 and shall be galvanized.

All complete steel rail elements, pipe terminal sections, posts, bolts, nuts, hardware and other steel fittings shall be galvanized or painted with an approved paint.

If galvanized, all elements of the railings shall be free from abrasions, rough or sharp edges, and shall not be kinked, twisted or bent. If straightening is necessary, it shall be done by methods approved by the Engineer.

Damaged galvanized surfaces, edges of holes and ends of steel, railing cut after galvanizing shall be cleaned and re-galvanised.

The railing shall be carefully adjusted prior to fixing in place to ensure proper matching at abutting joints and correct alignment and camber throughout their length. Holes for field connections shall be drilled with the railing in place in the structure at proper grade and alignment.

Unless otherwise specified on the drawings, metal railing shall be given one shop coat of paint and three coats of paint after erection if sections are not galvanized.

Railings shall not follow any irregularity in the alignment of the deck. When shown on the drawings, the rail elements shall be curved before erection.

1208.3. Cast-in-Situ Concrete Railings

The portion of the railing or parapet which is to be cast in place shall be constructed in accordance with the requirements for structural concrete in Section 800 and reinforcement shall conform to Section 1000 of these Specifications.

Forms shall either be of single width boards or shall be lined with suitable material duly approved by the Engineer. Form joints in plane surfaces will not be permitted.

All mouldings, panel work and bevel strips shall be constructed according to the details, shown on the drawings. All corners in the finished work shall be true, sharp and clean-cut and shall be free from cracks, spalls or other defects. Casting of posts shall be done in single pour.

1208.4. Parapets

Plain cement concrete M15 grade or brick or stone masonry parapets as shown on drawing shall be provided on R.C.C. slab culverts or minor bridges having overall length not exceeding 30 m. Minimum thickness of masonry parapets shall be 400 mm.

1208.5. Measurements for Payment

Measurements for railings and parapets shall be in running Metres.

1208.6. Rate

The contract unit rate for railings and parapets shall include the cost of all labour, material, tools and plants, formwork required for completing the work as per these Specifications.

RAILING

1. For concrete and steel specification of the item of ordinary concrete and reinforcement shall apply.
2. All components of the parapets shall be precast and arranged in the manner as shown on the drawing and shall be jointed together as per details shown on the drawings.
3. The parapet shall be truly and correctly aligned in line and level, along the center line of the parapet over the top rail, All edges and corners shall be straight and finished in true line and level.

4. Parapet shall be measured in running metres. Reinforcement in the parapet shall not be paid separately.

5. Unit rate includes cost of all materials including steel, form work, labour, tools and plants to complete the job as per the technical specifications of Item No. 32,

General

- a) Bridge railing includes the portion of the structure erected on and above the kerb for the protection of pedestrian and traffic.
- b) Railings shall not be constructed until the centering falsework for the
- c) The type of railing shall be carefully erected true to line and grade. Posts shall be vertical with a tolerance not to exceed 6mm in 3 metres. The pockets left for posts shall be filled up with non-shrinkable mortar.
- d) The type of railing to be constructed shall be as shown on the drawings.
- e) Care shall be exercised in assembling expansion joints in the railings to ensure that they function properly.
- f) The bridge railings shall be amenable to quick repairs.
- g) Railing materials, particularly metal railings, shall be handled and stored with care, so that the material and parts are kept clean and free from damage. Railing materials shall be stored above the ground on platforms, skids, or other supports and kept free from grease, dirt and other containments.

Any material which is lost, stolen or damaged after delivery shall be replaced by the Contractor. Methods of repair shall not damage the material or protective coating.

Cast-in-Situ Concrete Railings

The portion of the railing or parapet which is to cast in place shall be constructed in accordance with the Item No. 33 and The reinforcement shall conform to Specification of Item No. 37.

Forms shall either be of single width boards or shall be lined with suitable material duly approved by the Engineer. Form joints in plane surfaces will not be permitted.

All mouldings, panel work and bevel strips shall be constructed according to the details shown on the drawings. All corners in the finished works shall be true, sharp and clean-cut and shall be free from cracks, spalls or other defects. Casting of posts shall be done in single pour.

Precast Concrete Railings

precast members for railings shall be of reinforced cement concrete and shall conform to the specifications given in Item no. 33 and Item No. 37. The maximum size of the aggregate shall be limited to 12 mm and the concrete grade shall be M 30. The precast members shall be removed from the moulds as soon as practicable and shall be kept damp for a period of at least 10 days. During this period they shall be protected from sun and wind. Any precast member that becomes chipped, marred or cracked before or during the process of placing shall be rejected. Special care shall be taken to watch the surface of the cast-in-situ portion of the deck.

Item No. 38

Providing 12mm. Thick Pre-molded asphalt filler joints as per drawings

1. Open joints shall be constructed at the locations as directed by the Engineer-in-charge using a wood strip, metal plate, other suitable material which is subsequently removed. When removing the material, care shall be exercised to avoid chipping or breaking the corners of the concrete. The edge of the concrete at the joints shall be edge finished. Reinforcement shall not extend across as open joint.

2. When rate for each type of bearings shall include the cost of supplying and fixing the bearings in position complete. The rate shall also include the cost of samples and their testing as desired by the Engineer in charge. The rate shall also include the cost of adhesives for fixing them.

3. The material used for filling expansion joint shall be bitumen impregnated felt which shall conform to the requirement of IS: 1838, and shall be got approval from the Engineer-in-charge. The joint shall consist of large pieces and assembly of small pieces to make up the required size shall be avoided.

4. The expansion joint shall be measured in running metres. Thickness of the expansion joint will be 20 to 25mm. Width of the expansion joint shall be equal to full depth of the slab.

5. The rate shall include the cost of all material, labour, equipments and other incidental charges for fixing the joints complete in all respect as per these specifications and as shown on the drawings.

6. Payment shall made on Sqmt basis

Item No. 39

Providing G.I. 100mm. Dia Meter water spouts including necessary iron gratings as per drawings.

1. Material for the water spout shall be as mentioned in the item and shall be got approved from in Engineer in Charge.

2. Water spout shall be 100 mm. internal dia. Cost iron grating shall be provided at the entry and shall be fixed in the recess so as to be flush with the read surface. The quality and size of the grating shall be approved from the Engineer-in-charge. The water spout shall project at-least 10 cm. outside the concrete and shall be rigidly fixed in it. The grating and G.I. pipes shall be painted with two coats of anticorrosive black bitumen paint.

3. Measurement shall be per Number of water spout fixed. unit Rate included cost of material, labor and to completed the works.

Item No. 40

Providing PVC 100mm. Dia Meter water spouts including necessary iron gratings as per drawings.

1. Material for the water spout shall be as mentioned in the item and shall be got approved from in Engineer in Charge.

2. Water spout shall be 100 mm. internal dia. PVC shall be provided at the entry and shall be fixed in the recess so as to be flush with the read surface. The quality and size of the PVC shall be approved from the Engineer-in-charge. The water spout shall project at-least 10 cm. outside the concrete and shall be rigidly fixed in it. The PVC pipes shall be painted with two coats of anticorrosive black bitumen paint.

3. Measurement shall be per Number of water spout fixed. unit Rate included cost of material, labor and to completed the works.

Item No. 41

Filling available excavated earth (excluding rock) in trenches plinth sides of foundation etc. in layers not exceeding 20cm in depth consolidating each deposited layer by ramming and watering.

1.0 The earth to be used for filing shall be free from salts, organic or other foreign matter, All clods of earth shall be broken.

2.0 As soon as the work in foundation has been completed and measured, the site of foundation shall be cleared of all debris, stone, mortar droppings etc. and filled with earth in layers not exceeding 20 cms. each layer shall be adequately watered, rammed and consolidated before the succeeding layers is laid, the earth shall the rammed with iron rammers where reasible and with the butt ends of crow-bars. Where rammer can not be used. With iron rammers finished level, the surface shall be flooded with water for at least 24 hours and allowed to dry and then rammed and consolidated.

3.0 The excavated stuff of the selected type shall be allowed to be used in filling the trenches and plinth under no circumstances black cotton soil be used for filling.

4.0 The payment shall be made for filling in trenches and plinth. No deduction shall be made for shrinkage of voids, if consolidated as instructed above.

5.0 The rate shall be for a unit of one cubic Metre.

Item No. 42

Supplying and fixing reinforced concrete heavy duty non pressure pipes with collars for culverts carrying heavy traffic as per IS 458-1991 specification including setting and joining the pipes in C.M. 1:2 watering and laying (to level or slope) of I.S. Class NP-3 of following internal diameter with all lead and lift. (i) 600mm Dia.

And

Item No. 43

Supplying and fixing reinforced concrete heavy duty non pressure pipes with collars for culverts carrying heavy traffic as per IS 458-1991 specification including setting and joining the pipes in C.M. 1:2 watering and laying (to level or slope) of I.S. Class NP-3 of following internal diameter with all lead and lift. (i) 900mm Dia.

And

Item No. 44

Supplying and fixing reinforced concrete heavy duty non pressure pipes with collars for culverts carrying heavy traffic as per IS 458-1991 specification including setting and joining the pipes in C.M. 1:2 watering and laying (to level or slope) of I.S. Class NP-3 of following internal diameter with all lead and lift. (i) 1200mm Dia.

1. The work shall consist to furnishing and installing reinforced cement concrete pipe of the type dia metre and length required at the location shown on the drawings or as ordered by the Engineer in charge.

2. Reinforced concrete pipe shall be NP3 type conforming to the requirements of IS : 458 and shall be of dia as specified in the item each consignment of cement concrete pipes shall be inspected. If necessary and approved by the engineer in charge, either at the place of manufacture or at the site before their incorporation in the works.

NP3 , NP3 , NP1 pipes are used for RCC pipes where testing of pipes will not be feasible the contractors will have to produce a certificate from the manufacturers on company's letter head the given hereinafter form.

Production of such certificate will not however relieve the contractor from this responsibility of supplying pipes of required standard and will have to bear the loss or damage caused to the work in account of defects found subsequently during the execution It will also be necessary to purchase these pipes from manufacturer having standard equipments for carrying out various test as per IS : 458 at his factory.

