NAME OF WORK :- **Construction of Remaining Work of Nani Khavdi to Gagva Mungni Road of Jamnagar Taluka under SCSP MMGSY Yojana Package No. JAM/ SCSP/ MMGSY/ NP/ 2020-21/ P-02**

TALUKA :- Jamnagar DISTRICT :- Jamnagar

TECHNICAL SPECIFICATIONS OF ITEMS

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TALUKA :- Jamnagar DISTRICT :- Jamnagar

TECHNICAL

SPECIFICATIONS

OF ITEMS

Item No.1 Providing all time temporary Diversion suitable for Traffic during the construction period of the bridge/Cd work by levelling existing ground including earthwork for embankment and supplying and spreading WBM in layer.

1. The item provides for the diversion of water course by suitable means such as constructing ring bunds, coffer-dams, channeling, islanding or any other suitable means as may be necessary and approved by Engineer-in-charge. This item will not include dewatering of foundations, trenches, which will be covered in the item of open excavation. The contractor shall take all necessary protective measure against possible erosion due to tide variations if any maintain the cofferdams, bund or island in proper manner during construction. He shall not be entailed for any payment or compensation in the event of washing of the coffer dam, bund or island at any time either due to tidal waters if any or floods, or any other reasons whatsover and the contractor shall reconstruct the same, If required at his risk and cost, The size of the coffer dam, bund or island shall be such as would allow without obstructions and inconvenience enough working free space all around the foundation works.

2. The contractor shall plan, construct and maintain satisfactorily necessary diversion channels and protective works so as to safety pass the stream flow and also satisfactory meet with any sudden rise of flow due to tiles, flood or any other reasons, without damaging the foundation works. The cofferdam or bund shall be such as to give sufficient working space for constructions, inspection and installations of pumping machinery inside the enclosed area. The cofferdam or bund shall be of adequate section and properly designed, constructed to prevent ingess of water as practically as possible in the foundation pits and protect green concrete or masonary work.

3. Adequate pumping arrangement shall be made for dewatering the inside of cofferdam, bunds etc. Pumps of adequate capacity and in required number shall be provided to ensure adequate pumping.

4. The coffer dam, bund or inland shall be completely removed and their materials shall be disposed of on the manner by the Engineer-in-charge when no longer required.

5. The measurement for paying will be per number of pier or abutment for which diversion of watercourse etc. is required to be made. Unit of abutment will be inclusive of returns or wing walls attached to it.

6. The unit cost includes all materials labour and equipment to complete the job. Diversion of channels etc. will have to be construed and maintained till all operations to complete the entire bridge structure are complete as may be necessary.

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Item No.2 Earthwork for embankment from borrow area including breaking clods, dressing with all lead and lift (excluding watering and consolidation) for all lead and lift.

1. The land width on which the earth work is to be done shall be cleared of all trees having a girth 30 cm. and less, 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 stacks along the road boundary or as directed at places within 50 metres lead, and handed over to the department in convenient section. Unsuitable materials shall be burnt or otherwise disposed off by the contractor at his own cost without causing arty 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 clearing; the site, the alignment of the road shall be properly set out true to line, curves, slopes, grades and sections as shown on the plan or directed by the Engineer-in-charge. The contractor shall provide all labours and materials such as lime, strings, pegs, nails, bamboos, stone, mortar, concrete, etc. required for setting out, establishing. Bench Marks and giving profiles: The contract rate shall be responsible for maintaining the B. Ms. profiles alignment and other marks as long as they are required for the Work on 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 operations 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, roots, rubbish or any other objectionable materials. Only material considered suitable by the Engineer-in-charge shall be used for the construction and that considered unsuitable other disposed off as directed by him. The selection of the materials to be used in the construction of embankment shall be made after sail surveys

and investigations carried out by the Department. The embankment shall consist of earth available from road-side borrow pits on either side with all lead and all lifts and within land width in the manner specified in Para 11 bellow. 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 ill extend all necessary co-operation in helping contractor to get borrow area from nearby Government of 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 layers not exceeding 250 mm 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 and a maximum of size 5 cm when being placed in the top 45 cm of the embankment, the work of next layer shall be allowed only after the first layer below it has been thoroughly compacted.

7. Where an embankment is to be placed on sloping ground, the surface of the ground shall be benched in the steps of trenches or 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 an 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 left under the new embankment. If the existing road surface is of granular or bituminous type and lies within 1 mt of the mew sub grade level, the same shall be scarified to a depth of minimum 50 mm. so as to provide ample bond between the old and the new material.

8. To avoid interference with the construction of abutment, wing walls of culverts/bridge structures, the contractor shall, at point to be determined by the Engineer-in-charge, suspend work on embankments 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 or damage to the bridge work. Unless directed otherwise, the filling ground culverts, bridge and other structures up to 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 layers 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 filler medium and will be paid extra in the relevant item.

9. The embankment shall be finished in conformity with the alignment, levels, and cross sections and dimension shown on the plans or as directed by 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 drawings or as the Engineer in-charge may direct. Finishing operations shall include the work of shaping and dressing the shoulders, road bed and the side slopes to conform the cross section.

10. The earthwork measurements shall be paid on cross sectional measurements and computing the volumes of earthwork in cubic metres by average area method. The contractor shall sign day to day levelling work and also original cross sections, longitudinal section etc, in token of his acceptance. The working sections 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 authorised representative shall attend day to day levelling 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 of level book shall not be deemed as disagreement. The Executive Engineer shall also verify levelling 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 taken on compacted earth work. Deduction of 15% for shrinkage shall be made from gross measured quantity is 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 deformations etc. if any due to all settlements as well as other type of deformations etc. if any that might have taken place at the time of taking final measurement of 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 from a road side longitudinal gutter to drain the water, interrupted by such gutter.

(ii) The width of the drain shall be restricted to 1.5 Mts, 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 choose 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 6e dug within 5 metres of toe to the final section of the road embankment.

(v) No borrow pits shall be allowed in the length in which earth obtained fro cutting from cutting is specified to be used in embankment.

12.0 The rate of earthwork includes, clearing jungles, dog belling, fixing profiles, erecting necessary pillars for stones for bench marks for levelling purpose, excavating earth from borrow areas, breaking 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 be utilised in embankment construction under this item within the lead specified in the particular, 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 particular item, and only balance quantity of earthwork brought from borrow areas will be paid in this item.

13.0 The Payment will be made on cubic meter basis of finished work.

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Item No.3 Earthwork for embankment from borrow pits including breaking clods, dressing with all lead and lift (excluding watering and consolidation) for all lead and lift.

1. The land width on which the earth work is to be done shall be cleared of all trees having a girth 30 cm. and less, 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 stacks along the road boundary or as directed at places within 50 metres lead, and handed over to the department in convenient section. Unsuitable materials shall be burnt or otherwise disposed off by the contractor at his own cost without causing arty 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 clearing; the site, the alignment of the road shall be properly set out true to line, curves, slopes, grades and sections as shown on the plan or directed by the Engineer-in-charge. The contractor shall provide all labours and materials such as lime, strings, pegs, nails, bamboos, stone, mortar, concrete, etc. required for setting out, establishing. Bench Marks and giving profiles: The contract rate shall be responsible for maintaining the B. Ms. profiles alignment and other marks as long as they are required for the Work on 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 operations 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, roots, rubbish or any other objectionable materials. Only material considered suitable by the Engineer-in-charge shall be used for the construction and that considered unsuitable other disposed off as directed by him. The selection of the materials to be used in the construction of embankment shall be made after sail surveys and investigations carried out by the Department. The embankment shall consist of earth available from road-side borrow pits on either side with all lead and all lifts.

5. Location shape and size of borrow pits shall be as indicated by the engineer-in-charge. Pits shall not be dug continuously. Ridges of not less than 8 metres width should be left at interval not exceeding 300 metres. Small drain shall be cut through the ridges of facilities drainage. The outer edge of borrow pits shall be so regulated that the bottom does not cut an imaginary line having a slope of 1 virtical to 4 horizontal projected from the edge of final section of bank, the maximum depth in any case being limited to 1.50 metres. Also no pits shall be dug with in 5 metres of the toe of the final section of the road embankment.

5.1 No borrow pits shall be allowed at the following sites along the road.

(i) Up to 30 metres on either side of C. D. works.

(ii) up to 15 metres on either side of cart track crossing for which approaches are to be constructed.

5.2 If there is top layer of black cotton or other objectional soils, the same shall be removed and disposed off elsewhere and usable materials found at lower level will only be used in the embankment.

6. The embankment shall be constructed in uniform layers not exceeding 250 mm 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 and a maximum of size 5 cm when being placed in the top 45 cm of the embankment, the work of next layer shall be allowed only after the first layer below it has been thoroughly compacted to the density specified.

7. Where an embankment is to be placed on sloping ground, the surface of the ground shall be benched in the steps of trenches or 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 an 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 left under the new embankment. If the existing road surface is of granular or bituminous type and lies within 1 mt of the mew sub grade level, the same shall be scarified to a depth of minimum 50 mm. so as to provide ample bond between the old and the new material.

8. To avoid interference with the construction of abutment, wing walls of culverts/bridge structures, the contractor shall, at point to be determined by the Engineer-in-charge, suspend work on embankments 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 or damage to the bridge work. Unless directed otherwise, the filling ground culverts, bridge and other structures up to 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 layers 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 filler medium and will be paid extra in the relevant item.

9. The embankment shall be finished in conformity with the alignment, levels, and cross sections and dimension shown on the plans or as directed by 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 drawings or as the Engineer in-charge may direct. Finishing operations shall include the work of shaping and dressing the shoulders, road bed and the side slopes to conform the cross section.

10. The earthwork measurements shall be paid on cross sectional measurements and computing the volumes of earthwork 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 sections 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 of 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 taken on compacted earth work. Deduction of 15% for shrinkage shall be made from gross measured quantity is 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 deformations etc. if any due to all settlements as well as other type of deformations etc. if any that might have taken place at the time of taking final measurement of item.

11. The rate of earthwork includes, clearing jungles, dog belling, fixing profiles, erecting necessary pillars for stones for bench marks for leveling purpose, excavating earth from borrow areas, breaking 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 be utilized in embankment construction under this item within the lead specified in the particular, 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 particular item, and only balance quantity of earthwork brought from borrow areas will be paid in this item.

The payment shall be made on Cum basis of finished work.

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Item No.4 Rolling and watering of earthwork in layers with power roller including filling in depression which occur during the process as directed.

1.0 For spreading materials in layers and bringing the appropriate moisture content, the embankment materials shall be spread uniformly over the entire width of the embankment in layers 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 material 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 houseline 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 150mm when being placed in the lower layers of the embankment and a maximum size of 60mm when being placed in the top 0.5meter portion of the embankment below the sub grade.

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

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

2.0 Compaction : Only compacting equipment approved by Engineer-in-charge shall be employed to compact the materials. The contractor shall demonstrate the efficiency of the plants he intents 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 meter portion of embankment below sub grade 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 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 incite of that the 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.

3.0 Measurements for Payment : Consolidation of earth embankment construction shall be measured by taking cross section at intervals in the original position before the work starts and after its completion and computing of the volume of earthwork in cubic meters by the method of average and areas. The measurement of fill material from borrow area 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 meter of suitable materials brought to site from roadway and drainage excavation forms one cubic meter of compacted fill and bulking or shrinkage shall be ignored.

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

4.0 The contract unit rate includes cost of mechanical roller required for consolidation including all labour equipments fuel, hire charges, tools, and incidentals necessary.

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Item No.5 **Providing and laying Granular Sub Base Grade-I C.B.R. not less than 30% by Providing close graded materials , consisting of B.T. crushed stone aggregates 53mm to 9.5mm @ 50%, 9.5mm to 2.36mm @ 20%, 2.36mm to below @ 30% coarse sand combination and stone dust /Grit spreading in uniform layers with motor grader on prepared surface mixing by mix in place method with rotovator at OMC to required dry density including filling the depressions which occurred during the process using vibratory roller 8-T to 10-T complete as per Clause-401.**

GRANULAR SUB-BASE – as per MORT&H Section 401 for G.S.B.

401.1 Scope

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

401.2 Materials

The material to be used for the work shall be quarry spall material having CBR not less than 30% The material shall be free from organic or other deleterious constituents and conform to one of the three gradings given in Table 400-1.

While the gradings in Table 400-1 are in respect of close-graded granular sub-base materials, one each for maximum particle size of 75 mm, 53 mm and 26.5 mm, the corresponding gradings for the coarse graded materials for each of the three maximum particle sizes are Oven at Table 400-2. The grading to be adopted for a project shall be as specified in the Contract.

401.2.2. Physical requirements:

The material shall have a 10 per cent fines value of 50 kN or more (for sample in soaked condition) when tested in compliance with BS:812 (Part I 11). The water absorption value of the coarse aggregate shall be determined as per IS : 2386 (Part 3); if this value is greater than 2 per cent, the soundness test shall be carried out on the material delivered to site as per IS : 383. For Grading II and III materials, the CBR shall be determined at k density and moisture content likely to be developed in equilibrium conditions which shall be taken as being the density relating to a uniform air voids content of 5 per cent.

TABLE 400-1. GRADING FOR CLOSE-GRADED GRANULAR SUB-BASE MATERIALS

IS Sieve Designation	Per cent by weight passing the IS sieve_ Grading I	Grading 11	Grading III
75.0 mm	100	-	
53.0 mm	80-100	100	-
26.5 mm	55-90	70-100	100.
9.50 mm	35-65	50-80	65-95
4.75 mm	25-55	40-65	50-80
2.36 mm-	20-40	30-50	40-65
0.425 mm	10-25	15-25	20-35
0.075 mm	3-10	3-10	3-10
CBR Value (Minimum)	30	25	20

TABLE 400-2. GRADING FOR COARSE GRADED GRANULAR SUB-BASE MATERIALS

IS Sieve Designation	Per cent by weight passing the IS Sieve Grading I	Grading II	Grading III
75.0 mm	100	-	-
53.0 mm		100	
26.5 mm	55-75	50-80	100
9.50 mm			
4.75 mm	10-30	15-35	25-45
2.36 mm			
0.425 mm			
0.075 mm	<10	<10	<10
CBR Value (Minimum)	30	25	20

Note : The material passing 425 micron (0.425 mm) sieve for all the three gradings when tested according to IS : 2720 (Part 5) shall have liquid limit and plasticity index not more than 25 and 6 per cent respectively.

401.3. Strength of sub-base

It shall be ensured Prior to actual execution that the material to be used in the sub-base satisfies the requirements of CBR and other physical requirements when compacted and finished.

When directed by the Engineer, this shall be verified by performing CBR tests in the laboratory as required on specimens remoulded at field dry density and moisture content and any other tests for the “quality" of materials, as may be necessary.

Construction Operations

401.4.1. Preparation of sub grade :

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

401.4.2. Spreading and compacting :

The sub-base material of grading specified in the Contract shall be spread on the prepared sub grade with the help of a motor grader of adequate capacity, its blade having hydraulic controls suitable for initial adjustment and for maintaining the required slope and grade during the operation or other means as approved by the Engineer.

When the sub-base material consists of combination of materials mentioned in Clause 401.2.1, mixing shall be done mechanically by the mix In-place method.

Manual mixing shall be permitted only where the width of laying is not adequate for mechanical operations, as in small-sized jobs. The equipment used for mix-in-place construction shall be a rotavator or similar approved equipment capable of mixing the material to the desired degree, If so desired by the Engineer, trial runs with the equipment shall be carried out to establish its suitability for the work.

Moisture content of the loose material shall be checked in accordance with IS:2720 (Part 2) and suitably adjusted by sprinkling additional water from a truck mounted or trailer mounted water tank and suitable for applying water uniformly and at controlled quantifies to variable widths of surface or other means approved by the Engineer so that, at the time of compaction, it is from I per cent above to 2 per cent below the optimum moisture content corresponding to IS:2720 (Part 8). While adding water, due allowance shall be made for evaporation losses. After water has been added., the material shall be processed by mechanical or other approved means like disc harrows, rotavators until the layer is uniformly wet.

Immediately thereafter, rolling shall start. If the thickness of the compacted layer does not exceed 100 mm, a smooth wheeled roller of 80 to 100 kN weight may be used. For a compacted single layer up to 225 mm the compaction shall be done with the help of a vibratory roller of minimum 80 to 100 kN static weight with plain drum or pad foot drum or heavy pneumatic tyre roller of minimum 200 to 300 kN weight having a minimum tyre pressure of 0.7 MN/m2 or equivalent capacity roller capable of achieving the required compaction. Rolling shall commence at the lower edge and proceed towards the upper edge longitudinally for portions having unidirectional cross fall and super-elevation and shall commence at 6 the edges and progress towards the centre for portions having cross fall on both sides.

Each pass of the roller shall uniformly overlap not less than one third of the track made in the preceding pass. During rolling, the grade and cross fall (camber) shall be

checked and any high spots or depressions, which become apparent, corrected by removing or adding fresh material. The speed of the roller shall not exceed 5 kin per hour.

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

401.5. Surface Finish and Quality Control of Work

The surface finish of construction shall conform to the requirements of Clause 902.

Control on the quality of materials and works shall be exercised by the Engineer in accordance with Section 900.

Arrangements for Traffic

During the period of construction, arrangement of traffic shall be maintained in accordance with Clause 112.

401.7. Measurements for Payment

Granular sub-base shall be measured as finished work in position in on cross sectional measurement and computing the valume of GSB work in cubic meter by average area method.

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

Rate

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

(i) making arrangements for traffic to Clause 112 except for initial treatment to verges, shoulders 'and construction of diversions;

(ii) furnishing all materials to be incorporated in the work including all royalties, fees, rents where necessary and all leads and lifts;

(iii) all labour, tools, equipment and incidentals to complete the work to the Specifications-,

(iv) carrying out the work in pan widths of road where directed-, and

(v) carrying out the required tests for quality control.

The payment shall be made on cumt basis.

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Item No. 6 supplying and stacking of crushed stone aggregates , chippings etc of hard stone of 40 to 63 mm size free of disintegrated pieces deleterious and organic mater (for W.B.M.) and grading as per IRC code with all lead.

1. The crushed stone shall be hard, durable and free from excess flat, elongated, soft and disintegrated particles diet and other deleterious material. The stone metal shall be obtained from quarries approved by the Executive Engineer prior to collection. The metal shall be of approved quality with all leads and lift. The size of metal shall be 40mm to 63mm and shall be machine crushed.
2. The samples of metal collected form approved quarries shall be got tested at Government recognized Laboratory. The test results shall conform to the standard requirements laid down for metal to be use for W.B.M. work .
3. The physical requirements for standard size metal shall conform to the test results indicated in the Table below

Type of const.	T E S T	Test Method	Requirement
Base	* (a) Los Angeles Abrasion value OR	IS 2386 Part IV	40 % (Max)
	* Aggregate Impact Value (b) Combined Flakiness Index	IS 2386 Part IV or IS 5640 IS 2386 Part-I	30 % (Max) 30 % (Max)

Aggregate may satisfy requirement of either of two test

Frequency of test shall as per TABLE-7.1

4. The grading requirements of the metal to be used for W.B.M. shall be as under

Sr.No.	Size Range	Sieve Designation	Percentage by weight passing through the sieve
1	40 mm to 63 mm.	90 mm 63 mm 53 mm 45 mm 22.40 mm	100 90 – 100 25 – 75 0 - 15 0 - 5

5. Wherever any doubt exist as to whether the above requirements are satisfied, in whole or any part of the collection, metal shall be got screened by the contractor at his own cost, if so ordered by Engineer-in-charge.

6. Stacking shall be done by filling in the standard steel boxes of 2 m x 1.5 m x 0,5 m size which shall be supplied by the Department if available on rent. Other wise contractor shall make his own arrangements No deduction for voids shall be made from the gross measurements. Where any doubt exists as to whether the quantity of stacks of metal in any hectometer is not confirming with the cubical content of the standard pares (2 m x 1.5 m x 0.5 m) shall be got corrected by the contractor if so ordered by the Engineer-in-charge for which no extra payment shall be claimed by the contractor. If the quantity of metal in any stack in a particular hectometer is found to be less than the standard measurement viz. 1.5 cmt. The entire collection in the hectometers shall be paid on the basis for the quantity so found Regular stacks shall be done by the contractor on a fairly level ground. Stacking of the metal shall be done in manner as directed by the Engineer – in – charge Collection of metal shall be completed in two hectometer wise as per the final requirement and measurement shall be recorded two hectometer wise. Until the quantity of metal as per final bill requirement is not collected in any two consecutive HM and Std. boxes are not filled in completely in two hectometers, measurements shall not be recorded and payments shall nor be done.

7. For road work complete stacking of metal as per requirement shall be carried out in 3 KM. length before spreading. The metal stacks shall be measured and recorded and got cross checked by other Deputy Engineer as per rules before spreading.

   The collection shall always, commence at one end of the Km. and be carried continuously towards the other end unless the Engineer – in – charge shall direct otherwise.

8. The payment shall be on cubic meter basis without deduction for voids. The contractor shall maintain all stacks in regular and proper size till the whole materials shall be not measured and finally accepted by the Department. The spreading of materials shall not be allowed till the materials are fully stacked and completed kilometer wise.

9. The rate includes cost of collection, conveyance to the site with all lead and lift and filling the boxes including all labour, tools, equipment, and other incidental expense. The rate quoted are inclusive of all such tools duties, fees royalties, taxes etc.

10. MEASUREMENT FOR PAYMENT

    The payment shall be made on cubic metre basis.

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Item No. 7 **Supplying & stacking of crushed stone aggregates , chippings etc of hard stone of 6 to 10 mm on road side with all lead including filing measure boxes.**

1. The field of M.C. metal shall be of approved quarry as shown on the quarry chart as well as approved by the Executive Engineer prior to collection.

2. The M.C. metal shall be hard, tough, sound, durable, black trap field metal of close texture, free from decay and weathering. Each piece of the stone shall be angular and roughly cubical in shape and round elongated or flaky material shall be rejected. No roud or oblong pebbles or angular chips larger or smaller than specified size shall be allowed.

3. All unsound, weathered or disintegrated stone obtained from the upper surface layer of the quarry or other layer of boulders shall be rejected. The physical requirement for standard size metal shall conform to the test results indicated in the Table below

Type of const.	T E S T	Test Method	Requirement
Base	* (a) Los Angeles Abrasion value OR * Aggregate Impact Value (b) Flakiness Index	IS 2386 Part IV IS 2386 Part IV or IS 5640 IS 2386 Part-I	50 % (Max) 40 % (Max) 15 % (Max)

Frequency of test shall be as per Ministry of Surface Transport Specification.

4. The M.C.metal shall be as nearly uniform in size as possible and shall conform to following minimum requirements of passing through the rings

* For 10 to 12mm size

Size Range	**Percentage passing through the sieve**
11.20mm	100
5.60 mm	90-100
180 Micro	15-35

5. Wherever any doubt exist as to whether the above requirements are satisfied, in whole or part of the collection M.C. metal shall be got screened by the contractor if so

ordered by Engineer-in-charge and for which no extra payments shall be claimed by the contractor.

6. Any collection which does not fully satisfy the above requirements is liable to be rejected altogether.

7. Stacking shall be done by filling in the standard steel pharas of 2 m x 1.50 m x 0.50 m size and no deduction of voids shall be made from the gross measurements.

8. Regular stacks shall be done by the contractors on a fairly level ground. All the stacks shall be marked by white wash immediate on being measured and recored by the Engineer-in-charge.

9. The rate includes blasting the rock, if any, breaking the metal, stacking, measuring in pharas etc. complete.

10. **The payment shall be on cubic meter basis** without deduction for voids. The contractor shall maintain all stacks in regular and proper size till the whole materials shall be not measured and finally accepted by the Department. The spreading of materials shall not be allowed till the materials are fully stacked and completed kilometer wise.

11. The rate includes cost of collection, conveyance to the site with all lead and lift and filling the boxes including all labour, tools, equipment, and other incidental expense.

The rate quoted are inclusive of all such tools duties, fees royalties, taxes etc.

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Item No. 8 Supplying and stacking of stone dust as binding materials and filling in boxes with all lead and lift.

1. Material shall be conform to M-7. Material for the purpose shall be approved quality. Any materials which is found inferior shall be rejected and the contractor shall remove such rejected material from the site at his own cost. The material shall be collected from quarries approved by the Executive Engineer. The materials shall be granular and
2. The materials shall be got approved by the Executive Engineer prior to collection at site. It shall be free from all rubbish, dust and any organic materials as well as clods of back cotton soils. Materials shall not be allowed to be collected from within the road boundary.
3. Stacking shall be done by filling in the std. size steel boxes of 2 m x 1.50 x 0.5 mm size which shall be supplied by the department if available on rent otherwise contractor shall make his own arrangements and not deduction for voids shall made from the gross measurements. Where any doubt exist as to whether the quality of stacks of stone dust in an hectometer is not confirming with the cubical contents of the standard pharas (2m x 1.5 m. x 0.5) shall be got corrected by the contractor if so ordered by the Engineer-in-charge for which no found to be less than the std. Measurement viz. 1.50 cmt. The entire collection in the Hectometer shall be paid on the basis of the quantity so found. Regular stacks shall be done by the contractor on a fairly level ground. Stacking of the stone dust shall be done in a manner as directed by the Engineer-incharge.
4. For road work complete stacking of stone dust as per requirement shall be carried out in 2 KM. length before spreading. The stone dust stacks shall be got checked by the other Deputy Engineer as per rules before spreading. The collection shall always commence at one end of the KM. and be carried out continuously towards the other end unless the Engineer-in-charge shall direct otherwise.

5. **The payment shall be made on cubic meter basis** without deduction for voids. The contractor shall maintain all stacks in regular and proper size till the whole materials are collected measures and finally accepted by the Department. The spreading of material shall not be allowed till the materials are full stacks and completed kilometer wise.

6. The rate includes cost of collection, conveyance to the site with all lead and lift and filling the boxes including all labour, tools, equipment and other incidental expenses.

The rate quoted are inclusive of all such levels royalties, taxes etc.

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Item No.9 Spreading the stone aggregates for soiling and W.B.M. including filling the interstices forming the surface to required camber and gradient as directed.

1.0 Metal shall not be spread without permission of the Engineer-in-charge. Metal should be spread under careful supervision by trained coolies. Contractor shall see the uniform spreading as per collection of metal is done. The contractor shall spread the metal fully from the stacks without keeping any balance unless directed by the Engineer-in-charge to keep some stack in balance for making good unevenness or depressions during rolling works. To ensure that the material is spread to the required thickness, the road surface shall be marked out in to length o\over which the contents of heaps are to be spread. The bounds of earth or Murrum (one on either side) shall be laid with a distance between them equal to the width of road to be medaled and shall be enough to prevent the loose metal from spreading during consolidation as well as to retain water used for consolidation. Payment for bunds will be made in the respective item.

2.0 The metal (including old metal) shall be screened and rubbish, dust, grass shall be removed and spread evenly on the prepared surface in grade and camber by using board etc. so as ensure that the surface is true to camber and grade. At least two cambers by using camber boards shall be in use at site. The surface shall be checked at every 50 ft. by means of template while the correctness of the camber in between shall be tested by string corrected as required. Between the straight lengths and the curves in camber of road to super elevation shall be made very gradually as may be directed by the Engineer-in-charge.

3.0 The spreading of metal shall precede only 200 mt. (max.) advance of the rolling operations. The collection and spreading of the metal shall be carried out in one and the same kilometer.

4.0 At the time of rolling all surface irregularities, hollows, depressions, humps etc. shall be straight. The spreading of metal the above operations with all lead and lift except consolidation.

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Item No.10 Spreading the stone dust /binding materials filling the gaps in metal and levelling to camber and gradient as directed.

1. Spreading of materials shall be started after the fully supply in a particular K.M. is collected, measured and recorded in the measurement books. Permission of the Engineer-in-charges shall be obtained before spreading. If shall be seen that the formation is dressed to the required camber and grade. If the murrum is to be spread over the metaled surface then the spreading shall be uniform and as its has to act as binding surface it shall be used for filling the interstices of metal and forming a smooth running surface as far as possible. Murrum blind age shall be specified, as blind age shall be spread evenly with a twisting motion of the baskets. No more murrum made. I, the murrum is to be spread over embankment as a sub base or for side shoulders or as blind age, it shall be in a manner as directed by the Engineer-in-charge and as per required width and thickness. The contractor shall make good all unevenness, depression, projection etc. during consolidation work. Rate of this item includes all these operations except consolidation.
2. Quality of binding material /stone dust to be spread will be 0.10 cum per 10m 2 area . After application of stone dust the surface shall be copiously sprinkled with water the resulting slurry swept in which hand brooms or mechanical brooms to fill. The voids property and filled during which water shall be applied to the wheels of the roller if necessary to wash down the blinding materials sticking to them this operations shall continue until the resulting slurry after filling of voids, forms a wave ahead of the wheels of the moving roller.

2 The payment shall be made on cubic meter basis

3 The rate is for gross measurement and no deduction shall be made if the stone dust is to be spread as blind age it shall be spread in manner as directed by Executive Engineer.

5. The contractor shall make good all unevenness depression during consolidation works and the rate of this item includes all these operations.

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Item No.11 Rolling and consolidation of water Bound macadam using vibratory Road (Including watering).(layer not exceeding 100mm thickness)

1. Immediately following the spreading of the coarse aggregates rolling shall be with vibratory roller . The weight of the roller shall depend upon the types of the aggregate and be indicated by Engineer-in-charge.
2. Except on super elevated portions where the rolling shall proceed from inner edge to 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 inwards parallel to centre line of the road, in successive passes uniformly lapping proceeding by at least one half the width.
3. Rolling shall continue until the aggregate is thoroughly keyed and the creeping of the aggregate ahead of the roller is no longer, visible. During rolling slight sprinkling of water may be done, if necessary: Rolling shall not be done when the sub-grade is soft or yielding or when it causes a wave like motion in the sub-grade or sub-base course.The thickness of layer shall not excess 100m.
4. The rolled surface shall be checked transversely and longitudinal with templates and any irregularities corrected by loosening the surface, adding or removing necessary amounts of aggregate and re rolling until; the entire surface conforms to desired camber and grade. In no case shall the use of screening be permitted to make up depression.
5. The blindage material where it is required to be used 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 shall be 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 moving roller.
6. After the final compaction of water bound macadam course the road shall be allowed to dry overnight. Next morning hungry spots shall be filled screenings of binding materials as directed, lightly sprinkled with water if necessary and rolled no traffic shall be, allowed on the road until macadam has set. The Engineer-in-charge shall have the discretion to stop hauling traffic from using the macadam has set. The Engineer-in-charge shall have the discretion damage to the surface.

7. Payment will be made on **volume basis** of the finished work and shall include cost of watering, rent of machinery cost fuel, wages of drivers and cleaners and Murrum bund etc.
8. Measurement for payment shall be measured as finished the work in position in **Cum meter**. The finished compacted thickness of layer to be paid on **Cum basis**.

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Item No.12 Providing and applying primer coat with bitumen emulsion on prepared surface of granular base including cleaning of road surface and spraying primer @ rate of 0.60 Kg/Sqm using mechanical means.

503.1. Scope

This work shall consist of the application of a single coat of low viscosity liquid bituminous material to an existing bituminous road surface preparatory to the superimposition of a bituminous mix, when specified in the Contract or instructed by the Engineer.

503.2. Materials

503.2.1. Binder: The binder used for tack coat shall be Rapid Setting Bitumen Emulsion Grade RS-1 complying with IS:8887 or as specified in the Contract. The use of cutback bitumen (Medium Curing grade) as per IS:217 shall be restricted only for sites at sub-zero temperature or for emergency applications as directed by the Engineer.

503.3. Weather and Seasonal Limitations

Bituminous material shall not be applied to a wet surface or during a dust storm or when the weather is foggy, rainy or windy or when the temperature in the shade is less than 10o C. Where the tack coat consists of emulsion, the surface shall be slightly damp, but not wet. Where the tack coat is of cutback bitumen, the surface shall be dry.

503.4. Construction

503.4.1. Equipment: The tack coat distributor shall be a self-propelled or towed bitumen pressure sprayer, equipped for spraying the material uniformly at a specified rate. Hand spraying of small areas, inaccessible to the distributor, or in narrow strips, shall be permitted with a pressure hand sprayer, or as directed by the Engineer.

503.4.2. Preparation of base: The surface on which the tack coat is to be applied shall be clean and free from dust, dirt, and any extraneous material, and be otherwise prepared in accordance with the requirements of Clause 501. Immediately before the application of the tack coat, the surface shall be swept clean with a mechanical broom, or by other means as directed by the Engineer.

503.4.3. Application of binder: The binder shall be sprayed on the base at the rate specified in Table 500.2. The normal range of spraying temperature for a bituminous emulsion shall be 20o C – 60o C and for a cutback 50o C – 80o C if Medium curing grade is used. It shall be the responsibility of the Contractor to carefully handle the inflammable bituminous cutback material so as to safeguard against any fire mishap. The binder shall be applied uniformly with the aid of either self-propelled or towed bitumen pressure sprayer capable of spraying bitumen at specified rates and temperature so as to provide a uniformly unbroken spread of bitumen. Work should be

planned so that no more than the necessary tack coat for the day‟s operation is placed on the surface.

TABLE 500.2 : RATE OF APPLICATION OF TACK COAT

Type of surface	Quantity of Bituminous Emulsion in Kg Per Square meter area
(i) Normal bituminous surfaces	0.20 to 0.25
(ii) Dry and hungry bituminous surfaces	0.25 to 0.30
(iii) Granular surfaces treated with primer	0.25 to 0.30
(iv) Cement Concrete Pavement	0.30 to 0.35

503.4.4 Curing of tack coat: The tack coat shall be left to cure until all the volatiles have evaporated before any subsequent construction is started. No plant or vehicles shall be allowed on the tack coat.

503.5. Quality Control of Work

For control of the quality of materials supplied and the works carried out, the relevant provisions of Section 1800 shall apply.

503.6. Arrangements for Traffic

During the period of construction, arrangements for traffic shall be made in accordance with the provisions of Clause 111.

503.7. Measurements for Payment

Tack coat shall be measured in terms of surface area of application in square metres.

503.8 Rate

The contract unit rate for tack coat shall be payment in full for carrying out the required operations including for all components listed in Clause 401.9 (i) to (v) and as applicable to the work specified in these Specifications.

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Item No. 13 Providing and laying 37.50mm thick built up spray grout in one layers using black crushed stone aggregate as per gradation and specification including using bitumen for tackcoat at the rate of 2.5Kg/10sqm on surface by mechanical sprayer and bitumen of VG-10 grade mixing at the rate of 19.90 Kg/MT by weight of total mix (i.e. 1.99%) including heating and mixing the aggregate and bitumen by continues batching drum mix plant, transporting the mix and spreading the same by paver finished and consolidation with vibratory roller including cost of all materials , fuel , labours, tools and plants using contractor's own drum mix plant and machineries etc complete.