FORM OF CERTIFICATE FOR NP3, NP2, NP1 PIPES

We..... manufacture of RCC pipes produce RCC pipes as per the requirement of IS : 458 and also carry out the required test at our place. We have acquired equipments for carrying out test and are prepared to carry out test at our factory sites.

We have experience of manufacturing of pipes of years The pipes supplied by us to M/s Satisfy the requirement of IS " 458.

Date

Place

Manufacturer's sign.

3. No pipe shall be placed in position until the foundations have been approved by the engineer in charge, Where two or more pipes are to be laid adjacent to each other they shall be separated by a distance equal to at least half the diameter of the pipe subject to minimum of 450mm. The laying of pipes on the prepared foundation shall start from the outlet and proceed toward the inlet and be completed to the specified lines and grades. The pipes shall be fitted and matched so that when laid in works they form a culvert with a smooth uniform invert. Any pipe found defective or damaged during laying shall be removed at the cost of contractor.

4. The pipes shall be jointed either by collar joint or by flush joint in the former case the collars shall be of RCC 150 to 200 mm wide and having the same strength as the pipes to be jointed . Caulking space shall be slightly wet mix of cement and sand in the ratio of 1:2 rammed with caulking irons. Before caulking the

collar shall be so placed that its centre coincides with that of pipe and an even annular space is left between the collar and the pipes. Flush joint may be shaped to form a self centering joint with a joint space 13 mm wide. The joint space shall be filled with cement mortar, 1 cement 2. sand, mixed sufficiently dry to remain in position when forced with a trowel or rammer. Care shall be taken to fill all voids and excess mortar shall be removed. All joints shall be made with care so that their interior surface is smooth and consistent with the interior surface of the pipes. After finishing, the joint shall be kept covered and damp for at least four days.

5. RCC pipe shall be measured along their centre between their inlet and outlet ends in linear Metres.

6. The rate for the pipes shall include the cost of pipe including loading unloading handling storing laying in position and joining complete.

7. Payment shall be made on Running Metre basis.

Item No. 45

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

1504. INTERLOCKING CONCRETE BLOCK PAVEMENT

1504.1. Scope

Interlocking Concrete Block Pavement (ICBP) shall consist of a surface layer of appropriate sized concrete paving blocks paved and compacted over a thin bedding sand layer of specified grading, which is spread over a properly constructed and profiled base course and is bounded by properly installed edge restraints. The joints shall be filled by fine sand of specified grading. The work shall include supplying laying and paving of blocks including all materials, labour and equipment and performing all operations in connection with the laying of ICBP as per these Specifications.

1504.2. Materials

1504.2.1. The Concrete Paving Block shall conform to the relevant IS standard.

1504.2.2. Bedding sand : Bedding sand shall conform to the grading given in Table 1500.6.

1504.2.3. Joint filling sand : Joint filling sand shall conform to grading given in Table 1500.6.

TABLE 1500.6 : GRADINGS FOR BEDDING AND JOINT FILLING SAND

IS Sieve Size (mm)	Per cent Passing	
	For Bedding Sand	For Joint Filling Sand
10.00	100	100
4.75	90-100	90-100
2.36	60-95	75-100
1.18	15-34	55-90
0.60	25-60	35-59
0.30	5-20	8-30
0.15	0-10	0-10
0.075	0-5	0-5

1504.3. Buffer

Buffer of specified quantity of paving blocks (of the same shape, size and thickness) required for normal maintenance of paved area as specified by the Engineer, shall be supplied and stored for replacement as and when needed. Normally this will be 5 per cent of the blocks used in the paved area.

1504.4. Block Thickness

For rural roads catering to heavy vehicles, the minimum thickness of paving blocks shall be 60 mm for traffic up to 100 vehicles per day, and 80 mm for projected traffic from 100 to 250 vehicles per day.

1504.5. Dimensions and Tolerances

The dimensions and tolerances of paving blocks shall conform to the Specifications given in Table 1500.7. Aspect ratio is the ratio of length to thickness of blocks. Chamfer is the bevelled edge, provided on the top surface of a block. Plan area is the horizontal area bounded by the vertical faces. Wearing surface area is the horizontal area bounded by the vertical faces, minus the area reduced due to the presence of chamfer.

TABLE 1500.7 : DIMENSIONS AND TOLERANCES FOR PAVING BLOCKS

S. No.	Dimension	Recommended Values	Tolerance Limit
(1)	Width W	To be specified by Manufacturer	± 2 mm
(2)	Length L	To be specified by Manufacturer	± 2 mm
(3)	Thickness T	60 to 80 mm	± 3 mm
(4)	Aspect Ratio L/T	Maximum : 4.0	± 0.2
(5)	Chamfer (Arris)	Maximum : 5 mm Maximum : 7 mm	± 1 mm
(6)	Plan Area	Maximum : 0.03 m^2	$+0.001 \text{ m}^2$
(7)	Wearing Face Area	Minimum 75% of Plan Area	-1%
(8)	Squareness	Nil	± 2 mm

1504.6. Compressive Strength

1504.6.1. The average 28 days compressive strength of 8 blocks shall be 30 MPa and strength of individual block shall not be less than 26 MPa.

1504.6.2. The 28 days compressive strength of paving blocks tested as per relevant IS specification shall be determined as explained hereinafter.

1504.6.2.1. Compression testing machine of adequate capacity shall be used for testing of blocks. The steel bearing plates shall have a minimum thickness of 25 mm. The surface area of the bearing side of the plate should be such that no edge of the bearing plate is less than 10 mm from the outer edge of the paving block being tested.

1504.6.2.2. In case the testing surface of the paving block departs from a plain surface by more than 0.05 mm, capping using suitable materials shall be adopted for testing as per IS:516.

1504.6.2.3. The blocks shall be stored for 24 ± 4 hours in water maintained at a temperature of $(20 \pm 5)^\circ\text{C}$ before testing. The dimensions and plan areas of the block shall be determined. The bearing plates of

the testing machine shall be wiped clean. The specimen shall be clamped between the plates in such a way that the axes of the specimen are vertically aligned with those of the bearing plates.

1504.6.2.4. The load shall be applied without shock and increased continuously at a rate of 15 ± 3 N/mm²/minute until no greater load can be sustained by the specimen or delamination occurs. The maximum load applied to the specimen shall be noted.

1504.6.2.5. The apparent compressive strength of individual block shall be calculated by dividing the maximum load (N) by the plan area (mm²). The corrected compressive strength shall be calculated by multiplying the apparent compressive strength by the appropriate correction factor from Table 1500.8. The strength shall be expressed to the nearest 0.1 N/ mm².

TABLE 1500.8 : CORRECTION FACTORS FOR THICKNESS AND CHAMFER OF PAVING BLOCK FOR CALCULATION OF COMPRESSIVE STRENGTH

Paving Block Thickness (mm)	Correction Factor for	
	Plain Block	Chamfered Block
60	1.00	1.06
80	1.12	1.18

1504.6.2.6. Water Absorption: The water absorption being the average of five blocks shall be not more than 6 per cent by mass.

1504.7. Edge Blocks

The edge blocks shall have equivalent cube compressive strength not less than 30 MPa. The road kerbs provided on the edges of the road also serve the purpose of edge blocks. In case the end kerbs are not provided, 300 mm x 300 mm x 150 mm of M30 grade concrete edge blocks or other suitable size as per drawings or direction of the Engineer shall be provided.

1504.7.2. Subgrade

The Subgrade shall conform to Clause 1501.5.1 of these Specifications. The soaked CBR of subgrade soil shall not be less than 4 per cent.

1504.8. Sub-base

The sub-base shall be 100 mm thick granular layer conforming to Clause 401 or 100 mm thick WBM Gr.I conforming to Clause 405 of these Specifications. In case the subgrade soil is clayey, the sub-base shall be extended over the full formation width for proper drainage.

1504.9. Base Course

A minimum 100 mm thick layer of granular/stabilized base course shall be provided. The base course layer shall be extended at least 300 mm beyond the edge restraints. The material shall conform to Clause 402 of these Specifications.

1504.10. Bedding Sand

Bedding sand conforming to Table 1500.6 shall be uniformly laid to a compacted thickness of 25 mm for 60 mm thick blocks and 30 mm for 80 mm thick blocks. Bedding sand shall be unloaded in small piles regularly placed over the base course and shall preferably have a moisture content of about 6 per cent which will facilitate its spreading and compaction. Bedding sand shall be screeded in a uniform layer over the base course. The screed can be guided to level by tensioned string lines set above the base course. At the time of screeding, the thickness of sand must allow for the amount by which it will be subsequently compacted which is normally about 25 per cent more than the compacted thickness. Screeding shall not proceed beyond about 1 m ahead of the planned end of block paving for the day. Sand shall preferably be compacted with a manual, fabricated plate compactor and the level shall **be readjusted** using the screed. The surface profile of the screeded bedding **sand** shall **match that** required for the completed pavement.

1504.11. Paving Pattern

The pattern in which blocks are to be paved shall be decided in advance and got approved from the Engineer in charge.

1504.11.1. By and large, these patterns are the same as adopted for brick paving. All shapes of blocks are not amenable to the above paving patterns. For paving in trafficked areas, herringbone pattern shall be adopted for ensuring better performance. Paving shall commence and progress from one starting line only. Wherever possible, paving shall commence adjacent to or against edge restraint.

1504.12. Paving and Compaction of Blocks

Blocks shall be placed at the correct angle to the start line to achieve the final orientation of the laying pattern. For curved or unfavourably oriented edge restraints, a string line shall be established to permit fast, easy laying such that it is not required to force a block between the blocks already paved. Control over alignment, laying pattern and joint width can be assisted by the use of chalked string lines set at about 5 m intervals. Nominal joint width of 2 to 4 mm shall be maintained by holding the paving unit lightly against the face of the adjacent block and allowing it to slide into position. Cutting paving units for filling the paving gaps occurring against edge restraints etc. shall be deferred until sufficient work has progressed to allow reasonably continuous operation. When space does not permit the use of cut pieces of blocks, premixed or dry packed concrete shall be used. After a section has been paved, compaction shall be effected by using vibrating plate compactors in the following sequence of operations:

- (i) Vibrate the blocks with 3 passes of the plate vibrator of adequate capacity.
- (ii) Spread a thin layer of fine joint filing sand on top of the paved blocks and sweep it into the joints, using suitable brooms.
- (iii) Vibrate the sand into the joints by making 3 passes of the compactor.
- (iv) Sweep off the excess sand from top of blocks.

As a guide to the characteristics of typical vibrating plate compactors, standard compactors have a weight of 90 kg, a plate area of 0.3 m² and apply a centrifugal force of 1500 kg. Heavy duty compactors weigh between 300 to 600 kg, have a plate area of about 0.5 to 0.6 m² and apply a centrifugal force in the range of 2000-3000 kg. Use of heavy duty compactors is desirable for trafficked pavements.

1504.12.1. Trial length : The contractor shall lay a trial length of 30 m and get it inspected and approved by the Engineer before proceeding with the regular paving work. The trial length shall be rectified/relaid if found deficient in any respect. The procedure demonstrated in the laying of trial length shall be followed while executing the main construction work.

1504.13. Opening to Traffic

The pavement can be opened to traffic as soon as the construction work is completed.

1504.14.1. Transverse profile : When measured by a camber template, the transverse profile shall not deviate by more than 10 mm from the design profile.

1504.14.2. Longitudinal profile : When measured by a 3 m straight edge, the longitudinal profile shall not deviate by more than 12 mm from the design profile.

1504.15. Acceptance Criteria

From each lot of 500 blocks, 5 blocks shall be selected at random for water absorption and compressive strength tests. In case the number of blocks in the lot is less than 500, a minimum 1 per cent of the blocks delivered to site shall be tested for water absorption and strength. The blocks shall be first tested for water absorption and these shall meet the requirement of Clause 1504.5.2.6 of these Specifications. The same five blocks (or minimum 1 per cent) shall be tested for strength and shall conform to the strength as per Clause 1504.5.1 of these Specifications.

The paved surface shall meet the tolerances for lines, levels, and grades etc. as given in Section 1800 of these Specifications.

1504.16. Measurements for Payment

The measurement of the paved area shall be in square metres measured from the inner edge of edge restraints on one side of the pavement to the inner edge of the edge restraints on the transverse side of the pavement. The measurement of the edge restraints shall be in number of units or in cubic metres.

1504.17. Rate

The contract unit rate shall include the cost of blocks, cost of stacking, transportation to site and paving including supply and application of bedding sand and joint filling sand. The rate shall include full compensation for labour, tools, plant, equipment, testing and all incidentals to the work, including all royalties, taxes, storage rents wherever necessary, and all leads and lifts.

Item No. 46

Dismantling the existing structure including removing and stacking the dismantled materials as and where directed. Rubble masonry/ U.C.R. Masonry.

And

Item No. 47

Dismantling the existing structure including removing and stacking the dismantled materials as and where directed. RCC Work.

And

Item No. 48

Removing all types of Hume pipes and stacking within a lead of 1000m including earthwork and Dismantling of Masonry works as per technical Specification Clause. 202 Dia Metre 600mm to 900mm

202. DISMANTLING CULVERTS, SMALL BRIDGES, PAVEMENTS AND OTHER STRUCTURES

202.1. Scope

This work shall consist of removing, as hereinafter set forth, existing culverts, bridges, pavement, kerbs and other structures, like, railings, fences, utility services, manholes, catch basins, inlets etc., which are in place but interfere with the new construction or are not suitable to remain in place. It shall include salvaging and disposing of the resulting materials and backfilling the resulting trenches and pits.

Existing culverts, bridges, pavement and other structures which are within the road land and which are designated for removal, shall be removed up to the limits and extent specified in the drawings or as directed by the Engineer.

Dismantling and removal operations shall be carried out preferably with locally available tools and equipments and in such a manner as to leave undisturbed adjacent pavement, structures and any other work to be left in place. Use of specialized tools and equipments by the agency shall be incidental to this item.

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

202.2. Dismantling Culverts and Small Bridges

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

Unless otherwise specified, the superstructure portion of culverts/bridges shall be entirely removed and other parts removed below the ground level or as necessary depending upon the interference they cause to the new construction. Removal of overlying or adjacent material, if required in connection with the dismantling of the structures, shall be incidental to this item.

Where existing culverts/bridges are to be widened / strengthened or otherwise incorporated in the new work, only such part or parts of the existing structure shall be removed as are necessary for execution of work shown in drawings to provide a proper connection to the new work. The connecting edges shall be cut, chipped and trimmed to the required lines and grade without weakening or damaging any part of the structure to be retained. Due care should be taken to ensure that reinforcing bars which are to be left in place so as to project into the new work as dowels or ties are not damaged during removal of concrete and protected against rusting or corrosion.

Pipe culverts shall be carefully removed in such a manner as to avoid damage to the pipes.

Steel structures shall be carefully dismantled in such a manner as to avoid damage to members thereof, if the structure is to be removed in a condition suitable for re-erection as specified in the drawings or directed by the Engineer. All members shall be match marked with white lead paint by the Contractor before dismantling. All loose parts like pins, nuts, loose plates, etc. shall be securely wired to adjacent members or packed in boxes with proper markings for the ease of identification at the time of re-erection of the structure at later stage.

Timber structures shall be removed in such a manner as to avoid damage to such timber or lumber as is designated by the Engineer to be salvaged after joint inspection by the Engineer and the Contractor or their authorized representatives.

202.3. Dismantling Pavement and Other Structures

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

Concrete pavements, base courses in carriageway and shoulders, etc. designated for removal shall be broken to pieces and stock piled at designated locations or as directed by the Engineer, if the material is to be used later or otherwise, the Contractor shall arrange for disposal as stipulated in Clause 202.5.

202.4. Backfilling

Holes and depressions caused by dismantling operations shall be backfilled with excavated or other approved materials and compacted to required density conforming to these specifications, or as directed by the Engineer.

202.5 Disposal of Materials

All materials, obtained by dismantling, shall be the property of Government. Unless otherwise specified, materials having any salvage value shall be placed in neat stacks of like materials within the right-of-way, as directed by the Engineer with all lifts and upto a lead of 1000 m.

Pipe of culverts which are removed shall be cleaned and neatly piled on the right-of-way at spots designated by the Engineer with all lifts and lead upto 1000 m.

Structural steel removed from old structures shall, unless otherwise specified be stored in a neat and presentable manner in blocks at locations suitable for loading.

Timber or lumber salvaged from old structures shall have all nails and bolts removed therefrom and shall be stored in neat piles in locations suitable for loading in the right-of-way.

All materials obtained from dismantling operations which cannot be used or auctioned shall be disposed off as directed by the Engineer with all lifts and upto a lead of 1000 m.

202.6. Acceptance

Acceptance of dismantling and removal of salvaged material shall be based on visual inspection of the work and backfilling and compaction shall comply the tests specified for such work in these Specifications.

202.7. Measurements for Payment

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

(i)	Dismantling brick/stone masonry/concrete (Plain and reinforced)	cu.m.
(ii)	Dismantling flexible and cement concrete pavement	cu.m.
(iii)	Dismantling steel structures	tonne
(iv)	Dismantling pipes, guard rails, kerbs, gutters and fencing	Linear m
(v)	Utility services	Nos./linear m

202.8. Rate

The Contract unit rates for the various items of dismantling including utility services shall be paid in full for carrying out the required operations including all labour, materials tools, equipment, safeguards and incidental expenditure for the satisfactory completion of the work. These rates will also include excavation and backfilling where necessary to the required compaction and for handling, salvaging, piling and disposing of the dismantled materials within all lifts and upto a lead of 1000 m.

Item No. 49

Demolition and disposal of unserviceable materials with all lead and lift. (II) Unreinforced cement concrete.

1. The work shall consist of removing as herein after set forth, existing, culverts, bridges, pavement kerbs and other structures like guard rails, fences, utility poles, manholes, catch basins inlets etc. Which are in place but interfere with the new construction or are not suitable to remain in place and of salvaging and disposing of the resulting materials and backfilling the resulting trenches and pits.
2. Existing culverts, bridge, pavements and operations shall be carried out with such equipment and in such a manner as to leave undisturbed, adjacent pavement, structures and other work to be left in tact.
4. All operations necessary for the removal of any existing structure which might endanger new construction shall be completed prior of the start of new work.
5. The structures shall be dismantled carefully and the resulting materials so removed as not to cause and damage to the serviceable materials to be salvaged, the part of the structure to be retained and any other properties of structures nearby.
6. Unless otherwise specified, the superstructure portion of culverts / bridges shall be entirely removed and other parts removed to below the ground level or as necessary depending upon the interference they cause to the new construction. Removal of overlying of adjacent material if required in connection with the dismantling of the structures shall be incidental to this item.
7. Where existing culverts /bridges are to be extended or otherwise incorporated in the new work only such part of parts of the existing structure shall be removed as are necessary to provide a proper connection to the new work. The connecting edges shall be cut, chipped and trimmed to the required lines and grades without, weaken or damaging any part of the structure to be retained. Reinforcing bars which are to be left in place so as to project into new work as dowels or ties shall not be injured during removal of concrete.
8. Pipe culverts shall be carefully removed in such manner as to avoid damage to the pipes.
9. Steel structures shall unless otherwise provided be carefully dismantled in such a manner as to avoid damage to members hereof. If specified in the drawing or directed by the Engineer in charge that structure is to be removed in a condition suitable for re-erection all members shall be match marked by the contractor with white lead paint before dismantling. Eng pins, nuts, loose, plates, etc. shall be painted with mixture of white lead and tallow and loose parts shall be securely wired to adjacent members or packed in boxes.

10. Timber structures shall be removed in such a manner as to avoid damages to such timber or lumber as is designated by the Engineer in charge to be salvaged.