1. Description:

This work shall consist at a layer/two layer composite construction of compacted crushed coarse aggregates with application of bituminous after each layer and key aggregates on the top of the second layer, in accordance with requirement of these specifications and in conformity with the lines, grades and cross sections shown on the drawing or directed by the Engineer- in – charge.

2. Materials:

3.1 Binder: The binder shall straight run bitumen of a suitable grade Viscosity Grade (VG-10) as directed by the Engineer – in – charge satisfying the requirements of IS-73 or approved cutback.

3.2 Aggregates: The aggregates shall, durable of fairly cubical shape and free of disintegrated pieces, organic or their Abrasion Value and Aggregate impact Value shall 50 and 40 respectively. The coarse and key aggregates for built-up spray grout shall conform to the gradings given below.

Grandings requirements of coarse and key aggregates for built-up spray grout.

Sieve Designation	Percent by weight passing Sieve	
	Coarse Aggregate	Key Aggregate
50.0mm	100	-
25.0mm	35-70	-
20.0mm	-	100
12.5.0mm	0-15	35-70
4.75.0mm	-	0-15
2.36.0mm	0-5	0-5

3. Construction Operations

3.1 Weather and seasonal limitations: Built-up spray grout not be constructed during rainy weather, where the base is damp or when the atmospheric temperature in shade is 16 C or below.

3.2 Preparation of base: The base on which built-up grout in is to constructed shall be prepared. Shaped and conditioned to the specified lines, grades and cross-sections as directed by the Engineer-in- charge. The surface be thoroughly swept and scrapped clean of dust and other foreign matter.

3.3 Tack Coat: A tack coat as per item No.21 para shall be applied over the base preparatory to construction of the spray grout course.

3.4 Spreading and rolling coarse aggregates: Immediately after the application of tack coat the coarse aggregates in a dry and clean from shall be uniformly, and evenly at the rate of 0.5 cum per 10 sq removing or adding as may be required.

Immediately after spreading of the coarse aggregates. dry rolling shall be done with a 8-10 tonne smooth wheeled roller. Rolling shall commence at the edge and progress towards the center except in super- elevated portions where it shall proceed from the liner edge to the outer. Each pass of the roller shall uniformly overlap not less than one third of the track made in the preceding pass.

After initial rolling the surface shall be checked transversely and longitudinally with templates and any irregularities corrected corrected by loosening the surface. the surface, adding or removing necessary amounts of aggregate followed by rolling.

Rolling be stopped before voids in the aggregate layer are- closed to such an extent as to prevent free and uniform penetration of the binder.

3.5 Application of binder – First spray: The binder shall be heated to the temperature appropriate to grade of bitumen approved by the Engineer –in-charge and sprayed on aggregate layer at the rate of 15 kg/ 10 m (in terms of straight – run bitumen) in a uniform manner with the help of mechanical sprayers, Excessive deposits of caused by stopping or starting of the sprayers or through leakage or any other reason shall be corrected promptly.

3.6 Spreading and rolling for coarse aggregate fro the second layer: Immediately after the first application of binder the second layer of coarse aggregates shall be spread and rolled to 3.4 above.

3.7 Application of binder-second spray: The second aggregate layer shall then be given a binder spray at the rate off 15kg/ 10mm(in terms of straight-run bitumen) to 3.5 above.

3.8 Application of key aggregate: Immediately after second application of the binder key aggregate in a clean and dry state shall be spread uniformly at the rate of 13m/ 10m so as to cover the surface completely. if necessary, the surface shall be boomed to assure uniform application of the key aggregates. The entire surface shall then be rolled with an 8-10 tonne smooth wheeled roller. While rolling is in progress additional key aggregates where required shall be spread by hand. Rolling continue until the entire course is thoroughly compacted and the key aggregates firmly in position.

4.0 Surface Finish and Quality Control:

The Surface finish of construction shall conform to the requirements of 902 of M.O.S.T.

5.0 The built-up spray grout shall be provided with final surfacing without any delay.

6.0 Arrangements for Traffic:

During period of construction arrangements of traffic shall be done as per Para 112 of M.O.S.T Specification.

7.0 Measurements for payment:

Built- up spray grout shall be measured as finished work in square meters.

8.0 Rate:

The contract unit rate for built-up spray grout shall be payment in full for carrying out the required operations including full compensation for all components as follows:

(1) Providing all materials to be used in the work including royalty charges. out the required operations including full compensations for all components as follows:

(2) All lab our, tools plants, equipment's and incidental to complete the work to the specification.

(3) Providing and maintaining diversion and controlling traffic.

Asphalt used less than as specified on account of divination in tack coat or modification in rate of asphalt consumption in the item, it will be recovered at the rate as mentioned in Schedule " A" for quantity used less.

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Item No. 14 **Providing , laying and rolling of 25mm thick open graded premix bituminous carpet with BT aggregate as specified and using bitumen VG-10 for tackcoat at the rate of 2.5 Kg/10 Sqm on BT surface and using bitumen VG-10 for mixing with aggregate at the rate of 3.36% i.e. 33.60 Kg/MT of total mix including heating and mixing in drum mix plant, spreading the same with paver finisher and consolidation with vibratory roller including necessary fire wood , oil, lubricants, labor charges etc. using contractor's own drum mix planet and equipment, tools etc completed in accordance with the requirements of specification .**

1. The shall consist of construction in a single course of 25 mm thick carpet as course on a previously prepared base. Single course shall also included additional thickness if any to remove in evenness of the existing surface.
2. The course aggregate shall consist of crushed stone only. These shall be clean, strong, durable of fairly cubical shape free of disintegrated pieces, organic or other deleterious, matter and adherent coating. The aggregates shall preferably be hydrophobic and of low porosity and shall satisfy the physical requirement set forth and under :-

PHYSICAL REQUIREMENT OF AGGREGATE FOR BITUMINOUS MACADAM

Sr. No.	TEST	TEST METHOD REQUIREMENT	
1.1	Los Angles Abrasion Value	IS:2386 (Part IV)	40% maximum
2.	Aggregate Impact Value	IS:2386 (Part IV)	30% maximum
3.	Flakiness Index & Elongation	IS:2386 (Part-I)	30% maximum
4.	Stripping value	IS: 6241	25% maximum
5.	Water Absorption	IS:2386 (Part – III)	1% maximum

3. The fine aggregate shall consist of crusher run screenings, natural sand or mixture of both. These shall be clean hard, durable uncoated. Dry and free from injurious soft or flaky pieces and organic or deleterious substances.
4. The mineral aggregates, including mineral filler shall be so graded or combined as to confirm to the grading as under :-

AGGREGATES GRADATION FOR PREMIX CARPET

Sieve Designation	Percent by Weight passing the Sieve for 25 mm thickness
20 mm	100
12.5 mm	70 to 100
10 mm	20 to 40
4.75 mm	00 to 5

Aggregates satisfy requirements of either of the two test

The above gradation is tentative. To achieve correct quantity the contractor shall get the job mix formula for the mix approved by Engineer in Charge before starting the work

5. The samples of aggregates for required grading for the work shall be got approved from the Engineer – In – Charge prior to transportation and collection on plant site. Only approved materials shall be transported and stacked as per requirement. Inferior materials shall have to be removed from the plant site, the same will be removed by the department at the cost of the contractor. Collection of aggregate shall be in different stacks according to various sizes of aggregates.
6. For the purpose of collection of materials, plant site shall be established at suitable place where Hot mix plant shall be installed. Department will extent all extend all necessary co-operation in helping contractor to get hereby Government land for establishing plant size. However, department is not responsible if no such land is made available to the contractor and in that case the contractor will have to make own aggregate register for the purpose of record.
7. The binder shall be straight run bitumen of suitable grade satisfying the requirements of IS : 73, Bitumen shall be 80/100 grade. It shall have to be brought by the contractor to the site of work at his own cost. Drums of asphalt shall be so stored so as to allow easy inspection and in such place as will not damage the drums and cause the leakage or allow water and other foreign mater to enter. For the purpose of calculation consumption, wastage will not be allowed beyond 2.5 percent excess consumption over 2.5 percent will be charged at a panel rate.
8. For bulk asphalt contractor shall have to came adequate arrangement for stacking bulk asphalt at plant site according to requirements.
9. The asphalt should not be used as a fuel.
10. Department shall keep a day account of the supply and consumption of bitumen in a separate bound register having numbered pages and in the Performa prescribed by the department. Day to day signature of the contractor representative shall be obtained in this register.
11. Premix carpet shall not be laid during rainy weather or when the base course is damp or wt. And when air temperature is lower than 16 degrees centigrade.
12. The base on which premix carpet is to be laid shall be thoroughly swept and scraped clean and free and dust and foreign matter.

13. The work shall consist of application of a single coat of bituminous material to an existing road surface preparatory to another bituminous construction. The temperature of bitumen at the time to application shall be in the rage of 163 degree centigrade to 177 centigrade.

14. Binder shall be heated to the temperature appropriate to the grade of bitumen use and approved by the Engineer – in – charge and sprayed on the base at the rate specified below. The rate of spread of straight run bitumen for tack coat shall be 5 Kg./ 10 Smt. Area for an existing B.T. surface. The binder shall be applied uniformly. The tack coat shall be applied just ahead of the on coming bituminous construction. In case carpet is to be laid on W.B.M. surface. Rate of spread of bitumen for tack coat will be 10 Kg / 10 Smt.

15. The binder content for premixing shall be 3.28 percent by weight of the total mix in less otherwise specified. The quantities of aggregates shall be sufficient to yield the specified thickness after compaction.

16. The contractor shall get the job mix formula the mix approved by the Engineer – In – Charge before the work. In order to obtain the required type of mix the department may change the proportion of bitumen and grading of aggregate and contractor shall have to collect the materials accordingly. In case of increase or decrease in proportion of bitumen increased and decreased quantity will be adjusted at the rate provided in Schedule – 'B' the contractor shall have the responsibility of ensuring proper proportioning of materials in accordance with the approved job mix formula and producing a uniform size.

17. Hot mix plant of adequate capacity and capable producing and uniform quality shall be used for preparing the mix. The plants may be either a batch type of a continues one, having a coordinated set of essential unit such as dryer for heating the aggregate, device for batching, feeding by weight or volume the required quantities of aggregate binder heating and control unit for metering out of the correct, quantity of heated binder together with a peddle mixer for intimate mixing of the binder and aggregates.

18. The hot mix plant shall confirm generally to I.S. specification No. IS : 3066 /1965 as amended from time to time and shall be equipped with following arrangements.

18.1 GOLD AGGREGATE FEEDER ::-

The cold aggregate feeder shall have minimum three independent birds of compartment, catch provided with acceptable mechanical means for feeding the aggregate at a uniform and predetermined rate to the cold elevator of same intermediate canyon of directly into the dryer. The feeder shall provided for the

adjustment to total and proportional feed and shall be capable for being locked if any setting.

18.2 DRYER ::-

At the discharge and of the dryer or any other suitable location, means shall be provided for ascertaining the temperature of the heated aggregates.

18.3 MIXER UNIT ::-

The plant shall included a continuous mixer of an approved twin shaft pug mill type capable of producing a uniform mix. If not enclosed, the mixer boss shall be equipped with a dust head prevent less of dust. These should be an independent arrangement to food mineral fillers directly in the pug mill, the hopper / bind for mineral filler shall provide for being locked if any setting.

18.4 SCREENING UNIT AND GRADATION CONRTROL ::-

The died aggregate shall be screened into the less than three size. The plant shall include means for accurately proportioning each pin, size of aggregate. The unit shall include a feeder mounted under the compartment bind. Each to form an office or proportioning the material draw mechanical adjustment and provided on each gate to opening in centimeters.

18.5 BITUMEN HEATING ::-

A Circulating system for the bitumen shall be provided of adequate capacity to provide for proper and continues circulation between storage tank and proportioning units during the entire operating period suitable arrangement tank and in the circulating system.

18.6 SYCHRONIGATION ::-

Synchronization of aggregate and bitumen feed satisfactory means shall be provided to afford positive interlocking control between the flow of bitumen from the tank to pug mill with mechanism of sprocket wheel which allows a fixed quantity of bitumen for an particular setting of the wheel.

19. The temperature of binder at the time of mixing shall be in the range of 150-163 degree centigrade and of aggregates in the range of 155 / 163 degree centigrade provided also that at no time shall the difference in temperature between the aggregate and the binder excess 14 degree centigrade. The viscosity at the time of mixing shall be 150 – 300 cst. (Centistockes) of 75 to 150 Sft. (Say bold fuel)

20. Mixing shall be through to ensure that the homogenous mixture is obtained in which all the particles of the aggregates are coated uniformly.

21. The mix shall be transported form the mixing plant to the point of useful in suitable vehicles. The vehicles employed for transport shall be clean and be covered over transit, if so directed by the Engineer – In – Charge.

22. The mix, transported form the Hot mix plant to site shall be spread by means of a self propelled mechanical pavers with suitable scores dupable of spreading. Temping and finishing the mix, true to specified grade, lines and cross section. The temperature of mix at the time to laying shall be in the range 110 / 135 degree centigrade.

23. Longitudinal joints and adage shall be constructed true to the delineating lines parallel to the centre line of the road Longitudinal joints shall be offset by at least 150 mm form those in binder course. All joints shall be out vertical to the full thickness of the previously laid mix and the surface painted with hot bitumen before placing fresh materials.

24. Immediately after the spreading of mix, it shall be thoroughly compacted by 80Kn to 100Kn stating weight Vibratory roller moving at spread not exceeding 5 KM. per hour, rolling te4mperature shall not less than 105 degree. In any case the rolling shall be complete before the temperature of their rolls to about 80 degrees centigrade.

25. The roller wheels be kept damp to prevent the mix from adhering to then but in no case shall fuel lubricating oil be use for this purpose. Rolling shall commence longitudinally from the edge and progress towards the center except on super elevated portions, it shall progress from the lower to upper parallel to the center line of the pavement. The roller should proceed on the fresh materials with rear of fixed wheel leading so as to minimize the pushing of mix and each pass of the roller shall uniformly overlap not less than one third of the track made in the proceeding pass. Rolling shall continue unless the entire surface has been rolled to compaction and all the roller marks eliminated.

26. Sand or stone dust flushing at the rate of 0.03 Cmt. / 10 Sq.Mt. shall be done on asphalt surface for which no separate payment will be made.

27. Traffic may be allowed immediately after completion of the final rolling when the mix has coiled down to the surrounding temperature.

28. Surface finish and quality control of work control of the quality of materials and work shall be exercise by the Engineer – In – Charge by carrying out the following test at the frequencies shown against each.

Sr. No.	TACK COAT	TEST	FREQUENCY
1	Tack coat	(I) Binder temperature application	At regular close intervals.

		(II) Rate of spread of binder	Two test per day.
2.	Premix carpet	(I) Aggregate Impact Value	One test per 100 cubic meter of aggregates as per GOVT Circular dt.9-94 Vide No.SSR/1092/IB-129-10(5)
		(II) Flakiness Index of aggregates	-do-
		(III) Striping Value	-do-
		(IV) Mix Grading	One set of test on individual consistent and mixed aggregates from the dryer for each 100 tonnes of mix sub a minimum of two tests per plant per day.
		(V) Control temperature of binder in boiler aggregates in the dryer and mix at the time of laying and rolling	At regular close intervals.
		(VI) Control of binder content and gradation in the mix (Binder content ,test vide (ASTMD 2172)	One test for each 100 tonnes of mix subject of two test of minimum of two test per day per plant.
		(VII) Rate of Spread of mixed materials.	Regular Control through checks ion layer thickness.

29 The contractor shall at all times carry out work on the highway in a manner creating least interference to the flow execution of the same. For all works involving improvement to the existing highway, the contractor shall in accordance with the directives of the Engineer – In – Charge provide and maintain during the execution of the work a passage of traffic either alone apart of the existing damage way under improvement.

30. In case of the improvement works, namely widening strengthening of the existing payment of reconstruction repairs to road drainage works. Where such works could be carried out on part width at time and the traffic could simultaneously be passed without under delay and difficulty on the other part. The road shoulder shall be dressed and brought in line with the payment and maintained throughout the duration of the work to the satisfaction of the Engineer – in – charge where work is in progress in continuous long structures passing places, at least 20 meter long and 6 meter wide included at half to one kilometer intervals as directed by the Engineer – In – Charge extra treatment to

shoulders where necessary should be given as ordered by the Engineer – In – Charge.

31. The contractor shall take all necessary measures for the safely of traffic during construction and provide erect and maintain such barricades including sing marking lights and flagmen as may be required by the Engineer – In – Charge for the information and protect to traffic approaching passing through the section of the highway under improvement. Before taking up any construction an agreed phase programmed for the control of traffic on the highway shall be drawn up in consultation with the Engineer – In – Charge.

32. The barricades erected on either sides on carriageways / portion of the carriageway closed to traffic should be strong to resist violation, and painted with alternate block and white stripes and lanterns of warning lights of similar type shall be mounted on the barricades at night and kept lit throughout iron sunset to sunrise. At the point where traffic is to deviate from its normal path the channel for traffic shall be clearly marked with aid of payment markings, painted Hot of a similar device to the direction of the Engineer – In – Charge. At night the passages shall be delineated with lanterns of other suitable light sources.

3.3 One way traffic operation shall established wherever the traffic is to be pas4ed over part of the carriageway in adequate for two lane traffic. This shall be done with the help of filament kept positioned on posited sides during all hours. For regulation of traffic. The flagmen shall be equipped with red and greed flags and lanterns lights. One both sides, suitable regulatory / warning sings shall installed for the guidance of road users. On each approach at least two signs shall be put up one close to the point where transistation of carriageway beings and the other 120 meters away. The signs shall be approved design and on refectory type so directed.