11. In removing pavements kerbs, gutters and other structures, like guards rails, fences, manholes catch, basins, inlets etc. Where portion of the existing construction are to be left in the finished work, the same shall be removed to an existing joint or cut and chipped to a true line with a face perpendicular to the surface of the existing structure, sufficient removal shall be made to provide for proper grades and connections with the new work as directed by the Engineer in charge.

12. All concrete pavements base course in carriage way and shoulders etc. designated for removal shall be broken to pieces whose volumes shall not exceed 0.02 cubic metre and stockpiled at designated locations of the material is to be used later or otherwise arranged for disposal as directed.

13. All materials obtained by dismantling shall be the property of Govt. Unless otherwise specified, materials having any salvage value shall be placed in neat stack of like material within the right of way as directed by the Engineer in charge, for which contractor will remain responsible for its safe custody and preservation for 60 days after recording measurements of the salvaged material.

15. Pipe culverts that are removed shall be cleared and neatly piled on the right of way at points designated by the Engineer in charge.

16. Structural steel removed from old structure shall, unless otherwise specified or directed be stored in a neat and presentable manner on blocking in locations suitable for loading structures or portions thereof which are specified in the contract for re-erections shall be stored in separate piles.

17. Timber or lumber from old structures which is designated by the Engineer in charge as materials to be salvaged shall have all nuts and bolts removed from and shall be stored in neat piles in locations suitable for loading.

18. All the products of dismantling operations which in the opinion of the Engineer in charge as materials to be salvaged shall have all nuts and bolts removed from and shall be stored in neat piles in locations suitable for loading.

19. The work of dismantling structure shall be paid for in units indicated below by taking measurement before and after, as applicable :

(i)	Dismantling brick /stone /concrete (Plain and Reinforced) Masonry	Cubic metre
(ii)	Dismantling flexible and cement concrete pavement	Cubic metre
(iii)	Dismantling steel structure	Tonne
(iv)	Dismantling timber structure	Cubic metre
(v)	Dismantling pipes, guard rail Kerbs gutters and fencing	Linear Metre
(vi)	Utility Poles	Nos.

20. The contract unit rates for the various items of dismantling shall be for payment in full for carrying out the required operations including full compensation for all labour, materials, tools equipment, safeguard and incidentals necessary to complete the work, These will also include excavation and backfilling where necessary and for handling, salvaging, piling and disposing of the dismantled materials within all lifts and upto a lead of 100 Metres.

Item No. 50

Providing temporary all weather and fair weather diversion suitable for traffic during the construction Period of the bridge / Slab drain including providing necessary drains and all safety measures including red lamps / signals at night for traffic etc. complete.

111. ARRANGEMENT FOR TRAFFIC DURING CONSTRUCTION

111.1 General

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

111.2. Traffic Safety and Control

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

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

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

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

On both sides, suitable regulatory/warning signs, as approved by the Engineer, shall be installed for the guidance of road users. On each approach, at least two signs shall be put-up, one close to the point where transition of carriageway begins and the other 100 m away. The signs shall be of approved design and of reflectory type, if so directed by the Engineer.

111.3 Maintenance of Diversions and Traffic Control Devices

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

111.4. Measurements for Payment and Rate

All arrangements for traffic during construction including provision of treated shoulder including their maintenance, dismantling and clearing debris, where necessary, shall be considered as incidental to the works and shall be Contractor's responsibility.

The construction of temporary diversion including temporary cross-drainage structures shall be measured in linear Metre and the unit contract rate shall be inclusive of full compensation for construction (including supply of material, labour, tools, etc.) maintenance, final dismantling, and disposal.

Item No.51

Providing and Fixing Flood gauge post conforming to IRC 67-2001 using engineering grade retro reflective sheeting including lettering and border as directed. For New structure.

-: Scope :-

The item covers supplying and installing flood gauge post conforming to IRC:67:2001 in all respect in accordance with these specifications and as approved by the Engineer-in-charge.

General:-

The colour, configuration, size and location of flood gauge shall be as shown on the drawings and in absence of any details if any missing details, the same shall be provided as directed by the Engineer-in-charge.

Material for Sign:-

The various materials and fabrication of traffic signs shall conform to the following requirement

Concrete:- Concrete shall be of M-150 grade (mix 1:2:4).

Reinforcing Steel:- Reinforcing steel shall conform to the requirements of IS:1786 unless otherwise specified.

Alluminium:- Alluminium sheets used for sign boards shall be of smooth, hard and corroresistant alluminium alloy conforming to IS 736- Material designation 24345 or 1900.

Plate Thickness:- Plate thickness shall be at least 2 mm thick. The thickness of the sheet be related to the size of the sign and its support and shall be such that it dose not bend or deform prevailing wind and other loads.

Retro-reflective Sheeting:- The retro-reflective sheeting used on the signs shall consists of the white or coloured sheeting having a smooth outer surface which has the property of reflection over its entire surface. It shall be weather resistant and exhibit colourfastness. It shall be new and unused and shall show no evidence of cracking, scaling, pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. The reflective sheeting can be either of Engineering Grade material with enclosed lens.

Engineering grade sheeting:- The sheeting shall be of enclosed lens type con of microscopic lens elements embedded beneath the surface of a smooth, flexible, transperant, water-proof plastic, resulting in a non-exposed lens optical reflecting system. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient retro-reflection(determined in accordance with ASTM Standard:E-810) as indicated in Table below.

Table Showing the Acceptable Minimum Co-efficient of Retro-Reflection for Engineering Grade Sheeting(Candelas per Lux per Square Metre)

Observation angle in degrees	Enterance angle in degree	White	Yellow	Orange	Green	Red	Blue
0.2	- 4	70	20	25	9.0	14.5	4.0
0.2	+30	30	22	7.0	3.5	6.0	1.7
0.5	- 4	30	25	13.5	4.5	7.5	2.0

0.5	+30	15	13	4.0	2.2	3.0	0.8
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When totally wet, the sheeting shall not show less than 90 percent of the values of retro-reflection indicated in above table. At the end of 5 years, the sheeting shall retain at least 50 percent of its original retro-reflectance.

Adhesive:- The sheeting shall either have a pressure-sensitive adhesive of the aggressive- tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, or a tack free adhesive activated by heat, applied in a heat vacuum applicator, in a manner recommended by the sheeting manufacturer. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. In case of pressure-sensitive adhesive sheeting, the sheeting shall be applied in accordance with the manufacturer's specification. Sheeting with adhesive requiring use of solvents or other preparation for adhesive shall be applied strictly in accordance with the manufacturer's instructions.

Fabrication:- Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminium sheeting shall be de-greased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting.

Complete sheets of the material shall be used on the signs except where it is unavoidable. At splices, sheeting with pressure-sensitive adhesives shall be overlapped not less than 5 mm or butted with a gap not exceeding 0.75mm. Where screen printing with transparent colour is proposed, only butt jointing shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

Posts and mountings for signs

Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally, signs with an area up to 0.9 sqm shall be mounted on a single post, and for greater area two or more support shall be provided. Sign supports post shall be of mild steel section of size 125X50X125X50 4mm thick hollow section of 2.3 to 2.5 mtr long. End(s) shall be firmly fixed by means of properly designed foundation. The work of foundation shall conform to relevant specifications as specified.

All components of signs and support, other than the reflective portion of G.I. posts shall be thoroughly de sealed, cleaned, primed and painted with two coats of epoxy paint. Any part of mild steel(M.S.)post below ground shall be painted with three coats of red lead paint.

The signs shall be fixed to the post by welding in case of steel post or riveted as directed by Engineer-in-charge.

Colour for signs:- Signs shall be provided with retro-reflective sheeting in colours as shown on the detailed drawings. The reverse side of all sign shall be painted grey.

Colours shall comply with with the following I.S.I. shades given in Bureau of Indian Standard(B.I.S.):5-1978 "Colours for Ready Mixed Paints":

Blue	-	Indian Standard Colour No. 166 : French Blue
Red	-	Indian Standard Colour No. 537 : Signal Red
Grey	-	Indian Standard Colour No. 630 : French Grey

Green - Indian Standard Colour No. 284 : Indian Green

Testing:- Retro reflective sheeting of various colours shall be got tested in the recognized/Govt. laboratory as decided by the Engineer-in-charge before being used.

Measurement:- The measurement for payment shall be per number of flood gauge post fixed in position.

Rate:- The unit rate including the cost of materials, labor, tools, drilling hole, welding, riveting, curing lettering painting as directed by the engineer in charge.

Item No.52

Informatory Signs :-Providing and fixing sign boards made out of 2mm aluminium sheet; size 80 x 60cms. rectangle as per the design of IRC-67-1977 pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint; reflectorised with retro reflective sheeting as per latest M.O.S.T. Specifications; 3.1m long stand post and frame fabricated from suitable size iron angle of 35 x 35 x 3mm 75x75x6mm as required; 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 60cms. for each leg. including excavation curing etc. complete under the supervision of engineer in charge.(A) Engineer Grade(VR)...

And

Item No.53

Hazard Marker sign :

Providing and Fixing sign boards made out of 2mm aluminum sheet : size 90*30 cms. rectangle as per design / Drawing attached (IRC). Pretreated with phosphating process and acid etching : coated with one coat of epoxy primer and two coats of best quality epoxy paint: reflectorized with retro reflective sheeting as per latest M.O.S.T specification: 3.1 M. long (2 nos) stand post and frame fabricated from suitable size iron angle of 35*35*3mm and 50*50*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*45*60 cms for each leg: including excavation curing etc. comp. under the supervision of engineer-in-charge.(B) Engineering Grade

And

Item No.54

Hazard Marker Sign :-Providing and fixing sign boards made out of 2.0 mm aluminium sheet / 4 mm ACP (Aluminum composite Panel); size 90x30 cms. rectangular as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ; reflectorised with High Intensity Prismatic Grade retro reflective sheeting of Type-4 as per ASTM D-4956 and latest M.O.S.T.Specifications; 1.8mtr long stand post of Iron Angle 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with best quality epoxy coatings in black and white bends. The details of symbol for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60 Cms. for each leg including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 7 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. (B) Class-B Type-4 Retro Reflective sheeting

And

Item No.55

Facility Informatory Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 80 x 60 cms. rectangular as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ; reflectorised with High Intensity Prismatic Grade retro reflectivesheeting of Type-4 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.6mtr long stand post of Iron Angle 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol for each 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 7 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. (B) Class-B Type-4 Retro Reflective sheeting.

TRAFFIC SIGNS

801.1. General

801.1.1. The colour, configuration, size and location of all traffic signs for highways other than Expressways shall be in accordance with the Code of Practice for Road Signs, IRC: 67 or as shown on the drawings. For Expressways, the size of the signs, letters and their placement shall be as specified in the contract drawings and relevant Specifications. In the absence of any details or for any missing details, the signs shall be provided as directed by the Engineer.

801.1.2. The signs shall be either reflectorised or non-reflectorised as shown on the drawings or as directed by the Engineer. When they are of reflectorised type, they shall be of retro-reflectorised type and made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting as per these Specifications.

801.1.3. In general, cautionary and mandatory signs shall be fabricated through process of screen printing. In regard to informatory signs with inscriptions, either the message could be printed over the reflective sheeting, or cut letters of non-reflective black sheeting used for the purpose which must be bonded well on the base sheeting as directed by the Engineer.

801.2 Materials

The various materials and fabrication of the traffic signs shall conform to the following requirements :

801.2.1. Concrete: Concrete shall be of the grade shown on the Contract drawings or otherwise as directed by the Engineer.

801.2.2. Reinforcing steel: Reinforcing steel shall conform to the requirement of IS: 1786 unless otherwise shown on the drawing.

801.2.3. Bolts, nuts, washers: High strength bolts shall conform to IS: 1367 whereas precision bolts, nuts, etc., shall conform to IS: 1364.

801.2.4. Plates and supports: Plates and support sections for the sign posts shall conform to IS: 226 and IS: 2062 or any other relevant IS Specifications.

801.2.5. Aluminium: Aluminium sheets used for sign boards shall be of smooth, hard and corrosion resistant aluminium alloy conforming to IS: 736 – Material designation 24345 or 1900.

801.2.6. Signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5 mm thick. All others shall be at least 2 mm thick. The thickness of the sheet be related to the size of the sign and its support and shall be such that it does not bend or deform under the prevailing wind and other loads.

801.2.7. In respect of sign sizes not covered by IRC: 67, the structural details (thickness, etc.) shall be as per the approved drawings.

801.3. Traffic Signs Having Retro-Reflective Sheeting

801.3.1. General requirements: The retro-reflective sheeting used on the sign shall consist of the white or coloured sheeting having a smooth outer surface which has the property of retro-reflection over its entire surface. It shall be weather-resistant and show colour fastness. It shall be new and unused and shall show no evidence of cracking, scaling, pitting, blistering, edge lifting or curling and shall have the negligible shrinkage and expansion. A certificate of having tested the sheeting for these properties in an unprotected outdoor exposure facing the sun for two years and its having passed these tests shall be obtained from a reputed laboratory, by the manufacturer of the sheeting. The reflective sheeting shall be either of engineering grade material with enclosed lens or of high intensity grade with encapsulated lens. The type of the sheeting to be used would depend upon the type, functional hierarchy and importance of the road.

800.1.3.2. High intensity grade sheeting: This sheeting shall be of encapsulated lens type consisting of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent waterproof plastic having a smooth surface. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM Standard E: 810) as indicated in Table 800-1.

**TABLE 800- 1. ACCEPTABLE MINIMUM COEFFICIENT OF RETRO-REFLECTION FOR
HIGH INTENSITY GRADE SHEETING
(CANDELAS PER FLUX PER SQUARE METRE)**

Observation angle (in degrees)	Entrance angle (in degrees)	White	Yellow	Orange	Green/ Red	Blue
0.2	-4	250	170	100	45	20
0.2	+30	150	100	60	25	20
0.5	-4	95	62	30	15	7.5
0.5	+30	65	45	25	10	5.0

When totally wet, the sheeting shall now show less than 90 percent of the values of retro-reflectance indicated in Table – 800 – 1. At the end of 7 years, the sheeting shall retain at least 75 percent of its original retro-reflectance.

801.3.3. Engineering grade sheeting: This sheeting shall be of enclosed lens type consisting of microscopic lens elements embedded beneath the surface of a smooth, flexible, transparent, water-proof plastic, resulting in a non-exposed lens optical reflecting system. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined in accordance with ASTM Standard: E-810) as indicated in Table 800-2.

**TABLE 800 –2. ACCEPTABLE MINIMUM COEFFICIENT OF RETRO-REFLECTION FOR
ENGINEERING GRADE SHEETING
(CANDELAS PER LUX PER SQUARE METRE)**

Observation angle in degree	Entrance angle in degree	Whit in e	Yello w	Orange	Green	Red	Blue
0.2	-4	70	50	25	9.0	14.5	4.0
0.2	+30	30	22	7.0	3.5	6.0	1.7
0.5	-4	30	25	13.5	4.5	7.5	2.0

0.5	+30	15	13	4.0	2.2	3.0	0.8
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When totally wet, the sheeting shall not show less than 90 percent of the values, of retro-reflection indicated in Table 800 -2. At the end of 5 years, the sheeting shall retain at least 50 percent of its original retro-reflectance.

801.3.4. Messages / borders: The messages (legends, letters, numerals etc.) and borders shall either be screen printed or of cut-outs. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. Cut-outs shall be of materials as specified by the sheeting manufacturer and shall bonded with the sheeting in a manner specified by the manufacturer.

801.3.5. For screen-printed transparent coloured areas on white sheeting, the co-efficient of retro-reflection shall not be less than 50 percent of the values of corresponding colour in Table 800-1 and 2, as applicable.

801.3.6. Cut-out messages and borders, wherever used, shall be made out of retro-reflective sheeting (as per Clause 801.3.2. or 801.3.3. as applicable), except those in black which shall be of non-reflective sheeting.

801.3.7. Colour: Unless otherwise specified, the general colour scheme shall be as stipulated in IS: 5 “Colour for Ready Mixed Paints “. viz.

Blue	IS	Colour	No.166	French Blue
Red	IS	Colour	No.537	Signal Red
Green	IS	Colour	No.284	India Green
Orange	IS	Colour	No.591	Deep Orange

The colours shall be durable and uniform in acceptable hue when viewed in day light or under normal headlights at night.

801.3.8. Adhesives: The sheeting shall either have a pressure-sensitive adhesive of the aggressive –tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, or a tack free adhesive activated by heat, applied in a heat – vacuum applicator, in a manner recommended by the sheeting manufacturer. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. In case of pressure-sensitive adhesive sheeting, the sheeting shall be applied in accordance with the manufacturer’s specifications. Sheetting with adhesives requiring use of solvents or other preparation for adhesive shall be applied strictly in accordance with the manufacturer’s instructions.

801.3.9. Refurbishment: Where existing signs are specified for refurbishment, the sheeting shall have a semi-rigid aluminium backing pre-coated with aggressive – tack type pressure sensitive adhesive. The adhesive shall be suitable for the type of material used for the sign and should thoroughly bond with that material.

801.3.10 Fabrication:

801.3.10.1. Surface top be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminium sheeting shall be de-greased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting.

801.3.10.2. Complete sheets of the material shall be used on the signs except where it is unavoidable; at splices, sheeting with pressure sensitive adhesives shall be overlapped not less than 5 mm. Sheetting with

heat-activated adhesives may be spliced with an overlap not less than 5 mm or butted with a gap not exceeding 0.75 mm. Where screen printing with transparent colours is proposed, only butt jointing shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut – outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

801.3.11. Warranty and durability: The contractor shall obtain from the manufacturer a seven-year warranty for satisfactory field performance including stipulated retro-reflectance of the retro-reflective sheeting of high intensity grade and a five year warranty for the adhesive sheeting of engineering grade and submit the same to the engineer. In addition, a seven year and a five year warranty for satisfactory in-field performance of the finished sign with retro-reflective sheeting of high intensity grade and engineering grade respectively, inclusive of the screen printed or cut out letters/legends and their bonding to the retro-reflective sheeting shall be obtained from the Contractor/supplier and passed on to the Engineer. The Contractor/supplier shall also furnish a certification that the signs and materials supplied against the assigned work meets all the stipulated requirements and carry the stipulated warranty.

Processed and applied in accordance with recommended procedures, the reflective material shall be weather resistant and, following cleaning, shall show no appreciable discolouration, cracking, blistering or dimensional change and shall not have less than 50 percent of the specified minimum reflective intensity values (Table 800-1 and 800-2) when subjected to accelerated weathering for 1000 hours, using type E or EH Weatherometre (AASHTO Designation M 268).

801.4. Installation

801.4.1. Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement of vandalism. Normally, signs with an area up to 0.9 sq. m. shall be mounted on a single post, and for greater area two or more supports shall be provided. Sign supports may be of mild steel, reinforced concrete or galvanized iron (G. I). Post-end(s) shall be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant Specifications as specified.

801.4.2. All components of signs and supports, other than the reflective portion and G. I. posts shall be thoroughly descaled, cleaned, primed and painted with two coats of epoxy paint. Any part of mild steel (M. S.) post below ground shall be painted with three coats of red lead paint.

801.4.3. The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or G. I. posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

801.5. Measurements for Payment

The measurement of standard cautionary, mandatory and information signs shall be in numbers of different types of signs supplied and fixed, while for direction and place identification signs, these shall be measured by area in square metres.

801.6. Rate

The contract unit rate shall be payment in full for the cost of making the road sign, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications

Payment shall made on number basis

Item No.56

Cautionary Warning Sign : Providing and fixing sign boards made out of 2mm Aluminium sheet size 90x90x90 cms. Equilateral triangle as per the design of IRC-67-1977 pre treated with phosphating process and acid etching coated with one coat of epoxy primer and two coats of best quality epoxy paint reflectorized with retro reflective sheeting as per latest MOST specification 3.1 Mt. long stand post and frame fabricated from suitable size iron angle of 35x35x3mm, 75x75x6mm. as required painted with best quality epoxy coating 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 45x45x60cms. for each leg including excavation curing etc. complete under the supervision of engineer in charge (A) Engineering Grade.