34. The payment shall be made on the tonnage basis of the weight of mix of aggregate and bitumen. For this purpose the contractor shall have to install a weight bridge of suitable capacity for type purpose of weigh tent of dumpers at suitable place at his cost as directed weight of empty dumper and weight of loaded dumper will be recorded in bound and numbered register on plant site.

For the purpose of application of tack cost if the critical area as per sanctioned estimate for basis for tonne differ with the actual area of work done in the field, then the reduction in or addition to payment shall have to be elected to the contractor prorate basis depending upon the area reduced or exceed respectively as per Govt. in R&B Department Circular No.SSR / 2080 / UB-647 / P-IV-928 (Date 21st Nov. 1986)

Department will be free to get some loaded dumpers test checked at other weight bridges. Weight bridge will be periodically got deliberated and verified from weight and measure authorities.

35. Weight of mix materials will be done in presence of responsible person, not less than rank of supervisor of department and the measurements shall be record by the Deputy Engineer or Senior Engineer of Supervisor, if so authorized Recorded of each dumper will be maintained separately in bound and numbered register which will be maintained by the departmental representatives and signed by the contractor. Proper gate pass system shall be established, for the vehicles coming to the plants site and out going from the plant site. The location of the hectometer in which individual dumpers are unloaded shall be recorded carefully.

36. The contractor unit rate for premixed carpet shall be paid in full for carrying out the required operation including full compensation for.

(1) Making arrangements of control and safety of traffic

(2) Preparation of base

(3) Providing all materials to be incorporated in the work with all lead and lifts

(4) All lab our, tools, equipment's and incidental to complete the work to the Specification.

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Item No. 15 Providing and laying seal coat with B.T. aggregate as specified using aggregate at the rate of 0.18 cum/10 sqmt and bitumen Vg-10 for mixing with aggregate at the rate of 4.5% i.e. 45.00 Kg/MT of total mix including heating and mixing in drum mix plant and spreading the same by paver finisher and consolidation with vibratory roller including necessary fire wood, oil, lubricants , labour charges using contractor's own drum mix plant, machineries and equipment , tools etc complete in accordance with the requirement of specification.

1.0 DESCRIPTION :-

The work shall consist of construction of premix seal coat as wearing course, on a previously prepared base, to the requirement to these specifications.

2.0 MATERIAL :-

2.1 Binder :- The binder shall be straight run bitumen of 60/70 or 80/100 grade satisfying the requirements of IS-73, the actual grade of the bidder to be used shall be decided by the Engineer-In-Charge and it shall have to be brought by Contractor to the site at his own cost unless otherwise provided in Schedule-A.

2.2 Coarse Aggregates :-The coarse aggregate shall consist of crushed stone of crushed gravel. These shall be strong, durable, of fairly cubical shape, free of distegrated pieces, organic or other deleterious matter and adherent coatings. The aggregates shall preferably be hydrophobic and of low porosity and shall satisfy the physical requirement set forth in Table given in Item 18 para 2.

2.3 Fine Aggregates :- The fine aggregates shall consist of crusher run screenings, natural sand or a mixture of both. These shall be clean, hard durable, uncoated, dry and free from injurious soft or flaky pieces and organic or deleterious substances.

2.4 Filler :- The filler, where required shall be an inert material the whole of which passes 600 micron sieve, at least 90 % passing 150 micron sieve and not less than 70 passing 75 micron sieve. The filler shall be cement stone dust, hydrated line, fly as or other non-plastic mineral matter approved by the Engineer-In-Charge.

2.5 Aggregate Gradation :- The mineral aggregates, including mineral filler, shall be so graded or combined as to confirm to the grading set firth in table below :-

TABLE AGGREGATE GRADATION FOR PRE MIX SEAL COAT

Sieve designation	Percentage by Wt. for Type – "A"	Passing the Sieve for Type – "B"
12.5 mm	--	100
10 mm	100	70-100
4.75 mm	40-85	20-40
2.35 mm	5-20	5-20
75 micron	0-4	0-4

2.6 Proportioning Of Materials :-

The bidder content for premixing shall be 5/10 Kg. per 10 Sqmt. area for type A surfacing or at rate of 45-0 Kg./M.T. i.e. 4.50 for mixing.

The Contractor shall get the job-mix formula for the mix approved by the Engineer-In-Charge before starting the work.

2.7 Variation In Proportioning Of Materials :-

The Contractor shall have the responsibility of ensuring proper proportioning of materials in accordance with the approved job-mix formula and producing a uniform mix A variation in binder content of + 0.3 % by weight of total mix shall, however, be permissible in individual specimens taken for quality control tests vide MOST specification section 900.

3.0 CONSTRUCTION OPERATION :-

3.1 Weather and seasonal Limitation :-

Pre-mix seal coat shall not be laid during rainy weather or when the surface is damp or wet.

3.2 Preparation of base :-

The base on which premix seal coat is to be laid shall be prepared shaped and conditioned to the specified lines, grade and cross sections in accordance with MOST Specification Clause 501 as directed by the Engineer –In – Charge. The surface – shall – be – thoroughly swept and scraped clean and free of dust and foreign matter.

3.3 Preparation of the mix :-

Drum mix plant of adequate capacity and capable of producing a proper and uniform quality shall be used for preparing the mix the plant shall be continuous type having co-ordinates set of essential units such as dryer for heating the aggregates, device for batching feeding of weight or volume the required quantities of aggregates, a binder heating and control unit for matering on the correct quantity of heated binder together with a paddle mixer for intimate may be remixing of the binder and aggregates. For details relating Drum Mix Plant Annexure – 'A' (See page no.) may be referred. The

temperature of binder at the time mixing shall be in the range of 150 C to 165 C and aggregates in the range of 155C to 163C provided also that at time shall the difference in temperature between the aggregates and the binder exceed 14 C. The viscosity at the time of mixing shall be 150 – 300 cst of 75 – 150 cst.

Mixing shall be through to ensure that a homogeneous mixture is obtained in which all the particles of the mineral aggregates are coated uniformly.

The mix shall be transported from the mixing plant to the point of use in suitable vehicles. The vehicles employed for transport shall be clean and be covered over in transit of so directed by the Engineer – In – Charge.

3.4 Spreading :-

The mix transported from the mix plant to the site, shall be spread by means of self – propelled mechanical paver with suitable screens capable of spreading tamping and finishing the mixture to specified grand lines and cross sections. The temperature of mix and the time of laying shall be in range 120 C – 163 C.

Longitudinal joints and edges shall be constructed true to the delineating lines parallel to the center line of the road. Longitudinal joints shall be offset by at least 150 mm from those in the binder course. All joints shall be out vertical to the full thickness of the previously laid mix and the surface painted with hot bitumen before placing fresh material.

3.6 **Rolling :-**

As soon as sufficient length has been covered with the premixed material the surface shall be rolled with 80 KN to 100 KN static weight smooth wheeled Rollers. Rolling shall be continued until the premixed material completely seal the voids in the bituminous course and a smooth uniform surface is obtained. Rolling temperature shall not be less then 100 C in any case the rolling shall be completed before the temperature of mix falls to above 80 C.

The roller wheel shall be dept damp to prevent the mix from adhering to them but in no case shall fuel lubricating oil be used for this purpose. Rolling shall commence longitudinally from the edge and progress towards the centre except that on superelativated portions, it shall progress from the lower to upper edge parallel to the center line of the pavement. The roller should proceed on the fresh material with rear or fixed wheel leading so as to minimize the pushing of the mix and each pass of the roller shall uniformly overlap not less than one third of the track made in the preceding pass. Rolling shall continue unit the entire surface has been rolled to compaction and all the roller mark eliminated.

4.0 OPENING TO TRAFFIC :-

Traffic may be allowed immediately after completion of the final rolling when the mix has cooled down to the surrounding temperature.

5.0 SURFACE FINISH AND QUALITY CONTROL OF ORK :-

The surface finish of construction shall conform to the requirement of MOST Specification Clause 901. Control on the quality of material and works shall be exercised by the Engineer-In-Charge in accordance with MOST Specification Clause 902.

6.0 ARRANGEMENT FOR TRAFFIC :-

The provisions of MOST Specification Clause 105 shall apply as regards the flowed traffic during construction.

7.0 MEASUREMENTS FOR PAYMENT :-

The payment shall be made on the tonnage basis of the weight of mix of aggregates and bitumen. For this purpose the Contractor shall have to install a weight bridge of suitable capacity for the purpose of weighment of dumpers at suitable place at his cost as directed. Weight of empty dumper and weight of loaded dumper will be recorded in bound and numbered register on plant site. Department will be free to get some loaded bumpers test checked at other weight bridge. Weight bridge will be periodically got calibrated and verified from weight and measure authorities.

Weight of mix materials will be done in presence of responsible person, not less than the rank of Supervisor of Department and the measurements shall be recorded by the Deputy Executive Engineer or Assistant Engineer or Addl. Assistant Engineer, if authorized. Record or each dumper will be maintained separately in Contractor. Proper gate pass system shall be established for the vehicles coming to the plant site and out going from the plant site. The location of the Km. hectometer and meter in which individual dumpers are unloaded will be recorded carefully.

8.0 RATE :-

The contact unit rate for seal coat shall be for payment in full for carrying out the required operations including full compensation for all components listed in MOST Specification Clause 503.8.

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Item No.16 Excavation for foundation in Dese or Hard Soil upto all depth including sorting out and stacking of useful materials and disposing off the excavated stuff upto all lead and lift.

1. Excavation for structures shall consist of the removal of material for the construction of foundations for culvers, retaining walls, cut of walls pope 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 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 the footing. The contractor at his own expense shall put up necessary shoring, strutting and planking or cut slopes to a safer angle of both with due-regard to the safety of persons and works and to 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 material encounter 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 flow, seepage springs, rain of other reasons, the contractor shall take adequate measures such as dialing, 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 of sudden rising of water level. The method to be accepted in this regard and other details there of 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 protection arrangements 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 any fresh concrete. No pumping shall be permitted during the placing of concrete of 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 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 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 to level. If there are any slips of 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 operations do not affect or damage adjoining structures.

9. Backfilling shall be done with approved material after concrete or masonry is fully 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 of 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 band, shall be stacked neatly on Government land as directed by Engineer-in-charge within 50 meter lead. Unsuitable and surplus materials not intended for use in any part of the road shall be disposed off as directed by Engineer-in-charge.

12. Excavation for structures shall be measured in cubic meters for each class of material encountered. Limited to the dimensions shown of the drawings or as directed by 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 of 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 placing the foundations including trimming of bottoms of exactions;
4. Foundation sealing, dewatering including pumping;
5. Backfilling, clearing up the site and disposal of all surplus material within all lifts and leads up to 100 meters;
6. All labour, materials, tools, equipment, safeguards and incidentals necessary to Complete the work to the specification.

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

The payment shall be made on Cum Basis.

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Item No. 17 Excavation for foundation in Hard murrum up to all depth including sorting out and stacking of useful materials and disposing off the excavated stuff upto all elad and lift.

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 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 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 persons 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 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 flow, seepage springs, rain or other 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 water level. The method to be accepted in this regard and other details there of 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 protection arrangements 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 any fresh concrete. No pumping shall be permitted during 'he 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 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 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 lights at night to avoid accidents. The contractor shall be required to take adequate protective measures to see that the excavation operations do not affect or damage adjoining structures.

9. Backfilling shall be done with approved material after concrete or masonry, is fully set and carried out I in such a way as not to cause under thrust on any part of the structure. All space between foundation masonry or I 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 en- countered, 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 of excavation for structures shall be paid in full for carrying out the required operations including.

1 Setting Out

2. Construction of necessary shoring and braching and their subsequent removal:
3. Removal of all logs stumps, grubs and other deleterious matter and obstructions 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 material within all lifts and leads upto 100 metres;
6. All labour, materials, tools, equipment, safeguards and incidentals necessary to complete the work to the specification.

14. Excavation shall be in hard murrum 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 diametre in any one direction between 75 and 300 mm 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.

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Item No.18 Excavation for foundation in Hard Murrum and boulders and very stiff or sitcky clay and other similar strata including sorting , strulting , dewatering as necessary and disposing of excavated stuff as directed upto all lead and lift.

1. Excavation for structure 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 specification and the lines and dimensions shown on the drawings or as indicated by the Engineer-in-charge. The work shall be 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 excavation backfilling and clearing up to site disposal of all surplus materials.

2. After the site has been cleared the limits of excavation shall be set out true to lines, curves slopes grade and sections as shown on the drawing or as directed by the Engineer-in-charges. The Contractor shall provide all labour, survey instruments and materials such as strings, page nails bamboos stones lime, mortar, and concrete etc. required in connection with the sitting out of works and the establishment of benchmark centre line stones and other marks 0and stakes as long as in the opinion of the Engineer-in-charges, they are required for the work.

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

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 charges, 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, springs, rain or other reasons the contractor shall take adequate measures such as balling pumping to keep the foundation trenches dry when so required and to protect the green concrete / masonary against damage by erosion or sudden rushing of

water level. The methods to be adopted in this regard and other details there of shall be left to the choice of the contractor but subjects 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 form 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 or other similar means.

7. The bottom of the foundation shall be levelled both longitudinally and transversely or stepped as directed by the Engineer-in-charges. Before footing is liad, the surface be slightly watered and rammed. In the event of excavation having been made deeper than shown on the drawings or ad otherwise ordered by the Engineer-in-charges, the extra depth shall be made up with concrete of masonary of the foundation grade at the cost of the contractor. Ordinary filling shall not be used the purpose 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 lights 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 masonary is fully set and carried out in such a way as not to cause undue trust on any part of the structure. All space between foundation masonary or concrete and the sides of excavation shall be refilled to the original surface, making due allowance for settlement in 250mm. loose layers, which shall be watered and compacted.

10. All the excavation materials shall be the property of the Government. Where the excavation materials is to 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-charges within 100 metres lead. Unsuitable and surplus materials not intended for use shall be disposed off as directed by the Engineer-in-charges.

12. Excavation for structure shall be measured in cubic metres for each class of materials encountered 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 structure shall be paid in full for carrying out the required operation including.

    1. Setting out and fixing bench marks and centre lines stones.

    2. Construction of necessary shoring and bracing and their subsequent removel.

    3. Removal of all logs, stumps. Grubs and other deleterious matter and obstructions for placing the foundation 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 upto 100 metres.
    6. All labour materials, tools, equipment, safeguards and incidentals necessary to complete the work to the specification.

14. Excavation shall be in hard soil such as stiff heavy clay 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.

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Item No.19 Excavation in large boulders and soft rock by welding including shoring, strutting and dewatering as necessary and disposing of the excavated stuff as directed upto all lead and lift.

1. Excavation for structure 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 specification and the lines and dimensions shown on the drawings or as indicated by the Engineer-in-charge. The work shall be 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 excavation backfilling and clearing up to site disposal of all surplus materials.

2. After the site has been cleared the limits of excavation shall be set out true to lines, curves slopes grade and sections as shown on the drawing or as directed by the Engineer-in-charges. The Contractor shall provide all labour, survey instruments and materials such as strings, page nails bamboos stones lime, mortar, and concrete etc. required in connection with the sitting out of works and the establishment of benchmark centre line stones and other marks 0and stakes as long as in the opinion of the Engineer-in-charges, they are required for the work.

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

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 charges, 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, springs, rain or other reasons the contractor shall take adequate measures such as balling pumping to keep the foundation trenches dry when so required and to protect the green concrete / masonary against damage by erosion or sudden rushing of water level. The methods to be adopted in this regard and other details there of

shall be left to the choice of the contractor but subjects 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 form 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 or other similar means.

7. The bottom of the foundation shall be levelled both longitudinally and transversely or stepped as directed by the Engineer-in-charges. Before footing is liad, the surface be slightly watered and rammed. In the event of excavation having been made deeper than shown on the drawings or ad otherwise ordered by the Engineer-in-charges, the extra depth shall be made up with concrete of masonary of the foundation grade at the cost of the contractor. Ordinary filling shall not be used the purpose 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 lights 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 masonary is fully set and carried out in such a way as not to cause undue trust on any part of the structure. All space between foundation masonary or concrete and the sides of excavation shall be refilled to the original surface, making due allowance for settlement in 250mm. loose layers, which shall be watered and compacted.

10. All the excavation materials shall be the property of the Government. Where the excavation materials is to 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-charges within 100 metres lead. Unsuitable and surplus materials not intended for use shall be disposed off as directed by the Engineer-in-charges.

12. Excavation for structure shall be measured in cubic metres for each class of materials encountered 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 structure shall be paid in full for carrying out the required operation including.

1. Setting out and fixing bench marks and centre lines stones.

2. Construction of necessary shoring and bracing and their subsequent removel.

3. Removal of all logs, stumps. Grubs and other deleterious matter and obstructions for placing the foundation 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 upto 100 metres.

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

14. Excavation shall be in hard soil such as stiff heavy clay 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 and300mm. 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.

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Item No.20 Excavation in hard rock by dry-wet prohibited blasting and chiselling including dewatering preparing foundation base by proper benching and stepping and disposing of the excavated stuff as directed up to all lead and lift.