And Item No.57

Cautionary Warning Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 90 x 90 x 90 cms. equilateral triangle as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ; reflectorised with High Intensity Prismatic Grade retro reflectivesheeting of Type-4 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.6mtr long stand post of Iron Angle 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol 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 7 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. (B) Class-B Type-4 Retro Reflective sheeting

1403.11. Warning/Cautionary Signs :

1403.11.1. Advance warning / cautionary signs giving the information about the nearness of submersible bridge, speed limit and depth of water at ordinary flood level, length of submergence of road to the user shall be installed.

Advance warning-cum-informatory signs shall be located at about 200 m. from the start of submerged portion of approach road / bridge / "SLOW DOWN SUBMERSIBLE BRIDGE 200 m AHEAD" and second sign at about 50 m from the starting point of submersible bridge "DEAD SLOW SUBMERSIBLE BRIDGE 50 M AHEAD. NOT SAFE FOR VEHICULAR TRAFFIC TO CROSS WHEN FLOOD WATER OVERTOPS BRIDGE DECK".

1403.11.2. Advance warning / cautionary signs shall be in English as well as in local language and shall conform to the provisions of Clause 1701 of these Specifications.

1701.3. Materials

The various materials and fabrication of the traffic signs shall conform to the following requirements:-

1701.3.1. Concrete : Concrete for footing shall be of the grade shown on the Contract drawings or of minimum M15 grade conforming to Section 801 of these Specifications.

1701.3.2. Reinforcing steel : Reinforcing steel shall conform to the requirement of IS:1786 unless otherwise shown on the drawing.

1701.3.3. Bolts, nuts, washers : High strength bolts shall conform to IS: 1367.

1701.3.4. M.S. Sheets, Plates and supports : Plates and support sections for the sign posts shall conform to IS:2062 or any other relevant IS Specifications.

17013.5. Reflectorised paint: Reflectorised paint shall conform to IS:5 or the manufacturer's specifications in case of proprietary product and as approved by the Engineer.

1701.3.6. Non reflectorised paint : Non-reflectorised paint shall conform to IS: 164 and as approved by the Engineer.

17013.7. Engineering grade sheeting : This sheeting shall be enclosed lens type consisting of microscopic lens elements embedded beneath the surface of a smooth, flexible, transparent, water-proof plastic, resulting in a non-exposed lens optical reflecting system. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined in accordance with ASTM Standard) as indicated in Table 1700.1.

When totally wet, the sheeting shall not show less than 90 per cent of the values, of retro-reflection indicated in Table 1700.1. At the end of 5 years, the sheeting shall retain at least 50 per cent of its original retro-reflectance.

TABLE 1700.1 : ACCEPTABLE MINIMUM COEFFICIENT OF RETRO-REFLECTION FOR ENGINEERING GRADE SHEETING (CANDEL AS PER LUX PER SQUARE METRE)

Observation angle in degree	Entrance angle in degree	White	Yellow	Orange	Green	Red	Blue
0.2	-4	70	50	25	9.0	14.5	4.0
0.2	+30	30	22	7.0	3.5	6.0	1.7
0.5	-4	30	25	13.5	4.5	7.5	2.0
0.5	+30	15	13	4.0	2.2	3.0	0.8

1701.3.8. Signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5 mm thick. All others shall be at least 2 mm thick. The thickness of the sheet shall be related to the size of the sign board and its support and shall be such that it does not bend or deform under the prevailing wind and other loads.

1701.3.9. In respect of sign sizes not covered by IRC:67, the structural details (thickness, etc.) shall be as per the approved drawings.

1701.4. Installation

1701.4.1. Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally signs with an area upto 0.9 sq.m can be mounted on a single post and for greater area two or more supports shall be provided. Sign supports may be of mild steel, reinforced concrete or Galvanised Iron (G.I.) posts and should be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant Specifications as specified.

1701.4.2. All components of signs and supports, other than the reflective portion and G.I. posts shall be thoroughly de-scaled, cleaned, primed and painted with two coats of epoxy paint. Any part of mild steel (M.S.) post below ground shall be painted with three coats of red lead paint.

1701.4.3. The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or G.I. posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

1701.4.4. Mild steel sheets of sign boards shall be stove enameled on both sides in furnace at required temperature, the lettering, borders shall be painted with ready mix synthetic enamel paint of superior quality in required shade and colour as specified.

1701.5. Measurements for Payment

The measurement of standard cautionary, mandatory and facility information signs shall be in numbers of different types of signs supplied and fixed, while for direction and place identification signs, these shall be measured by area in square metres.

1701.6. Rate

The Contract unit rate shall be payment in full for the cost of making the road sign including all materials and installing it at the site and incidentals to complete the work to the Specifications.

The work covers supplying and installing traffic signs conforming to IRC 67 complete in all respects in accordance with these specifications and as approved by the Engineer.

- (1) The Board will be a composite unit consisting of aluminum plates of 2 mm thickness. The main lower most Aluminum will be 1800mm x 1600mm size welded over M.S. angle iron frame of 35mm x 35mm x 3mm size. Welding of all sheet over angle and flat iron frame will be done neatly to have plain surface on side. The angle iron frame of the lower most plate and flat frame of the middle plate will be welded to two not. 75mm x 75mm x 6mm M.S angle posts placed at 1125 mm apart center to center. The top of the middle. These posts will be embedded in cement concrete M-15 grade blocks of 450mm x 450mm x 600mm below ground level. The height of bottom of the lower most plate will be 1200mm from ground level.
- (2) All Aluminum plates will be stove enameled on both sides in furnace at required temperature. The lettering details of works in prescribed format will be painted with ready mixed synthetic enamel paints of superior quality in required shade and colour as specified. All the sections for frame and posts will be painted with primer and two coats of Epoxy paint. The steel angle below ground level will be painted with three coats of epoxy paint, painting and lettering will be done as per approved drawing.

Payment shall made on number basis

Item No.58

Providing and fixing "W" shape metal crash safety barrier comprising of 3mm thick galvanized sheet to be fixed on ISMC 150 (150x75x5.4mm) series channel vertical post to be spaced 2.0 mtr. c/c to be kept 1.650mtr height as per MOST specification incl. necessary foundation, fittings with bolts, painting and required all process as per specification and as per drawings.

810. METAL BEAM CRASH BARRIERS

810.1. General

810.1.1. This work shall consist of furnishing and erection of metal beam crash barrier of dimensions and at locations as shown on the drawing (s) or as directed by the Engineer.

810.1.2. Metal beam crash barrier shall generally be located on approaches to bridge structures, at locations where the embankment height is more than 3 metres and at horizontal curves.

810.2. Materials

810.2.1. Metal beam rail shall be corrugated sheet steel beams of the class, type, section and thickness indicated on the plans. Railing posts shall be made of steel of the section, weight and length as shown on the plans. All complete steel rail elements, terminal sections, posts, bolts, nuts, hardware and other steel fittings shall be galvanized. All elements of the railing shall be free from abrasions, rough or sharp edges and shall not be kinked, twisted or bent.

810.2.2. Steel beam elements and terminal sections shall be galvanized (zinc coated, 0.55 kg per square metre, minimum single spot) unless otherwise specified. The galvanizing on all other steel parts shall conform to the relevant IS Specifications. All fittings (bolts, nuts, washers) shall conform to the IS : 1367 and IS : 1364. All galvanizing shall be done after fabrication.

810.2.3. Concrete for bedding and anchor assembly shall conform to section 1700 of these Specifications.

810.3. Construction Operations

810.3.1. The line and grade of railing shall be true to that shown on the plans. The railing shall be carefully adjusted prior to fixing in place, to ensure proper matching at abutting joints and correct alignment and camber throughout their length. Holes for field connections shall be drilled with the railing in place in the structure at proper grade and alignment.

810.3.2. Unless otherwise specified on the drawing, railing steel posts shall be given one shop coat of paint (primer) and three coats of paint on structural steel after erection, if the sections are not galvanised. Any part of assembly below ground shall be painted with three coats of red lead paint.

810.3.3. Splices and end connections shall be of the type and designs or shown on the plans and shall be of such strength as to develop full design strength of the rail elements.

810.4 Installation of Posts

810.4.1. Holes shall be dug or drilled to the depth indicated on the plans or posts may be driven by approved methods and equipment, provided these are erected in proper position and are free from distortion and burring or any other damage.

810.4.2. All post holes that are dug or drilled shall be of such size as will permit proper setting of the posts and allow sufficient room for back filling and tapping.

810.4.3. Holes shall be back filled with selected earth or stable materials in layers not exceeding 100 mm thickness and each layer shall be thoroughly tamped and rammed. When back filling and tamping are completed, the posts or anchors shall be held securely in place.

810.4.4. Post holes that are drilled in rock and holes for anchor posts shall be back filled with concrete.

810.4.5. Posts for metal beam guardrails on bridges shall be bolted to the structure as detailed on the plans. The anchor bolts shall be set to proper location and elevation with templates and carefully checked.

810.5 Erection

810.5.1. All guardrail anchors shall be set and attachments made and placed as indicated on the plans or as directed by the Engineer.

810.5.2. All bolts or clips used for fastening the guardrail or fittings to the posts shall be drawn up tightly. Each bolt shall have sufficient length to extend at least 6 mm through and beyond the full nut, except where such extensions might interfere with or endanger traffic in which case the bolts shall be cut off flush with the nut.

810.5.3. All railings shall be erected, drawn and adjusted so that a length of 3 metre. The railing barrier shall be erected true to line and grade.

810.6. Tolerance - The posts shall be vertical with a tolerance not exceeding 6 mm in a length of 3 metre. The railing barrier shall be erected true to line and grade.

810.7. Measurements for Payment

810.7.1. Metal beam railing barriers will be measured by linear metre of completed length as per plans and accepted in place. Terminals/anchors of various types shall be paid for by numbers.

810.7.2. No measurement for payment shall be made for projections or anchors beyond the end posts except as noted above. Furnishing and placing anchor bolts and/or devices for guard rail posts on bridges shall be considered incidental to the construction and the costs thereof shall be included in the price for other items of construction.