1. Excavation for structure 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 specification and the lines and dimensions shown on the drawings or as indicated by the Engineer-in-charge. The work shall be 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 excavation backfilling and clearing up to site disposal of all surplus materials.
2. After the site has been cleared the limits of excavation shall be set out true to lines, curves slopes grade and sections as shown on the drawing or as directed by the Engineer-in-charges. The Contractor shall provide all labour, survey instruments and materials such as strings, page nails bamboos stones lime, mortar, and concrete etc. required in connection with the sitting out of works and the establishment of benchmark centre line stones and other marks 0and stakes as long as in the opinion of the Engineer-in-charges, they are required for the work.
3. Excavation shall be taken to the with of the lowest step of the footing. The Contractor at his own expense shall put up to necessary shoring strutting and planking or cut slopes to a safer angle or both with due regard to the safety of personal and works to the satisfaction of the Engineer-in-charges.
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 charges, 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, springs, rain or other reasons the contractor shall take adequate measures such as balling pumping to keep the foundation trenches dry when so required and to protect the green concrete / masonary against damage by erosion or sudden rushing of water level. The methods to be adopted in this regard and other details there of shall be left to the choice of the contractor but subjects 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 form 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 or other similar means.
7. The bottom of the foundation shall be levelled both longitudinally and transversely or stepped as directed by the Engineer-in-charges. Before footing is liad, the surface be slightly watered and rammed. In the event of excavation having been made deeper than shown on the drawings or ad otherwise ordered by the Engineer-in-charges, the extra depth shall be made up with concrete of masonary of the foundation grade at the cost of the contractor. Ordinary filling shall not be used the purpose 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 lights 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 masonary is fully set and carried out in such a way as not to cause undue trust on any part of the structure. All space between foundation masonary or concrete and the sides of excavation shall be refilled to the original surface, making due allowance for settlement in 250mm. loose layers, which shall be watered and compacted.
10. All the excavation materials shall be the property of the Government. Where the excavation materials is to 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-charges within 100 metres lead. Unsuitable and surplus materials not intended for use shall be disposed off as directed by the Engineer-in-charges.
12. Excavation for structure shall be measured in cubic metres for each class of materials encountered 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 structure shall be paid in full for carrying out the required operation including.

    1. Setting out and fixing bench marks and centre lines stones.

    2. Construction of necessary shoring and bracing and their subsequent removel.

    3. Removal of all logs, stumps. Grubs and other deleterious matter and obstructions for placing the foundation 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 upto 100 metres.

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

14. Excavation shall be in any rock or boulders for which the use of mechanical plant for 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 explosives 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. In the opinion of the Engineer-in-charge where blasting is prohibited for any reason excavation shall be carried out by chiseling wedging or any other agreed method.

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

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

18. The magazine for the storage of explosives shall be built to the designs and specifications of the Explosives Department concerned and located at the approval site No unauthorized person shall be admitted into the magzine which when not in use shall bbe kept securely locked No. matches or inflammable material shall be allowed in the magazine The magazine shall have an effective lightning conductor The following shall be hang 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 upto date stock in the magazine

(c) A certificate shadowing 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 predations 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 equipments used for blasting operations shall be approved type. The Engineer-in-charge may specify the type of explosives 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 denfinitely known to permit such a safe length being cut as will permit sufficient time to the fires or reach safely before explosion takes place. Detonators shall be capable of giving effective blasting of the explosives. The blasting powder explosives detonators etc. ashalt be fresh and not damaged due to dump moisture or other cause. They shall be inspected totally and removed immediately.

21. The blasting operation shall remain in the charge of competent and experienced supervisor and workmen who are thoroughly acquainted with the handling explosives and blasting operations.

22. The blasting shall be carried out during fixed hours of the day preferably during the midday lunch hour or at the close of the works 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 prominently in all directions during the blasting operations people exept those who actually light the fuse shall be prohibited from entering this areas The flags shall be planted 200 meters from the blasting site in all directions and all persons including workmen shall be exexluded from the flagged area at least 10 minutes before the firing a warning whistle being sounded for the purpose.

24. The enlarge holes shall be drilled to required depths and in suitable places. Blasting should be as light as possible consistent with through breakge of the material necessary for economic loading and hauling. Any method of blasting which leads to overshooting shall be discontinued .

25. When blasting is done with powder th fuse cut the required length shall be inserted into the hole and powder dropped in. The powder shall be gently tampered with copper roads with rounded ends. The explosive powder shall then, be covered with tamping materials which shall be tampered 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 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 debris and explosive inserted. The space of about 20 cm. above the charge shall then be gently filled with dry clay passed home and the rest of the tamping formed of any convenient material gently packed with a wooden hammer.

27. At a time not more than 10 such charges will be prepared and fired. The man in charge shall blow a whistle in a recognized manner for cautioning the people All the people shall then be required to safe distances The charge shall be lighted by the man in charge only The mean in charge shall cont the numbers explosions He shall satisfy himself that all the charges have been exploded before allowing the workmen to go back top the work site.

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

(1) Sufficient time shall be allowed to account for the delayed blast. The man in charge shall inspect all the charges and determine the missed charges.

(2) If it is the blasting powder charge it shall be completely flooded with water A new hole shal be drlled ar about 45 cm from the old hole and fired. This should blast the old charge should it not blast the old charge the procedure shall be repeated till the old charge is blasted.

(3) In case of charges of gelatin dynamite etc the man in charge shall gently remove the tramping 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 30 cm of tamping and the direction then ascertained by placing a stick in the hole in the hole. Another hole may then be drilled 15 cm away and parallel of it. This hole shall then be charged and fired. The misfired hole should explode at the same time. The man in charge shall at once report to the contractor's office and Engineer-in charge all cases of the cause of the same and what steps were taken in connection therewith.

29. If a misifre has been found to be due to defective detonator or dynamite, the whole quantity in the box form which defective article was taken must be sent to the authority by the Engineer-in-charge for inspection ascertain wherever 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 Engineer-in-charge in the approved register and manner which shall be open to inspection by the Engineer-in-charge at all time.

31. Excavating shall be be measured after removal of the over burden by tacking cross sections at suitable intervals in the original position before the work starts and after it completion and computing the volumes in cuble meters by the methods of average end areas. Where it is not feasible to compute volumes by this method because of erratic locations of isolated deposits, the volumes shall be computed by other accepted methods. At the option of 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 mixing 40 percent deduction therefrom.

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Item No.21 Providing and fixing mild steel dowel bars 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. This item provides for necessary F-415 bars of 32 mm. dia. for anchoring in foundations strata as per detailed drawings and as directed by Engineer-in-charge. For this purpose, 100 mm holes shall be kept in steining itself at regular intervals as shown in drawing or as directed by Engineer-in-charge. The item includes transporting the bars to the site of work, handling, cutting, bending, hooking and placing the same in position as required as per drawing. The grout holes shall be not less than 100 mm. dia. The anchorage length of bars shall net be lass then 60 times dis. of bar. Grouting of grouthole shall be of 1:2 proportion (1 part of cement, 2 parts of sand) and shall be done under pressure as directed. These dowels bars shall be inserted through holes kept in the well staining to the bottom of the grout holes. Grout holes shall not be less than I Mt, in depth. In case, no dowel bars are ultimately decided to be provided in the holes of the staining kept for the purpose, the same shall be filled with the concrete of the same proportion as of well staining at the cost of the contractor.

2. Mode of measurement will be per Rmt. of dowel bar considered as from bottom of grout hole to the top of staining.

3. Unit rate includes cost of material, labour tools and plant and grouting the staining holes to complete the work.

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Item No.22 Providing and filling in foundation with ordinary Cement concrete M-100 mix and providing necessary vertical pin headers including formwork, vibrating, ramming and curing complete.

1. In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportions of cement, tine aggregates and coarse aggregates are specified by volume as given in table below for different grades of concrete designated as ordinary M. 100, M. 150, M.200 and M.250.
2. In the designation of a concrete mix, letter "M" refers to the mix and the number the specified 28 days works cube compressive strength of that mix on 150 mm cubes expressed in kg. / cm^2.
3. The ordinary concrete mix shall generally b6 specified by volume. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg of cement as 0.035 cubic metres 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 I.S.: 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 aggregate by volume per 50 Kg. / of cement to be taken as per sum of individual volume of fine and coarse aggregates, maximum**	**Proportion of fine aggregate to coarse aggregate.**	**Quantity of water per 50 Kg. of cement maximum.**
1	**2**	**3**	**4**	**5**
Ordinary	Liters			Liters
M-100	1:3:6	300	Generally 1 : 2	34
M-150	1:2:4	220	for aggregate	32
M-200	1:1 ½ :	160	to coarse	30
M-250	3	100	aggregate by	27
M-350	1 : 1 : 2		volume but subject to and upper limit of 1 : 1 ½ and a lower limit 1 : 3	

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

Example - For an average grading of fine aggregate (that is Zone II of I.S.: 383-1963) the proportions shall be 1:1.1/2, 1:2 and 1:3 for maximum size of aggregates 10 mm, 20 mm. and 40 mm. respectively (after carrying out sieve analysis).

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

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

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

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

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

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

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

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

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

11. When hand mixing is permitted by the Engineer-in-charge for small jobs or for certain other reasons. It shall be done on a smooth watertight platform large enough to allow efficient turning over of the ingredients of concrete before and

after adding water. Mixing platform shall be so arranged that no foreign material shall get mixed with concrete nor does the mixing water flow out. Cement in required number of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregate, which shall also be spread in a layer of uniform thickness on the mixing platform. Dry coarse and fine aggregate and cement shall then be mixed thoroughly by turning over to get a mixture of uniform colour. Enough water shall then be added gradually through a rose can and the mass turned over till a mix of required consistency is obtained. In hand mixing quantity of cement shall be increased by 10 per cent above that specified.

12. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed to be the Engineer-in-charge, the first batch of concrete from the mixer shall contain only two thirds of normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.
13. The method of transporting and placing concrete shall be approved by the Engineer-in-charge. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes places. All form work and reinforcement contained in it shall be cleaned and made free from standing water, dust, snow or ice immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the Engineer-in-charge has been obtained.

14. If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer-in-charge. Concreting being given, it shall proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly design agitators, operating continuously, when this time shall be within 2 hours of the addition of cement to the mix and within 30 minutes of its discharge from the agitator. Except where otherwise agreed to be the Engineer-in- charge, concrete shall be deposited in horizontal layers to neither a compacted depth of nor 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 13 mm layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened, all laitance shall be removed by scrubbing the 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 150 mm in thickness, and shall be well rammed against old work particular attention being given to corners and close spots.

16. All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrators, unless otherwise permitted by the Engineer-in-

charge for exceptional cases, such as concreting under water, where vibrators 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, frost and driving out process. It shall be covered with wet sacking, Hessian or other similar absorbent material approved by the Engineer-in-charge soon after the initial set, and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonary work over the foundation concrete may be started after 48 hours of it's laying but the curing of concrete shall be continued for a minimum period of 14 days.

18. From work shall include all temporary or permanent forms required for forming the concrete together with all temporary construction required for their support. Form work shall however be divided into following two distinct categories:
(1) Shuttering i.e., form work required for forming the concrete.
(2) Scaffolding i.e., form-work required for supporting shuttering.
Forms for shuttering shall be constructed only in metal suitably lined. Forms for scaffolding shall be constructed of metal. Both shuttering and scaffolding shall be or 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. Only steel formwork shall be used.

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 lines occurring during and after placing the concrete. Screw jacks or hard wood wedges where required shall be provided to make up any settlement in the formwork either before or during the placing of concrete. Suitable comber shall be provided in horizontal members of structure, specially in long spans to counteract the effects of any fixed as to provide for such camber. Forms shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections. Unless otherwise specified or directed, chambers or fillets of sizes 25 mm x 25 mm shall be provided at all angles of formwork to avoid sharp corners.

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

21. Special measures shall be taken to ensure that the form work does not hinder the shrinkage of concrete because without these cracking could occur before the from 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 pre stressed structures. Where there are re-entrant angles in the concrete sections the form work should be removed at those sections as soon as possible after the concrete has set in order to avoid cracking due to shrinkage of concrete. From work shall be tight enough to prevent any appreciable loss of cement during vibrations, suitable tolerances should be provided in the harm work, immediately before concreting all farms 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 for results obtained.

22. The Engineer-in-charge shall be informed in advance be 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 soffits 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 refuse the formwork, it shall be cleaned and made good to the satisfaction of the Engineer-in-charge.

23. Immediately after the removal of forms, all exposed bars or bolts passing through the Cement concrete member and used for shuttering or any other purpose shall be cut inside the cement concrete member to a depth of at lest 25 mm below the surface of the concrete and the resulting holes be filled by cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties and all other holes and depressions, honeycomb spots, broken edges or corners and other defects, shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry as consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which have been pointed shall be kept moist for a period of twenty four hours. If rock pockets/honeycombs, in the opinion of the Engineer-in-change 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 nay 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 up on 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.

Sr. No.	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	10 mm to 25 mm	80 mm
(ii)	Beams, slabs and columns simply reinforced	25 mm to 40 mm	100 mm to 120 mm
(iii)	Thin R.C.C. section or section with congested steel.	40 mm to 50 mm	125 mm to 150 mm

25. Works strength tests shall be made in accordance with I.S.: 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 meter, the minimum number of cubes can be reduced to 6 with the specific permission of the Engineer-in-charge. Similar works tests shall be carried out whenever the quality and grading of materials is charged irrespective of the quantity of concrete proud. 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 specifies strength.

27. R.C.C. work shall have exposed concrete surface. Centering design and its erection shall approved by he 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 provide so that steel reinforcement in position is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, Kapchi or metal pieces shall not be used for this purpose. Concreting of important structural members shall always be done in the presence and under the supervision of departmental person not below the rank of Assistant Engineer / Additional Assistant 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 expressed 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 cumt basis of the finished work.

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

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Item No.23 Providing & casting in situ ordinary cement concrete M-200 mix and providing necessary pin headers including shuttering, scaffolding, laying, vibrating, curing and finishing complete without V-Groves for all height.

1. In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportions of cement, tine aggregates and coarse aggregates are specified by volume as given in table below for different grades of concrete designated as ordinary M. 100, M. 150, M.200 and M.250.
2. In the designation of a concrete mix, letter "M" refers to the mix and the number the specified 28 days works cube compressive strength of that mix on 150 mm cubes expressed in kg. / cm^2.
3. The ordinary concrete mix shall generally b6 specified by volume. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg of cement as 0.035 cubic metres 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 I.S.: 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 aggregate by volume per 50 Kg. / of cement to be taken as per sum of individual volume of fine and coarse aggregates, maximum**	**Proportion of fine aggregate to coarse aggregate.**	**Quantity of water per 50 Kg. of cement maximum.**
1	**2**	**3**	**4**	**5**
Ordinary	Liters			Liters
M-100	1:3:6	300	Generally 1 : 2	34
M-150	1:2:4	220	for aggregate	32
M-200	1:1 ½ :	160	to coarse	30
M-250	3	100	aggregate by	27
M-350	1 : 1 : 2		volume but subject to and upper limit of 1 : 1 ½ and a lower limit 1 : 3	

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

Example - For an average grading of fine aggregate (that is Zone II of I.S.: 383-1963) the proportions shall be 1:1.1/2, 1:2 and 1:3 for maximum size of aggregates 10 mm, 20 mm. and 40 mm. respectively (after carrying out sieve analysis).

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

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

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

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

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

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

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

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

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

11. When hand mixing is permitted by the Engineer-in-charge for small jobs or for certain other reasons. It shall be done on a smooth watertight platform large

enough to allow efficient turning over of the ingredients of concrete before and after adding water. Mixing platform shall be so arranged that no foreign material shall get mixed with concrete nor does the mixing water flow out. Cement in required number of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregate, which shall also be spread in a layer of uniform thickness on the mixing platform. Dry coarse and fine aggregate and cement shall then be mixed thoroughly by turning over to get a mixture of uniform colour. Enough water shall then be added gradually through a rose can and the mass turned over till a mix of required consistency is obtained. In hand mixing quantity of cement shall be increased by 10 per cent above that specified.

12. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed to be the Engineer-in-charge, the first batch of concrete from the mixer shall contain only two thirds of normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.
13. The method of transporting and placing concrete shall be approved by the Engineer-in-charge. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes places. All form work and reinforcement contained in it shall be cleaned and made free from standing water, dust, snow or ice immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the Engineer-in-charge has been obtained.

14. If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer-in-charge. Concreting being given, it shall proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly design agitators, operating continuously, when this time shall be within 2 hours of the addition of cement to the mix and within 30 minutes of its discharge from the agitator. Except where otherwise agreed to be the Engineer-in- charge, concrete shall be deposited in horizontal layers to neither a compacted depth of nor 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 13 mm layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened, all laitance shall be removed by scrubbing the 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 150 mm in thickness, and shall be well rammed against old work particular attention being given to corners and close spots.

16. All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrators, unless otherwise permitted by the Engineer-in-charge for exceptional cases, such as concreting under water, where vibrators 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, frost and driving out process. It shall be covered with wet sacking, Hessian or other similar absorbent material approved by the Engineer-in-charge soon after the initial set, and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonary work over the foundation concrete may be started after 48 hours of it's laying but the curing of concrete shall be continued for a minimum period of 14 days.

18. From work shall include all temporary or permanent forms required for forming the concrete together with all temporary construction required for their support. Form work shall however be divided into following two distinct categories:
(1) Shuttering i.e., form work required for forming the concrete.
(2) Scaffolding i.e., form-work required for supporting shuttering.
Forms for shuttering shall be constructed only in metal suitably lined. Forms for scaffolding shall be constructed of metal. Both shuttering and scaffolding shall be or 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. Only steel formwork shall be used.

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 lines occurring during and after placing the concrete. Screw jacks or hard wood wedges where required shall be provided to make up any settlement in the formwork either before or during the placing of concrete. Suitable comber shall be provided in horizontal members of structure, specially in long spans to counteract the effects of any fixed as to provide for such camber. Forms shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections. Unless otherwise specified or directed, chambers or fillets of sizes 25 mm x 25 mm shall be provided at all angles of formwork to avoid sharp corners.

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

21. Special measures shall be taken to ensure that the form work does not hinder the shrinkage of concrete because without these cracking could occur before the from 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 pre stressed structures. Where there are re-entrant angles in the concrete sections the form work should be removed at those sections as soon as possible after the concrete has set in order to avoid cracking due to shrinkage of concrete. From work shall be tight enough to prevent any appreciable loss of cement during vibrations, suitable tolerances should be provided in the harm work, immediately before concreting all farms 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 for results obtained.

22. The Engineer-in-charge shall be informed in advance be 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 soffits 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 refuse the formwork, it shall be cleaned and made good to the satisfaction of the Engineer-in-charge.

23. Immediately after the removal of forms, all exposed bars or bolts passing through the Cement concrete member and used for shuttering or any other purpose shall be cut inside the cement concrete member to a depth of at lest 25 mm below the surface of the concrete and the resulting holes be filled by cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties and all other holes and depressions, honeycomb spots, broken edges or corners and other defects, shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry as consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which have been pointed shall be kept moist for a period of twenty four hours. If rock pockets/honeycombs, in the opinion of the Engineer-in-change 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 nay declare the concrete defective and require the removal and replacement of the portions of the structure affected.

25. 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 up on 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.

Sr. No.	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	10 mm to 25 mm	80 mm
(ii)	Beams, slabs and columns simply reinforced	25 mm to 40 mm	100 mm to 120 mm
(iii)	Thin R.C.C. section or section with congested steel.	40 mm to 50 mm	125 mm to 150 mm

25. Works strength tests shall be made in accordance with I.S.: 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 meter, the minimum number of cubes can be reduced to 6 with the specific permission of the Engineer-in-charge. Similar works tests shall be carried out whenever the quality and grading of materials is charged irrespective of the quantity of concrete proud. 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 specifies strength.

27. R.C.C. work shall have exposed concrete surface. Centering design and its erection shall approved by he 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 provide so that steel reinforcement in position is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, Kapchi or metal pieces shall not be used for this purpose. Concreting of important structural members shall always be done in the presence and under the supervision of departmental person not below the rank of Assistant Engineer / Additional Assistant 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 expressed 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 cumt basis of the finished work.

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

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Item No.24 **Providing and casting in situ ordinary cement concrete M-200 for R.C.C. works in pier cap abutment cap and dirt wall including controlled cement concrete M-250 Bed block or pedestal or required size below bearings as per detailed drawings, centering, shuttering, scaffoldiring, wherever necessary, laying vibrating curing and finishing complete.**

1. In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportions of cement, tine aggregates and coarse aggregates are specified by volume as given in table below for different grades of concrete designated as ordinary M. 100, M. 150, M.200 and M.250.
2. In the designation of a concrete mix, letter "M" refers to the mix and the number the specified 28 days works cube compressive strength of that mix on 150 mm cubes expressed in kg. / cm^2.
3. The ordinary concrete mix shall generally b6 specified by volume. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg of cement as 0.035 cubic metres 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 I.S.: 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 aggregate by volume per 50 Kg. / of cement to be taken as per sum of individual volume of fine and coarse aggregates, maximum**	**Proportion of fine aggregate to coarse aggregate.**	**Quantity of water per 50 Kg. of cement maximum.**
1	**2**	**3**	**4**	**5**
Ordinary	Liters			Liters
M-100	1:3:6	300	Generally 1 : 2	34
M-150	1:2:4	220	for aggregate	32
M-200	1:1 ½ :	160	to coarse	30
M-250	3	100	aggregate by	27
M-350	1 : 1 : 2		volume but subject to and upper limit of 1 : 1 ½ and a lower limit 1 : 3	

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

Example - For an average grading of fine aggregate (that is Zone II of I.S.: 383-1963) the proportions shall be 1:1.1/2, 1:2 and 1:3 for maximum size of aggregates 10 mm, 20 mm. and 40 mm. respectively (after carrying out sieve analysis).

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

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

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

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

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

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

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

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

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

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

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

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

14. If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer-in-charge. Concreting being given, it shall proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly design agitators, operating continuously, when this time shall be within 2 hours of the addition of cement to the mix and within 30 minutes of its discharge from the agitator. Except where otherwise agreed to be the Engineer-in- charge, concrete shall be deposited in horizontal layers to neither a compacted depth of nor 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 13 mm layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened, all laitance shall be removed by scrubbing the 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 150 mm in thickness, and

shall be well rammed against old work particular attention being given to corners and close spots.

16. All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrators, unless otherwise permitted by the Engineer-in-charge for exceptional cases, such as concreting under water, where vibrators 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, frost and driving out process. It shall be covered with wet sacking, Hessian or other similar absorbent material approved by the Engineer-in-charge soon after the initial set, and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonary work over the foundation concrete may be started after 48 hours of it's laying but the curing of concrete shall be continued for a minimum period of 14 days.

18. From work shall include all temporary or permanent forms required for forming the concrete together with all temporary construction required for their support. Form work shall however be divided into following two distinct categories:
(1) Shuttering i.e., form work required for forming the concrete.
(2) Scaffolding i.e., form-work required for supporting shuttering.
Forms for shuttering shall be constructed only in metal suitably lined. Forms for scaffolding shall be constructed of metal. Both shuttering and scaffolding shall be or 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. Only steel formwork shall be used.

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 lines occurring during and after placing the concrete. Screw jacks or hard wood wedges where required shall be provided to make up any settlement in the formwork either before or during the placing of concrete. Suitable comber shall be provided in horizontal members of structure, specially in long spans to counteract the effects of any fixed as to provide for such camber. Forms shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections. Unless otherwise specified or directed, chambers or fillets of sizes 25 mm x 25 mm shall be provided at all angles of formwork to avoid sharp corners.

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

21. Special measures shall be taken to ensure that the form work does not hinder the shrinkage of concrete because without these cracking could occur before the from 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 pre stressed structures. Where there are re-entrant angles in the concrete sections the form work should be removed at those sections as soon as possible after the concrete has set in order to avoid cracking due to shrinkage of concrete. From work shall be tight enough to prevent any appreciable loss of cement during vibrations, suitable tolerances should be provided in the harm work, immediately before concreting all farms 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 for results obtained.

22. The Engineer-in-charge shall be informed in advance be 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 soffits 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 refuse the formwork, it shall be cleaned and made good to the satisfaction of the Engineer-in-charge.

23. Immediately after the removal of forms, all exposed bars or bolts passing through the Cement concrete member and used for shuttering or any other purpose shall be cut inside the cement concrete member to a depth of at lest 25 mm below the surface of the concrete and the resulting holes be filled by cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties and all other holes and depressions, honeycomb spots, broken edges or corners and other defects, shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry as consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which have been pointed shall be kept moist for a period of twenty four hours. If rock pockets/honeycombs, in the opinion of the Engineer-in-change 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 nay declare the concrete defective and require the removal and replacement of the portions of the structure affected.

26. 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 up on 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.

Sr. No.	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	10 mm to 25 mm	80 mm
(ii)	Beams, slabs and columns simply reinforced	25 mm to 40 mm	100 mm to 120 mm
(iii)	Thin R.C.C. section or section with congested steel.	40 mm to 50 mm	125 mm to 150 mm

25. Works strength tests shall be made in accordance with I.S.: 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 meter, the minimum number of cubes can be reduced to 6 with the specific permission of the Engineer-in-charge. Similar works tests shall be carried out whenever the quality and grading of materials is charged irrespective of the quantity of concrete proud. 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 specifies strength.

27. R.C.C. work shall have exposed concrete surface. Centering design and its erection shall approved by he 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 provide so that steel reinforcement in position is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, Kapchi or metal pieces shall not be used for this purpose. Concreting of important structural members shall always be done in the presence and under the supervision of departmental person not below the rank of Assistant Engineer / Additional Assistant 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 expressed 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 cumt basis of the finished work.

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

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Item No.25 Providing & laying weep hole in Aburtments, and returns by using A.C. pipe of 100mm including laying in proper grede and jointing the completed as per detailed specification.

1) General

The weep holes in the masonary / mass cement concrete of abutment and returns shall be provided of the A.C. 100 mm dia pipe. The pipe shall be fixed of suitable length and in full thickness of the masonary/concrete work. Necessary i.e. grating shall be provided on back side of abutment and returns on the inlet of opening of weep holes.

2) Materials :

The Absestose Cement pipes of 100 mm diameter specified in the description of this item shall confirm to I.S. 1626-1900. The interior of pipe shall have a smooth finish, regular surface and regular internal diameters.

3) The tolerance in all dim. Shall be as per I.S. 1926 – Part – I 1980.

4) The grating shall be C.I. 100 mm dia and as per I.R.C. Specification.

5) Workman ship :

The weep holes shall be provided at 1 MT. C/C and shall be placed in staggered. After laying weep holes, it shall be clear of earth and other materials from its complete length.

6) Payments:

The rate for payment of this items shall be on 1-No. basis of complete item.

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Item No.26 Providing and fixing in position Mild steel dowel bars in pier caps or abutment caps for anchorage in fixed end as per detailed drawings including cutting, bending and welding complete.

1. For HYSD bars conforming to FE-415 specifications for reinforcement shall apply.
2. The work shall consist of furnishing and placing reinforcement of the shape and dimensions shown on the drawings or as directed by the Engineer-in-charge.
3. Steel shall be clean and free from loose rust and loose milt scale at the time of fixing ill position and subsequent concreting.
4. Reinforcing steel conform accurately to the dimensions given in the Bar benden schedules shown on relevant drawings. Bars 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 a manner that will injure the material. Bars bent during transport or handling shall be straightened before being used on work; they shall be not heated to facilitate bending. Unless otherwise specified a 'U' type hook at the end of each bar shall invariably provided. The radius of the bend shall not be less than twice the diameter of the round bar and the length of the straight part of the bar beyond the end of the curve shall be at least four times the diameter of the round bar. In the case of bars which are not round and in the case of deformed bars, teb diameter shall be taken as the diameter of circle having an equivalent effective area. The nooks snail be suitably encased to prevent any spliting of the concrete.
5. All reinforcement oars shall be accurately placed in excat position shown on the drawings, and shall be securely held in position during placing of concrete by annealed binding wire not less than 1 mm. in size and conforming to IS : 280 and by using stay blocks or metal chairs, spacers, metal hangers supporting wires or other approved devices at sufficiently close intervals. Bars will not be allowed to sag between supports nor displaced during concreting or any other operation of the work. All devices used for positioning shall be of 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 progresses for adjusting bar spacing 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 blocks or other approved devices. Reinforcement after being placed in position shall be

maintained in a clean condition until completely embedded in concrete. Special care shall be exercised to prevent any desplacement of reinforcement in concrete already placed. To protect reinforcement from corrosion concrete cover shall be provided as indicated on the drawings. All bars proruding 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.

6. Bars crossing each other, where required, shall be secured by binding wire (annealed) of size not less than 1 mm. and conforming to IS : 280 in such a manner that they do not slip over each other at the time of fixing and concreting.

7. 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 bars shall not touch each other, but be kept apart by 25 mm. 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, and not less than 1 mm. thickness twisted tight. The overlaps shall be staggered for different bars and located at points, along the span where neither sphere nor bending moment is maximum.

8. Whenever indicated on the drawings or desired by the Engineer-in-charge bar shall be jointed by couplings which shall have a cross-section sufficient to transist the full stresses of bars. The ends of the bars that are jointed by couplings shall be upset for a sufficient length so that the effective cross-section at the base of threads is not less than the norman cross-section of the bar. Threads shall be standard white worth theads. Steel for coupling shall conform to IS : 226.

9. When permitted or specified on the drawings, joints of reinforcement bars shall be butt welded so as to transmit their full stresses. Welded joints shall preferably be located at points where steel not be subject to more than 75 per cent of the maximum permissible stresses and welds so staggered that, at any one section not more than 20 per cent of the rods are welded. Only electric are welding using a process which excludes air from the molten metal and conforms to any or all other 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 of tests shall be as directed by the Engineer-in-charge.

10. For the purpose of calculating consumption wastage shall not be permitted beyond 5 percent. Excess consumption over 5% will be charged at penal rate. Useful pieces of steel, as may be decided by the Engineer-in-charge shall be taken back by the Government at issue rate and at P.W.D. Store from where the steel was supplied. All the expenses of loading, carting, unloading and returning the waste will be borned by the contractors.

11. Reinforcement shall be measured in leveling incuring overlaps separately for different diameters as actually used in the work, where welding or coupling is restored to, in place of lap-joints, such joints shall be measured for payment as the, equivalent length of over-lap as per design requirement. From the length so measured the weight of reinforcement shall be calculated in tonnes on the same basis of IS : 1732 even though steel is supplied to the contractor by the Department on actual weighment. Length shall include hooks at ends, Wastage and annealed steel wire for binding shall not be measured and cost of these items shall be deemed to be included in the rates for reinforcement.

12. Rate for reinforcement shall include cost of all steel, its carting from P.W.D. Store to work site, cutting, bending, placing, binding and fixing in position as shown on the drawings end as directed by the Engineer-in-charge. It shall also include cost of all devices for keeping reinforcement in approved position, cost of jointing as per Approved methods, and all wastage and spacer bars.

13. The HYSD 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 as approved by Engineer-in-charge.

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

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

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Item No. 27 Providing and fixing in position Mild steel dowel bars in pier caps or abutments caps for anchorage in free end as per detailed drawing including cutting, bending and welding complete.

1. For HYSD bars conforming to FE-415 specifications for reinforcement shall apply.
2. The work shall consist of furnishing and placing reinforcement of the shape and dimensions shown on the drawings or as directed by the Engineer-in-charge.
3. Steel shall be clean and free from loose rust and loose milt scale at the time of fixing ill position and subsequent concreting.
4. Reinforcing steel conform accurately to the dimensions given in the Bar benden schedules shown on relevant drawings. Bars 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 a manner that will injure the material. Bars bent during transport or handling shall be straightened before being used on work; they shall be not heated to facilitate bending. Unless otherwise specified a 'U' type hook at the end of each bar shall invariably provided. The radius of the bend shall not be less than twice the diameter of the round bar and the length of the straight part of the bar beyond the end of the curve shall be at least four times the diameter of the round bar. In the case of bars which are not round and in the case of deformed bars, teb diameter shall be taken as the diameter of circle having an equivalent effective area. The nooks snail be suitably encased to prevent any spliting of the concrete.
5. All reinforcement oars shall be accurately placed in excat position shown on the drawings, and shall be securely held in position during placing of concrete by annealed binding wire not less than 1 mm. in size and conforming to IS : 280 and by using stay blocks or metal chairs, spacers, metal hangers supporting wires or other approved devices at sufficiently close intervals. Bars will not be allowed to sag between supports nor displaced during concreting or any other operation of the work. All devices used for positioning shall be of 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 progresses for adjusting bar spacing 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 blocks or other approved devices. Reinforcement after being placed in position shall be

maintained in a clean condition until completely embedded in concrete. Special care shall be exercised to prevent any desplacement of reinforcement in concrete already placed. To protect reinforcement from corrosion concrete cover shall be provided as indicated on the drawings. All bars proruding 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.

6. Bars crossing each other, where required, shall be secured by binding wire (annealed) of size not less than 1 mm. and conforming to IS : 280 in such a manner that they do not slip over each other at the time of fixing and concreting.

7. 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 bars shall not touch each other, but be kept apart by 25 mm. 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, and not less than 1 mm. thickness twisted tight. The overlaps shall be staggered for different bars and located at points, along the span where neither sphere nor bending moment is maximum.

8. Whenever indicated on the drawings or desired by the Engineer-in-charge bar shall be jointed by couplings which shall have a cross-section sufficient to transist the full stresses of bars. The ends of the bars that are jointed by couplings shall be upset for a sufficient length so that the effective cross-section at the base of threads is not less than the norman cross-section of the bar. Threads shall be standard white worth theads. Steel for coupling shall conform to IS : 226.

9. When permitted or specified on the drawings, joints of reinforcement bars shall be butt welded so as to transmit their full stresses. Welded joints shall preferably be located at points where steel not be subject to more than 75 per cent of the maximum permissible stresses and welds so staggered that, at any one section not more than 20 per cent of the rods are welded. Only electric are welding using a process which excludes air from the molten metal and conforms to any or all other 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 of tests shall be as directed by the Engineer-in-charge.

10. For the purpose of calculating consumption wastage shall not be permitted beyond 5 percent. Excess consumption over 5% will be charged at penal rate. Useful pieces of steel, as may be decided by the Engineer-in-charge shall be taken back by the Government at issue rate and at P.W.D. Store from where the steel was supplied. All the expenses of loading, carting, unloading and returning the waste will be borned by the contractors.

11. Reinforcement shall be measured in leveling incuring overlaps separately for different diameters as actually used in the work, where welding or coupling is restored to, in place of lap-joints, such joints shall be measured for payment as the, equivalent length of over-lap as per design requirement. From the length so measured the weight of reinforcement shall be calculated in tonnes on the same basis of IS : 1732 even though steel is supplied to the contractor by the Department on actual weighment. Length shall include hooks at ends, Wastage and annealed steel wire for binding shall not be measured and cost of these items shall be deemed to be included in the rates for reinforcement.

12. Rate for reinforcement shall include cost of all steel, its carting from P.W.D. Store to work site, cutting, bending, placing, binding and fixing in position as shown on the drawings end as directed by the Engineer-in-charge. It shall also include cost of all devices for keeping reinforcement in approved position, cost of jointing as per Approved methods, and all wastage and spacer bars.

13. The HYSD 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 as approved by Engineer-in-charge.

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

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

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Item No.28 Providing and casting in situ ordinary Cement concrete M-250 for R.C.C. solid slab including centering, scaffolding curing and finishing complete.