810.7.3. No measurement for payment will be made for excavation or back filling performed in connection with this construction.

810.8. Rate

The Contract unit rate shall include full compensation for furnishing

Item No.59

Providing and laying PP Extruded Geogrid techgrid PP 3030 having sperture of 38mmx38mm. The Biaxial Geogrid shall have tensil strength of 11kn/m @21.6kn/m 2% & 5% strain respectively & confirm to attached specification as per direction of Engineer-in-charge

REINFORCED EARTH

703.1. Scope

The work covers the construction of reinforced earth structures, together with the construction of earthwork in layers, assembly and erection of reinforcing elements and placement of facing panels and all associated components.

703.2. Reinforcing Element

703.2.1. The reinforcing element shall be of Geotextile, aluminium alloy strip, copper strip, carbon steel strip, mats of metal or synthetic grids, or any other proprietary material which may be approved by the Engineer and indicated on the drawings.

703.2.2. Geotextile: The material shall conform to Clause 701.2.6.

703.2.3. Aluminium alloy strip shall comply with BS : 1470 quality 5454 in the H 24 condition.

703.2.4. Copper strip shall comply with BS : 2870 quality C 101 or C 102 in the 1/2 H condition and shall have 0.2 per cent proof stress of not less than 180 N/mm².

703.2.5. Carbon steel strip which shall be galvanized shall comply with BS : 1449 (Part 1), either quality KHR 34/20 P or quality 50/35 P, each having a silicon content of not less than 0.25 per cent and not more than 0.04 per cent. The fabricated element shall be galvanized in accordance with BS : 729, and the average zinc coating weight for any individual test area shall not be less than 1000 gm/sq.m.

703.2.6. Stainless steel strip shall comply with BS : 1449 (Part 2) quality 316 S 31 or 316 S 33 except that the material shall be cold rolled to provide a 0.2 per cent proof stress of not less than 400 N/sq. mm and the tensile strength shall not be less than 540 N/sq.m.

703.2.7. All metallic components buried in soil shall be of electrolytically compatible materials.

703.2.8. Geogrids: The supply of geogrids shall carry a certification of BIS or ISO 9002 for all works. While the reinforcing element for wall or slope portion shall be with mono oriented Geogrid, the reinforcement for the foundation of a reinforced earth wall or slope shall be with bi-directionally oriented Geogrid. For mono oriented Geogrid, the characteristic design tensile strength at a strain not exceeding 10 per cent in 100 years shall be at least 40 kN/m when measured as per GRI:GG3. The strength for bi-directionally oriented Geogrid in the longitudinal direction shall be at least 40 kN/m at a maximum elongation of 15 per cent. The Geogrid shall be inert to all naturally occurring chemicals, minerals and salts found in soil.

703.3. Earth Fill

The fill material for reinforced earth structures shall have an angle of interface friction between the compacted fill and the reinforcing element of not less than 25°C, measured in accordance with IS : 13326 (Part 1). The soil should be predominantly coarse grained; not more than 10 per cent of the particles shall pass 75 micron sieve. The soil should have properties such that the salts in the soil should not react chemically or electrically with the reinforcing elements in an adverse manner.

703.4. Facia Material

703.4.1. The facing shall comprise of one of following:

- (i) Reinforced concrete (Cast in situ or precast) slabs
- (ii) Plain cement concrete form fill hollow block (Precast)
- (iii) Masonry construction, Rubble facia
- (iv) Other proprietary and patented proven system

The facing shall be sufficiently flexible to withstand any deformation of the fill.

703.4.2. Facia unit joint filler should be durable, resistant to the effect of air pollution and water/saline water.

703.4.3. Bedding material shall consist of either cement mortar or a durable gasket seating such as resin bonded cork strip.

703.4.4. Connection between the facia and the reinforcing element shall be by using polyethylene strips/rods, fibre glass dowels or any other material shown in the drawing. Any other material used shall be tested to provide 100 percent joint strength as of parent element in continuity.

Overlapping in principal reinforcement or in the joint shall ensure load transfer through joints, perpendicular to the direction of laying.

703.5 Construction Details

703.5.1. The plan area of the reinforced earth structure shall be excavated to provide a nominally level base which may be stepped at the back as required to receive the horizontal reinforcing element grid.

The depth of the foundation below the finished ground level at the foot of the slope or wall shall not be less than 1000 mm.

Additional strip footing, trough guide made of concrete or anchor key pad shall be provided at founding level to receive the facia or the bottom most reinforcement connection. This shall have adequate soil cover against erosion and scour in particular cases.

703.5.2. Orientation: The reinforcing elements shall be placed at right angles to the face of the wall, with greater cross sectional dimension in the horizontal plane. The placement of the elements including their vertical/horizontal spacing and length shall be as in the drawing.

703.5.3. Facing batter: It may be necessary to set facing unit at an additional batter than as provided in the drawing as there is a tendency for initially positioned units of facia to lean outward as the fill material is placed and compacted. Care and caution shall be taken to rectify this phenomenon.

703.5.4. Drainage: Drainage shall be provided as per drawing given in detail. The retained fill shall have a suitably designed drainage bay to allow free draining of the reinforced fill.

703.5.5. Laying and compacting: The reinforcing elements shall be laid free from all kinks, damage and displacement during deposition, spreading, levelling and compaction of the fill. The programme of filling shall be such that no construction plant runs directly on the reinforcement.

All construction plant having a mass exceeding 1000 Kg shall be kept at least 1.5 m away from the face of slope or wall. In this area (upto 1.5 m from the face of slope or wall), following compaction plant shall be used:

- (i) Vibratory roller having a weight per metre width of roll not exceeding 1300 kg with total weight not exceeding 10,000 kg.
- (ii) Vibratory plate compactor of maximum weight 1000kg.
- (iii) Vibro tamper having a weight not exceeding 75 kg.

Compaction by any other method like using dozer or back blade compaction by dozer or excavator bucket shall be permitted with due approval from the Engineer after ascertaining the level of compaction so achieved.

During construction of reinforced fill, the retained material beyond the reinforcement at the rear or the structure shall be maintained at the same level as reinforced fill.

The compacted layer shall not be more than 200 mm, to achieve compaction of 95 per cent of maximum laboratory density where measured as per IS : 2720 (Part 8). Temporary formwork shall be used to support the construction as per specified details given in the drawing. The forms, scaffolding and props shall be sufficient in numbers to allow taking up of a sectoral construction schedule specified in the design.

703.6. Measurements for Payment

Measurement for reinforcing elements shall be in linear metre for anchor strips or in sq.m. for geogrid/geotextile etc.

The measurement for fascia shall be in sq.metres. The measurement for foundation for fascia and capping beam shall be in linear metres. Measurement for compacted earthfill shall be in cubic metres for compacted soil.

703.7. Rates

Rate shall include cost of labour, plant hire, material storage and handling expenses, for completing the works.

Rate for providing reinforcing elements shall include material cost, all transportation costs and storage of the same as per special provisions. The rate shall also include all cost of laying of the reinforcing elements including all overlaps, jointing or stitching, heat bonding or extension.

Rate for fascia fixing shall include cost of joints, all necessary temporary formwork, scaffolding and all lifts and leads, if any, as shown in the drawing, unless otherwise specified to be treated separately along with foundation or slope/wall kerb at the top of slope or wall. Rate for bed block and capping beam shall include all items of excavation, concrete, reinforcing steel, formwork, labour and equipment.

Rate for soil fill shall include compaction as desired in requisite layers through mechanical means, cost of hire or labour for plant operations, dressing and levelling slopes, including special measures for edge reinforcements as shown in the drawing.

704. GEOSYTHETICS FOR HIGHWAY PAVEMENTS

704.1. Scope

This work shall consist of laying geosynthetic materials over existing bituminous surface, including preparation of surface and joining, stitching or overlapping of geosynthetic fabric etc., as part of highway pavement strengthening in layers as shown on drawings.

704.2. Paving Fabrics

704.2.1. Description: This work shall consist of furnishing and placing as asphalt/bitumen overlay textile (paving fabric) beneath a pavement overlay or between pavement layers to provide a water resistant membrane and crack retarding layer.

704.3. Material Requirements

704.3.1. Paving fabric: The paving fabric will be a nonwoven heat set material consisting of at least 85 percent by weight polyolefins, polyesters or polyamides. The paving fabric shall be resistant to chemical attack, rot and mildew and shall have no tears or defects which will adversely alter its physical properties. The fabric shall be specifically designed for pavement applications and be heat bonded only on one side to reduce bleed-through of tack coat during installation. The fabric shall meet the physical requirements of Table 704-2. Heavy duty paving fabrics should be used in areas experiencing unusually high impact forces or heavy loads such as airport runways and taxiways:

Table 704.2. Physical Requirements - Paving Fabrics

Property	Units	Standard Requirements	Test Method
	Kg	36.3	ASTM D 4632
Elongation	%	50	ASTM D 4632
Asphalt Retention	Kg/10 sq.m	10	Texas DOT 3099
Melting Point	°C	150	ASTM D 276
Surface Texture	-	Heat bonded on one side only	Visual Inspection

Notes :

1. Certification of conformance from paving fabric manufacturer may be required.
2. All numerical values represent minimum average roll values (average of test results from any sampled roll in a lot shall meet or exceed the minimum values) in weaker principal direction. Lot shall be sampled accordance to ASTM D 4354, "Practice for Sampling of Geosynthetics for Testing".
3. Conformance of paving fabrics to specification property requirements shall be determined as per ASTM D 4759, "Practice for Determining the Specification Conformance of Geosynthetics".

704.3.2. Tack Coat: The tack coat used to impregnate the fabric and bond the fabric to the pavement shall be a paving grade Bitumen of 80-100 penetration. A cationic or anionic emulsion may be used as approved by the engineer. The use of cutbacks or emulsions which contain solvents shall not be used.