1. In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportions of cement, tine aggregates and coarse aggregates are specified by volume as given in table below for different grades of concrete designated as ordinary M. 100, M. 150, M.200 and M.250.
2. In the designation of a concrete mix, letter "M" refers to the mix and the number the specified 28 days works cube compressive strength of that mix on 150 mm cubes expressed in kg. / cm^2.
3. The ordinary concrete mix shall generally b6 specified by volume. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg of cement as 0.035 cubic metres 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 I.S.: 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 aggregate by volume per 50 Kg. / of cement to be taken as per sum of individual volume of fine and coarse aggregates, maximum**	**Proportion of fine aggregate to coarse aggregate.**	**Quantity of water per 50 Kg. of cement maximum.**
1	**2**	**3**	**4**	**5**
Ordinary	Liters			Liters
M-100	1:3:6	300	Generally 1 : 2	34
M-150	1:2:4	220	for aggregate	32
M-200	1:1 ½ :	160	to coarse	30
M-250	3	100	aggregate by	27
M-350	1 : 1 : 2		volume but subject to and upper limit of 1 : 1 ½ and a lower limit 1 : 3	

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

Example - For an average grading of fine aggregate (that is Zone II of I.S.: 383-1963) the proportions shall be 1:1.1/2, 1:2 and 1:3 for maximum size of aggregates 10 mm, 20 mm. and 40 mm. respectively (after carrying out sieve analysis).

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

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

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

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

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

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

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

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

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

11. When hand mixing is permitted by the Engineer-in-charge for small jobs or for certain other reasons. It shall be done on a smooth watertight platform large enough to allow efficient turning over of the ingredients of concrete before and

after adding water. Mixing platform shall be so arranged that no foreign material shall get mixed with concrete nor does the mixing water flow out. Cement in required number of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregate, which shall also be spread in a layer of uniform thickness on the mixing platform. Dry coarse and fine aggregate and cement shall then be mixed thoroughly by turning over to get a mixture of uniform colour. Enough water shall then be added gradually through a rose can and the mass turned over till a mix of required consistency is obtained. In hand mixing quantity of cement shall be increased by 10 per cent above that specified.

12. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed to be the Engineer-in-charge, the first batch of concrete from the mixer shall contain only two thirds of normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.
13. The method of transporting and placing concrete shall be approved by the Engineer-in-charge. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes places. All form work and reinforcement contained in it shall be cleaned and made free from standing water, dust, snow or ice immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the Engineer-in-charge has been obtained.

14. If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer-in-charge. Concreting being given, it shall proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly design agitators, operating continuously, when this time shall be within 2 hours of the addition of cement to the mix and within 30 minutes of its discharge from the agitator. Except where otherwise agreed to be the Engineer-in- charge, concrete shall be deposited in horizontal layers to neither a compacted depth of nor 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 13 mm layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened, all laitance shall be removed by scrubbing the 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 150 mm in thickness, and shall be well rammed against old work particular attention being given to corners and close spots.

16. All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrators, unless otherwise permitted by the Engineer-in-

charge for exceptional cases, such as concreting under water, where vibrators 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, frost and driving out process. It shall be covered with wet sacking, Hessian or other similar absorbent material approved by the Engineer-in-charge soon after the initial set, and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonary work over the foundation concrete may be started after 48 hours of it's laying but the curing of concrete shall be continued for a minimum period of 14 days.

18. From work shall include all temporary or permanent forms required for forming the concrete together with all temporary construction required for their support. Form work shall however be divided into following two distinct categories:
(1) Shuttering i.e., form work required for forming the concrete.
(2) Scaffolding i.e., form-work required for supporting shuttering.
Forms for shuttering shall be constructed only in metal suitably lined. Forms for scaffolding shall be constructed of metal. Both shuttering and scaffolding shall be or 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. Only steel formwork shall be used.

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 lines occurring during and after placing the concrete. Screw jacks or hard wood wedges where required shall be provided to make up any settlement in the formwork either before or during the placing of concrete. Suitable comber shall be provided in horizontal members of structure, specially in long spans to counteract the effects of any fixed as to provide for such camber. Forms shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections. Unless otherwise specified or directed, chambers or fillets of sizes 25 mm x 25 mm shall be provided at all angles of formwork to avoid sharp corners.

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

21. Special measures shall be taken to ensure that the form work does not hinder the shrinkage of concrete because without these cracking could occur before the from 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 pre stressed structures. Where there are re-entrant angles in the concrete sections the form work should be removed at those sections as soon as possible after the concrete has set in order to avoid cracking due to shrinkage of concrete. From work shall be tight enough to prevent any appreciable loss of cement during vibrations, suitable tolerances should be provided in the harm work, immediately before concreting all farms 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 for results obtained.

22. The Engineer-in-charge shall be informed in advance be 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 soffits 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 refuse the formwork, it shall be cleaned and made good to the satisfaction of the Engineer-in-charge.

23. Immediately after the removal of forms, all exposed bars or bolts passing through the Cement concrete member and used for shuttering or any other purpose shall be cut inside the cement concrete member to a depth of at lest 25 mm below the surface of the concrete and the resulting holes be filled by cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties and all other holes and depressions, honeycomb spots, broken edges or corners and other defects, shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry as consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which have been pointed shall be kept moist for a period of twenty four hours. If rock pockets/honeycombs, in the opinion of the Engineer-in-change 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 nay declare the concrete defective and require the removal and replacement of the portions of the structure affected.

27. 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 up on 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.

Sr. No.	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	10 mm to 25 mm	80 mm
(ii)	Beams, slabs and columns simply reinforced	25 mm to 40 mm	100 mm to 120 mm
(iii)	Thin R.C.C. section or section with congested steel.	40 mm to 50 mm	125 mm to 150 mm

25. Works strength tests shall be made in accordance with I.S.: 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 meter, the minimum number of cubes can be reduced to 6 with the specific permission of the Engineer-in-charge. Similar works tests shall be carried out whenever the quality and grading of materials is charged irrespective of the quantity of concrete proud. 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 specifies strength.

27. R.C.C. work shall have exposed concrete surface. Centering design and its erection shall approved by he 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 provide so that steel reinforcement in position is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, Kapchi or metal pieces shall not be used for this purpose. Concreting of important structural members shall always be done in the presence and under the supervision of departmental person not below the rank of Assistant Engineer / Additional Assistant 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 expressed 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 cumt basis of the finished work.

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

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Item No.29 Providing 12mm thick Pre-moulded asphalt filler joints as per drawings.

1. Open joints shall be constructed at the location as directed by 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 edges of the concrete at the joints shall be finished. Reinforcement shall not extend across as open joint.
2. When performed filler is to be provided the filler shall be placed in correct position before concrete is placed against the filler. The filler material shall form part of the joint and while concreting the slab. Care shall be taken to prevent the former from bring displaced. After the work is completed , the exposed face of the joint shall be cleaned of all loose material sticking to it.

3. The material using for filling expansion joint shall be bitumen impregnated felt which shall conform to the requirements of I S : 1838 , and shall be approved from 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 smt .The thickness of the expansion joint will be 12 mm.Width of the expansion joint shall be as equal to full depth of the slab.

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

The rate shall be made on sqm basis.

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Item No.30 Providing and casting in situ ordinary cement concrete M-250 for average 75 mm 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 proportions of cement, tine aggregates and coarse aggregates are specified by volume as given in table below for different grades of concrete designated as ordinary M. 100, M. 150, M.200 and M.250.
2. In the designation of a concrete mix, letter "M" refers to the mix and the number the specified 28 days works cube compressive strength of that mix on 150 mm cubes expressed in kg. / cm^2.
3. The ordinary concrete mix shall generally b6 specified by volume. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg of cement as 0.035 cubic metres 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 I.S.: 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 aggregate by volume per 50 Kg. / of cement to be taken as per sum of individual volume of fine and coarse aggregates, maximum**	**Proportion of fine aggregate to coarse aggregate.**	**Quantity of water per 50 Kg. of cement maximum.**
1	**2**	**3**	**4**	**5**
Ordinary	Liters			Liters
M-100	1:3:6	300	Generally 1 : 2	34
M-150	1:2:4	220	for aggregate	32
M-200	1:1 ½ :	160	to coarse	30
M-250	3	100	aggregate by	27
M-350	1 : 1 : 2		volume but subject to and upper limit of 1 : 1 ½ and a lower limit 1 : 3	

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

Example - For an average grading of fine aggregate (that is Zone II of I.S.: 383-1963) the proportions shall be 1:1.1/2, 1:2 and 1:3 for maximum size of aggregates 10 mm, 20 mm. and 40 mm. respectively (after carrying out sieve analysis).

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

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

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

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

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

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

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

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

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

11. When hand mixing is permitted by the Engineer-in-charge for small jobs or for certain other reasons. It shall be done on a smooth watertight platform large enough to allow efficient turning over of the ingredients of concrete before and

after adding water. Mixing platform shall be so arranged that no foreign material shall get mixed with concrete nor does the mixing water flow out. Cement in required number of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregate, which shall also be spread in a layer of uniform thickness on the mixing platform. Dry coarse and fine aggregate and cement shall then be mixed thoroughly by turning over to get a mixture of uniform colour. Enough water shall then be added gradually through a rose can and the mass turned over till a mix of required consistency is obtained. In hand mixing quantity of cement shall be increased by 10 per cent above that specified.

12. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed to be the Engineer-in-charge, the first batch of concrete from the mixer shall contain only two thirds of normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.
13. The method of transporting and placing concrete shall be approved by the Engineer-in-charge. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes places. All form work and reinforcement contained in it shall be cleaned and made free from standing water, dust, snow or ice immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the Engineer-in-charge has been obtained.

14. If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer-in-charge. Concreting being given, it shall proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly design agitators, operating continuously, when this time shall be within 2 hours of the addition of cement to the mix and within 30 minutes of its discharge from the agitator. Except where otherwise agreed to be the Engineer-in- charge, concrete shall be deposited in horizontal layers to neither a compacted depth of nor 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 13 mm layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened, all laitance shall be removed by scrubbing the 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 150 mm in thickness, and shall be well rammed against old work particular attention being given to corners and close spots.

16. All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrators, unless otherwise permitted by the Engineer-in-

charge for exceptional cases, such as concreting under water, where vibrators 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, frost and driving out process. It shall be covered with wet sacking, Hessian or other similar absorbent material approved by the Engineer-in-charge soon after the initial set, and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonary work over the foundation concrete may be started after 48 hours of it's laying but the curing of concrete shall be continued for a minimum period of 14 days.

18. From work shall include all temporary or permanent forms required for forming the concrete together with all temporary construction required for their support. Form work shall however be divided into following two distinct categories:
(1) Shuttering i.e., form work required for forming the concrete.
(2) Scaffolding i.e., form-work required for supporting shuttering.
Forms for shuttering shall be constructed only in metal suitably lined. Forms for scaffolding shall be constructed of metal. Both shuttering and scaffolding shall be or 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. Only steel formwork shall be used.

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 lines occurring during and after placing the concrete. Screw jacks or hard wood wedges where required shall be provided to make up any settlement in the formwork either before or during the placing of concrete. Suitable comber shall be provided in horizontal members of structure, specially in long spans to counteract the effects of any fixed as to provide for such camber. Forms shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections. Unless otherwise specified or directed, chambers or fillets of sizes 25 mm x 25 mm shall be provided at all angles of formwork to avoid sharp corners.

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

21. Special measures shall be taken to ensure that the form work does not hinder the shrinkage of concrete because without these cracking could occur before the from 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 pre stressed structures. Where there are re-entrant angles in the concrete sections the form work should be removed at those sections as soon as possible after the concrete has set in order to avoid cracking due to shrinkage of concrete. From work shall be tight enough to prevent any appreciable loss of cement during vibrations, suitable tolerances should be provided in the harm work, immediately before concreting all farms 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 for results obtained.

22. The Engineer-in-charge shall be informed in advance be 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 soffits 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 refuse the formwork, it shall be cleaned and made good to the satisfaction of the Engineer-in-charge.

23. Immediately after the removal of forms, all exposed bars or bolts passing through the Cement concrete member and used for shuttering or any other purpose shall be cut inside the cement concrete member to a depth of at lest 25 mm below the surface of the concrete and the resulting holes be filled by cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties and all other holes and depressions, honeycomb spots, broken edges or corners and other defects, shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry as consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which have been pointed shall be kept moist for a period of twenty four hours. If rock pockets/honeycombs, in the opinion of the Engineer-in-change 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 nay declare the concrete defective and require the removal and replacement of the portions of the structure affected.

28. 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 up on 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.

Sr. No.	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	10 mm to 25 mm	80 mm
(ii)	Beams, slabs and columns simply reinforced	25 mm to 40 mm	100 mm to 120 mm
(iii)	Thin R.C.C. section or section with congested steel.	40 mm to 50 mm	125 mm to 150 mm

25. Works strength tests shall be made in accordance with I.S.: 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 meter, the minimum number of cubes can be reduced to 6 with the specific permission of the Engineer-in-charge. Similar works tests shall be carried out whenever the quality and grading of materials is charged irrespective of the quantity of concrete proud. 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 specifies strength.

27. R.C.C. work shall have exposed concrete surface. Centering design and its erection shall approved by he 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 provide so that steel reinforcement in position is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, Kapchi or metal pieces shall not be used for this purpose. Concreting of important structural members shall always be done in the presence and under the supervision of departmental person not below the rank of Assistant Engineer / Additional Assistant 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 expressed 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 cumt basis of the finished work.

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

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Item No.31 Providing and casting in situ ordinary cement concrete M-200 for average 10 mm 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 proportions of cement, tine aggregates and coarse aggregates are specified by volume as given in table below for different grades of concrete designated as ordinary M. 100, M. 150, M.200 and M.250.
2. In the designation of a concrete mix, letter "M" refers to the mix and the number the specified 28 days works cube compressive strength of that mix on 150 mm cubes expressed in kg. / cm^2.
3. The ordinary concrete mix shall generally b6 specified by volume. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg of cement as 0.035 cubic metres 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 I.S.: 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 aggregate by volume per 50 Kg. / of cement to be taken as per sum of individual volume of fine and coarse aggregates, maximum	Proportion of fine aggregate to coarse aggregate.	Quantity of water per 50 Kg. of cement maximum.
1	2	3	4	5
Ordinary	Liters			Liters
M-100	1:3:6	300	Generally 1 : 2	34
M-150	1:2:4	220	for aggregate	32
M-200	1:1 ½ :	160	to coarse	30
M-250	3	100	aggregate by	27
M-350	1 : 1 : 2		volume but subject to and upper limit of 1 : 1 ½ and a lower limit 1 : 3	

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

Example - For an average grading of fine aggregate (that is Zone II of I.S.: 383-1963) the proportions shall be 1:1.1/2, 1:2 and 1:3 for maximum size of aggregates 10 mm, 20 mm. and 40 mm. respectively (after carrying out sieve analysis).

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

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

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

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

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

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

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

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

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

11. When hand mixing is permitted by the Engineer-in-charge for small jobs or for certain other reasons. It shall be done on a smooth watertight platform large enough to allow efficient turning over of the ingredients of concrete before and

after adding water. Mixing platform shall be so arranged that no foreign material shall get mixed with concrete nor does the mixing water flow out. Cement in required number of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregate, which shall also be spread in a layer of uniform thickness on the mixing platform. Dry coarse and fine aggregate and cement shall then be mixed thoroughly by turning over to get a mixture of uniform colour. Enough water shall then be added gradually through a rose can and the mass turned over till a mix of required consistency is obtained. In hand mixing quantity of cement shall be increased by 10 per cent above that specified.

12. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed to be the Engineer-in-charge, the first batch of concrete from the mixer shall contain only two thirds of normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.
13. The method of transporting and placing concrete shall be approved by the Engineer-in-charge. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes places. All form work and reinforcement contained in it shall be cleaned and made free from standing water, dust, snow or ice immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the Engineer-in-charge has been obtained.

14. If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer-in-charge. Concreting being given, it shall proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly design agitators, operating continuously, when this time shall be within 2 hours of the addition of cement to the mix and within 30 minutes of its discharge from the agitator. Except where otherwise agreed to be the Engineer-in- charge, concrete shall be deposited in horizontal layers to neither a compacted depth of nor 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 13 mm layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened, all laitance shall be removed by scrubbing the 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 150 mm in thickness, and shall be well rammed against old work particular attention being given to corners and close spots.

16. All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrators, unless otherwise permitted by the Engineer-in-

charge for exceptional cases, such as concreting under water, where vibrators 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, frost and driving out process. It shall be covered with wet sacking, Hessian or other similar absorbent material approved by the Engineer-in-charge soon after the initial set, and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonary work over the foundation concrete may be started after 48 hours of it's laying but the curing of concrete shall be continued for a minimum period of 14 days.

18. From work shall include all temporary or permanent forms required for forming the concrete together with all temporary construction required for their support. Form work shall however be divided into following two distinct categories:
(1) Shuttering i.e., form work required for forming the concrete.
(2) Scaffolding i.e., form-work required for supporting shuttering.
Forms for shuttering shall be constructed only in metal suitably lined. Forms for scaffolding shall be constructed of metal. Both shuttering and scaffolding shall be or 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. Only steel formwork shall be used.

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 lines occurring during and after placing the concrete. Screw jacks or hard wood wedges where required shall be provided to make up any settlement in the formwork either before or during the placing of concrete. Suitable comber shall be provided in horizontal members of structure, specially in long spans to counteract the effects of any fixed as to provide for such camber. Forms shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections. Unless otherwise specified or directed, chambers or fillets of sizes 25 mm x 25 mm shall be provided at all angles of formwork to avoid sharp corners.