704.4. Construction and Installation Requirements

704.4.1. Shipment and storage: The paving fabric shall be kept dry and wrapped such that it is protected from the elements during shipping and storage. At no time shall the paving fabric be exposed to ultraviolet light for a period exceeding fourteen days. Paving fabric rolls shall be stored in a manner which protects them from the elements. If stored outdoors, they shall be elevated and protected with a waterproof cover. The paving fabric shall be labeled as per ASTM D 4873, "Guide for identification, storage, and handling geotextiles".

704.4.2. Weather limitations: Minimum air and pavement temperature shall be at least 10°C and rising for placement of bitumen and shall be at least 15°C and rising for placement bitumen emulsion. Neither bitumen tack coat nor paving fabric shall be placed when weather conditions, in the opinion of the engineer, are not suitable.

704.4.3. Surface preparation: The pavement surface shall be thoroughly cleaned of all dirt, water, and oil to the satisfaction of the engineer. Cracks 3 mm wide or greater shall be cleaned and filled with suitable bituminous material or by a method approved by the engineer. Crack filling material shall be allowed to cure prior to paving fabric placement. Potholes and other pavement distress shall be repaired. Repairs shall be performed as directed by the engineer.

704.4.4. Tack coat application: The tack coat shall be spread by means of a calibrated distributor spray bar. Hand spraying and brush application may be used in locations of fabric overlap. Every effort shall be made to keep hand spraying to a minimum. The tack coat shall be applied, uniformly to the prepared dry pavement surface at the rate of 1 kg/sq.m. or as recommended by the paving fabric manufacturer and approved by the engineer. When using emulsions, the application rate must be increased as directed by the engineer to offset the water content of the emulsion. Within street intersections, on steep grades, or in other zones where vehicle speed changes are common place, the normal application rate shall be reduced by about 20 percent as directed by the engineer. The tack coat application rate must be sufficient to saturate the fabric and to bond the fabric to the existing pavement surface.

The temperature of the tack coat shall be sufficiently high to permit a uniform spray pattern. For bitumen, the minimum temperature shall be 140°C. To avoid damage to the fabric, distributor tank temperatures shall not exceed 160°C. For bitumen emulsions, the distributor tank temperature shall be maintained between 55°C and 70°C.

The target width of tack coat application shall be equal to the paving fabric width plus 150 mm. The tack coat shall be applied only as far in advance of paving fabric installation as is appropriate to ensure a tacky surface at the time of paving fabric placement. Traffic shall not be allowed on the tack coat. Excess tack coat shall be cleaned from the pavement.

704.4.5. Paving fabric placement: The paving fabric shall be placed onto the tack coat using mechanical or manual laydown equipment capable of providing a smooth installation with a minimum amount of wrinkling or folding. The paving fabric shall be placed prior to the tack coat cooling and losing tackiness. Paving fabric shall not be installed in areas where the overlay asphalt tapers to a thickness of less than 40 mm. Excess paving fabric which extends beyond the edge of existing pavement or areas of tack coat application shall be trimmed and removed. When bitumen emulsions are used, the emulsion shall be allowed to cure properly such that essentially no water moisture remains prior to placing the paving fabric. Wrinkles or folds in excess of 25 mm shall be slit and laid flat. All transverse joints and slit folds or wrinkles shall be shingle-lapped in the direction of the paving operation. Brooming and/or pneumatic rolling will be required to maximize paving fabric contact with the pavement surface. Additional hand-placed tack coat may be required at laps and repairs as determined by the engineer to satisfy bitumen retention of the lapped paving fabric. All areas with paving fabrics placed will be paved the same day. No traffic except necessary construction equipment will be allowed to drive on the paving fabric.

Turning of the paver and other vehicles shall be done gradually and kept to a minimum to avoid movement and damage to the paving fabric. Abrupt starts and stops shall also be avoided. Damaged fabric shall be removed and replaced with the same type of fabric. Overlaps shall be shingled-lapped in the direction of paving. Additional tack coat shall be placed between the overlap to satisfy saturation requirements of the fabric. Overlap shall be sufficient to ensure full closure of the joint but not exceed 150 mm.

704.4.6. Overlay placement: Bituminous overlay construction shall closely follow fabric placement. All areas in which paving fabric has been placed will be paved during the same day. Excess tack coat which bleeds through the paving fabric shall be removed. Excess tack coat can be removed by broadcasting hot mix or sand on the paving fabric.

CONTRACTOR'S SIGNATURE

EXECUTIVE ENGINEER

Deputy Executive Engineer
Panchayat R&B Sub Dn
Savarkundla

Executive Engineer
Panchayat R&B Division
Amreli.

- : SCHEDULE FOR TESTING OF MATERIALS :-

For ensuring quality control and workmanship Various tests prescribed below for materials shall be taken at periodical intervals as stipulated below. The materials shall be got tested at Government recognized Laboratory (R&B) or field Laboratory of GERI (R&B) for which 1% of the estimated amount put to tender shall be recovered from the contractor from the RA bills and final bills and the testing charges shall be paid to the GERI by the Government . However if the charges increase over 1% no excess recovery shall be made from the contractor as per resolution of B & C department dated 10th May 1985 vide TNC/ 1085/ (4)/ S

Sr. No.	Material /Item	Approx. Qty.		Description of tests.	Frequency of test	No. of reqd. tests
1	Cement	5578.10	MT	Fineness, Compressive Strength, Consistency setting time, Chemical Analysis	1 Test/up to 50 2 Test/50 to 100 MT 3 Test/100 to 200 MT 4 Test/200 to 300 MT 5 Test/300 to 500 MT 6 Test/500 to 800 MT 7 Test/800 to 1300 MT	8
2	Earthwork	4395	Cum	PI/ LL/ OMC / MDD / CBR Sieve Analysis	1 test / 3000 cum	2
3	90 to 45mm Agg. (WBM-1)	1441	Cum	Elongation, Gradation, Flakiness ,Water absorption, Impact, Abrasion etc	1 test/up to 100cum 3 Test /101 to 500cum 5Test/501 to 1500cum 7Test/1501 to 5000cum	5
4	13.20 MM Agg. (WBM-1-2)	322	Cum	Elongation, Gradation, Flakiness ,Water absorption, Impact, Abrasion etc	1 test/up to 100cum 3 Test /101 to 500cum 5Test/501 to 1500cum 7Test/1501 to 5000cum	3
5	Stone dust (WMB Gr.1-2) (BM,MSS)	95	Cum	PI Value	1 test/up to 100cum 3 Test /101 to 500cum 5Test/501 to 1500cum 7Test/1501 to 5000cum	1
6	Quarry spall	1151	Cum	Gradation, OMC, MDD, PI, CBR	5 test/500 to 1500cum	5
7	Rubble Not less than 40kg	405	Cum	Weight Soundness water absorption	-	1
8	Coarse Sand	8280	Cum	Silt content Gradation	1test /Work	1
9	Crushed stone agg.40mm	1444	Cum	Elongation, Gradation, Flakiness ,Water absorption, Impact, Abrasion etc	1 test/up to 100cum 3 Test /101 to 500cum 5Test/501 to 1500cum 7Test/1501 to 5000cum	5

10	Crushed stone agg. 10mm	4572	Cum	Elongation, Gradation, Flakiness ,Water absorption, Impact, Abrasion etc	1 test/upto 100cum 3 Test /101 to 500cum 5Test/501 to 1500cum 7Test/1501 to 5000cum	7
11	Crushed stone agg. 20mm	9931	Cum	Elongation, Gradation, Flakiness ,Water absorption, Impact, Abrasion etc	1 test/upto 100cum3 Test /101 to 500cum5Test/501 to 1500cum7Test/1501 to 5000cum	7
12	NP3 Pipes 300mm. dia.	100	Rmt	-	Manu. certificate	Manu. certificate
13	NP3 Pipes 900mm. dia.	100	Rmt	-	Manu. certificate	Manu. certificate
14	NP3 Pipes 1200mm. dia.	60	Rmt	-	Manu. certificate	Manu. certificate
15	C.C. cube M-100	2221	Cum	Comp. strength	4 test / 20 to 50 cum + 1 test/50cum	48
16	C.C. cube M-150	12541	Cum	Comp. strength	4 test / 20 to 50 cum + 1 test/50cum	254
17	CC Cube M-200	3324	Cum	Comp. strength	4 test / 20 to 50 cum + 1 test/50cum	70
18	CC Cube M-250	613	Cum	Comp. strength	4 test / 20 to 50 cum + 1 test/50cum	16
19	TMT Bar reinforcement	175.04	MT	Tensile strength Yeild stress Elongation	1 test / forEach dia.	7
20	Water	-	-	Chemical Test	1 test / sourse	1
21	Pre-cast Rubber Dye / steel Dye	120.00	-	Water Absormtion Compressive Strength	1 test /LOT	1
22	Retroreflective Sheeting for Signages	Coefficient of Retroreflection (On site Testing with Reflectometer Make : Delta, Zehntner, Roadvista complying to ASTM D4956)				3 Reading for 10 Boards for Each Colour
23	Road Stud/Cat Eyes	Compressive Strength, Flexural Strength, Resistance to Lens Cracking- Lens Impact Strength, Co-efficient of Muminious Intensity. (Laboratory Testing)				1 Sample for Each colour
24	Hot Applied Thermoplast Road Marking	Onsite testing (Retro Reflectivity, Skid Resistancree)				1 test / sourse
25		Laboratory Testuing (Constituents of Marking Material)				1 Sample for each colour.

The Number of tests will be as per Manual of quality control or latest Govt. G.R./Circular and it will be considered final

The contractor shall have to pay 1% of the estimated cost put to tender towards all testing of materials and the same shall be deducted from their bills for the works.

Testing charges of GERI shall be borne by Govt. No refund be made nor extra charges over 1% shall be recoverable from the contractor.

If directed by the Engineer in charge, the materials intended to be used for the work but not included in the above schedule shall also be got tested at Government recognized Laboratory or field Laboratory.

The Numbers of tests will be as per manual of quality control or latest Govt. G.R./Circular will be final.

Signature of Contractor

Executive Engineer
Panchayat (R&B) Division
Amreli

Deputy Executive Engineer
Panchayat R&B Sub Dn
Savarkundla