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

21. Special measures shall be taken to ensure that the form work does not hinder the shrinkage of concrete because without these cracking could occur before the from 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 pre stressed structures. Where there are re-entrant angles in the concrete sections the form work should be removed at those sections as soon as possible after the concrete has set in order to avoid cracking due to shrinkage of concrete. From work shall be tight enough to prevent any appreciable loss of cement during vibrations, suitable tolerances should be provided in the harm work, immediately before concreting all farms 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 for results obtained.

22. The Engineer-in-charge shall be informed in advance be 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 soffits 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 refuse the formwork, it shall be cleaned and made good to the satisfaction of the Engineer-in-charge.

23. Immediately after the removal of forms, all exposed bars or bolts passing through the Cement concrete member and used for shuttering or any other purpose shall be cut inside the cement concrete member to a depth of at lest 25 mm below the surface of the concrete and the resulting holes be filled by cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties and all other holes and depressions, honeycomb spots, broken edges or corners and other defects, shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry as consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which have been pointed shall be kept moist for a period of twenty four hours. If rock pockets/honeycombs, in the opinion of the Engineer-in-change 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 nay declare the concrete defective and require the removal and replacement of the portions of the structure affected.

29. 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 up on 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.

Sr. No.	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	10 mm to 25 mm	80 mm
(ii)	Beams, slabs and columns simply reinforced	25 mm to 40 mm	100 mm to 120 mm
(iii)	Thin R.C.C. section or section with congested steel.	40 mm to 50 mm	125 mm to 150 mm

25. Works strength tests shall be made in accordance with I.S.: 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 meter, the minimum number of cubes can be reduced to 6 with the specific permission of the Engineer-in-charge. Similar works tests shall be carried out whenever the quality and grading of materials is charged irrespective of the quantity of concrete proud. 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 specifies strength.

27. R.C.C. work shall have exposed concrete surface. Centering design and its erection shall approved by he 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 provide so that steel reinforcement in position is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, Kapchi or metal pieces shall not be used for this purpose. Concreting of important structural members shall always be done in the presence and under the supervision of departmental person not below the rank of Assistant Engineer / Additional Assistant 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 expressed 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 cumt basis of the finished work.

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

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Item No.32 Providing and casting in situ ordinary cement concrete M-250 for approach slab including formwork curing and finishing complete.

1. In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportions of cement, tine aggregates and coarse aggregates are specified by volume as given in table below for different grades of concrete designated as ordinary M. 100, M. 150, M.200 and M.250.
2. In the designation of a concrete mix, letter "M" refers to the mix and the number the specified 28 days works cube compressive strength of that mix on 150 mm cubes expressed in kg. / cm^2.
3. The ordinary concrete mix shall generally b6 specified by volume. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg of cement as 0.035 cubic metres 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 I.S.: 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 aggregate by volume per 50 Kg. / of cement to be taken as per sum of individual volume of fine and coarse aggregates, maximum**	**Proportion of fine aggregate to coarse aggregate.**	**Quantity of water per 50 Kg. of cement maximum.**
1	**2**	**3**	**4**	**5**
Ordinary	Liters			Liters
M-100	1:3:6	300	Generally 1 : 2	34
M-150	1:2:4	220	for aggregate	32
M-200	1:1 ½ :	160	to coarse	30
M-250	3	100	aggregate by	27
M-350	1 : 1 : 2		volume but subject to and upper limit of 1 : 1 ½ and a lower limit 1 : 3	

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

Example - For an average grading of fine aggregate (that is Zone II of I.S.: 383-1963) the proportions shall be 1:1.1/2, 1:2 and 1:3 for maximum size of aggregates 10 mm, 20 mm. and 40 mm. respectively (after carrying out sieve analysis).

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

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

Sr. No.	**Item of Construction**	**Maximum nominal size**

		of coarse aggregate
(i)	R.C.C. well curb, R.C.C. well staining and R.C.C. pipes	40 mm.
(ii)	R.C.C. well staining	63 mm
(iii)	Well cap or pipe cap; solid type pipes abutment and wing-walls, and their pipe caps	40 mm
(iv)	R.C.C. works in cross girders deck slab, wearing coats, kerb, light posts, blast walls, approach slab etc. and hollow type piers, abutment, wing-walls and their pier caps.	20 mm
(v)	R.C.C. bearings	20 mm
(vi)	For any other item of construction not covered by items (i) to (v)	As specified on the drawing or as desired by the Engineer-in-charge in case it is not specified on drawing.

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

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

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

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

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

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

11. When hand mixing is permitted by the Engineer-in-charge for small jobs or for certain other reasons. It shall be done on a smooth watertight platform large enough to allow efficient turning over of the ingredients of concrete before and after adding water. Mixing platform shall be so arranged that no foreign material

shall get mixed with concrete nor does the mixing water flow out. Cement in required number of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregate, which shall also be spread in a layer of uniform thickness on the mixing platform. Dry coarse and fine aggregate and cement shall then be mixed thoroughly by turning over to get a mixture of uniform colour. Enough water shall then be added gradually through a rose can and the mass turned over till a mix of required consistency is obtained. In hand mixing quantity of cement shall be increased by 10 per cent above that specified.

12. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed to be the Engineer-in-charge, the first batch of concrete from the mixer shall contain only two thirds of normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.
13. The method of transporting and placing concrete shall be approved by the Engineer-in-charge. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes places. All form work and reinforcement contained in it shall be cleaned and made free from standing water, dust, snow or ice immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the Engineer-in-charge has been obtained.

14. If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer-in-charge. Concreting being given, it shall proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly design agitators, operating continuously, when this time shall be within 2 hours of the addition of cement to the mix and within 30 minutes of its discharge from the agitator. Except where otherwise agreed to be the Engineer-in- charge, concrete shall be deposited in horizontal layers to neither a compacted depth of nor 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 13 mm layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened, all laitance shall be removed by scrubbing the 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 150 mm in thickness, and shall be well rammed against old work particular attention being given to corners and close spots.

16. All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrators, unless otherwise permitted by the Engineer-in-charge for exceptional cases, such as concreting under water, where vibrators

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, frost and driving out process. It shall be covered with wet sacking, Hessian or other similar absorbent material approved by the Engineer-in-charge soon after the initial set, and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonary work over the foundation concrete may be started after 48 hours of it's laying but the curing of concrete shall be continued for a minimum period of 14 days.

18. From work shall include all temporary or permanent forms required for forming the concrete together with all temporary construction required for their support. Form work shall however be divided into following two distinct categories:
(1) Shuttering i.e., form work required for forming the concrete.
(2) Scaffolding i.e., form-work required for supporting shuttering.
Forms for shuttering shall be constructed only in metal suitably lined. Forms for scaffolding shall be constructed of metal. Both shuttering and scaffolding shall be or 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. Only steel formwork shall be used.

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 lines occurring during and after placing the concrete. Screw jacks or hard wood wedges where required shall be provided to make up any settlement in the formwork either before or during the placing of concrete. Suitable comber shall be provided in horizontal members of structure, specially in long spans to counteract the effects of any fixed as to provide for such camber. Forms shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections. Unless otherwise specified or directed, chambers or fillets of sizes 25 mm x 25 mm shall be provided at all angles of formwork to avoid sharp corners.

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

21. Special measures shall be taken to ensure that the form work does not hinder the shrinkage of concrete because without these cracking could occur before the from 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 pre stressed structures. Where

there are re-entrant angles in the concrete sections the form work should be removed at those sections as soon as possible after the concrete has set in order to avoid cracking due to shrinkage of concrete. From work shall be tight enough to prevent any appreciable loss of cement during vibrations, suitable tolerances should be provided in the harm work, immediately before concreting all farms 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 for results obtained.

22. The Engineer-in-charge shall be informed in advance be 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 soffits 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 refuse the formwork, it shall be cleaned and made good to the satisfaction of the Engineer-in-charge.

23. Immediately after the removal of forms, all exposed bars or bolts passing through the Cement concrete member and used for shuttering or any other purpose shall be cut inside the cement concrete member to a depth of at lest 25 mm below the surface of the concrete and the resulting holes be filled by cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties and all other holes and depressions, honeycomb spots, broken edges or corners and other defects, shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry as consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which have been pointed shall be kept moist for a period of twenty four hours. If rock pockets/honeycombs, in the opinion of the Engineer-in-change 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 nay declare the concrete defective and require the removal and replacement of the portions of the structure affected.

30. 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 up on 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.

Sr. No.	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	10 mm to 25 mm	80 mm
(ii)	Beams, slabs and columns simply reinforced	25 mm to 40 mm	100 mm to 120 mm
(iii)	Thin R.C.C. section or section with congested steel.	40 mm to 50 mm	125 mm to 150 mm

25. Works strength tests shall be made in accordance with I.S.: 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 meter, the minimum number of cubes can be reduced to 6 with the specific permission of the Engineer-in-charge. Similar works tests shall be carried out whenever the quality and grading of materials is charged irrespective of the quantity of concrete proud. 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 specifies strength.

27. R.C.C. work shall have exposed concrete surface. Centering design and its erection shall approved by he 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 provide so that steel reinforcement in position is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, Kapchi or metal pieces shall not be used for this purpose. Concreting of important structural members shall always be done in the presence and under the supervision of departmental person not below the rank of Assistant Engineer / Additional Assistant 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 expressed 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 cumt basis of the finished work.

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

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Item No.33 Providing and laying in position FE 415 TMT bar reinforcement including cutting, bending, hooking and tying complete as per detailed drawings for all concrete items.

The work shall be carried out for all floor height with all lead and lift including cutting, bending and placing in position as per design or as directed by the Engineer-in-charge

1.0. GENERAL

This work shall consist of furnishing and placing coated, or uncoated or high strength deformed reinforcement. bars (intentioned) of the shape and dimensions shown on the drawings and conforming to these Specifications or as approved by the Engineer-in-charge.

2.0. MATERIAL

2.1. TMT Bars

Reinforcement may be either TMT tensile steel, high strength deformed bars. They may be uncoated or coated with epoxy or with approved protective coatings.

2.2. TMT bars reinforcement for RCC work shall conform IS 432 (Part II) 1966 and shall be of tested quality. It shall also comply with relevant part of IS 456-1966

2.3. All reinforcement shall be clean and free from dirt, paint, grease of oil. all scale or loose or thickrust at the time of placing

2.4. All steel shall be procured form original producers no re-rolled steel shall be incorporated in the work.

2.5. Only new steel shall be delivered to the site every bar shall be inspected before placing to its position and detective brittle or burnt bar shall be discarded cracked ends of bars shall be discarded

3.0. Pitch

3.1. Distance between bars shall be as specified in drawings and as directed by the Engineer in Charge all bars shall be place at an accurate distance from each other and shall be bind tightly to maintain the desired pitch Suitable means shall be provided for holding bars securely in position.

4.0. Binding wire

4.1. Mild steel binding wire shall be of 1.63 mm of 1.22 mm (16 to 18 gauge diameter and shall conform IS 280-1972.

4.2. The use of black wire will be permitted for binding reinforcement bars It shall be free form free form dirt, paint, grease of oil. oil scale or loose of thick rust and

any other undesirable coating which may prevent adhesion of cement mortar at the time of binding.

4.3. Only new binding wire shall be delivered to the site all binding wire shall be inspected before binding to its position and defective brittle, rusted, used wire, shall be discarded

5.0. PROTECTION OF REINFORCEMENT

5.1. Uncoated reinforcing steel shall be protected from rusting of chloride contamination. Reinforcement shall be free from rust, mortar, loose mill scale, grease, oil or paints. This may be ensured either by using reinforcement fresh from the factory or thoroughly cleaning all reinforcement to remove rust using any suitable method such as sand blasting, mechanical wire brushing. etc. as directed by the Engineer. Reinforcements shall be stored on bricks, racks of platforms and above the ground in a clean and dry condition and shall be suitably marked to facilitate inspection and identification.

5.2. Portions of uncoated reinforcing steel and dowels projection from concreate shall be protected within on week after initial placing of concrete with a brush coat of neat cement mixed with water to a consistency of thick paint. This coating shall be removed by lightly tapping with a hammer or other tool not more than one week before placing of the adjacent pour of concrete. Coated reinforcing steel shall be protected against damage to the coating. If the coating on the bars is damaged during transportation or handling and cannot be repaired, the same shall be rejected.

6.0. Workmanship

6.1. The work shall consist of furnishing and placing reinforcement to the shape and dimensions shown as on the drawings or as directed by The Engineer in charge,

6.2. Reinforcing steel shall conform accurate to the dimensions given in the bar bending schedules shown relevant drawing.

7.0. BENDING OF REINFORCEMENT

7.1. Bar bend g schedule shall be furnished by the Contractor and got approved by the Engineer before start of work.

7.2. Reinforcing steel shall conform to the dimensions and shapes given in the approved bar bending Schedules.

7.3. Bars shall be bent cold to the specified shape and dimensions or directed by the Engineer using a proper bar bender operated by hand power to obtain the correct radius of bends and shape.

Bar shall not be bent or straightened in a manner that will damage parent material or the coating bars bent during transport or handling shall. be

straightened before being used on work and shall not be heated to facilitate straightening.

8.0. PLACING OF REINFORCEMENT

8.1. The reinforcement cage should generally be fabricated in the yard at ground level. and then shifted and placed in position. The reinforcement shall be placed strictly, in accordance with the drawings and shall be assembled in position. only when structure is otherwise ready for placing of concrete. Prolonged time gap, between assembling of reinforcements and casting of concrete. which may result in rust formation of the surface. shall not be permitted.

8.2. Reinforcement bar shall be placed accurately in position as shown on the drawings. The bars, crossing one another shall be tied together at every intersection with binding wire (annealed). conforming to IS : 280 to make the skeleton of the reinforcement rigid such that the reinforcement does not get displaced during placing of concrete, or any other operation. The diameter of binding wire shall not be less than 1mm.

8.3. Bars shall be kept in position usually by the following methods:
In case of beam an slab construction. industrially produced polymer cover blocks of thickness equal to the specified cove shall be place between the bars and formwork subject to Satisfactory evidence that the polymer composition is not harmful to concrete and reinforcement. Cover blocks made of concrete may be permitted by the Engineer, provided they have the same strength and specification as those of the member.

8.4. In case of dowels for Columns and walls the vertical reinforcement shall be kept in position by means of timber templates with slots in them accurately, or with cover blocks tied to the Reinforcement Timber templates shall be removed after the concreting has progressed up to a level just below their location.

8.5. Layers of reinforcements shall be separated by spacer bars at approximately One meter intervals. The minimum diameter of spacer bars shall be 12 mm of : equal to maximum size of main reinforcement or maximum size of coarse aggregate. Whichever is greater. Horizontal reinforcement shall not be, allowed to sag between supports.

8.6. Necessary stays, blocks, metal chairs, spacers, metal hangers supporting wires etc, or other subsidiary, reinforcement shall be provided to fix the reinforcements firmly in its correct position.

8.7. Use of pebbles broken stone, metal pipe, brick, mortar or wooden blocks etc as devices for positioning reinforcement shall not be permitted.

8.8. Bars coated woth epoxy or any other approved protective coating shall be placed on supports that do not damage the coating. Supports shall be installed in a manner such that planes of weakness are not created in hardened concreate. The coated reinforcing steel shall be held in place by usse of plastic coated binding wires especially manufactured for the purpose.

8.9. placing and fixing of reinforcement shall be inspected and approved by the Engineer before concrete is deposited.

9.0. Lapping

9.1. All reinforcement shall be furnished in full lengths as indicated on the drawing. No splicing of bars, Except where shown on the drawing; will be permitted without approval of the Engineer. The lengths of splice shall be as indicated on drawing or as approved by the Engineer. Where practicable, overlapping bars shall not touch each other, and shall be kept apart by 25 mm or 1 1 1/4 times the maximum sized of coarse aggregate, whichever is greater, If this is not feasible. overlapping bars shall be bound with annealed steel binding wire, not less than 1 mm diameter and twisted tight in such a manner as to maintain minimum clear cover to the reinforcement from the concrete surface. Lapped splices shall be staggered or located at points, along the span where stresses are low.

10.0 Welding

10.1 Splicing by welding of reinforcement will be permitted only if detailed on the drawing or approved by the Engineer. Weld shall develop an ultimate strength equal to or greater than that of the bars connected.

10.2 While welding may be permitted for T.M.T. reinforcing bars conforming to IS:432, welding of deformed bars conforming to IS: 1786 shall in general be prohibited. Welding may be permitted in case of bars of other than S 240 grade including special. Welding grade of S 415 grade bars conforming to IS:1786, for which necessary chemical analysis has been secured and the carbon equivalent (CE) calculated from the chemical composition using the formula:

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mg + V}{5} + \frac{Ni + Cu}{15}$$

is 0.4 or less.

10.3 The method of welding shall conform to IS:2751 and IS:9417 and to any supplemental specifications to the satisfaction of the Engineer.

10.4 Bars shall be bent cold to the specified shape and dimensions or as directed by Engineer in charge using the proper bender tool, operated by hand or power to attain proper radius of bends. Bars shall not be bend or straightened in manner that will injure the material. Bars bent during transport or handling shall be

straightened before being used in the work. Bars shall not be heated to facilate bending.

10.5 Unless otherwise specified a 'U' type hook at the end of each bar shall invariably be provided to main reinforcement. The radius of the bane shall not be less than twice the diameter of the round bar and the length of the straight part of the bar beyond the end of the curve shall be at least four times of the diameter of the round bar. In case of bars which are not round and in case of deformed bars, the diameter shall be taken as the diameter of circle having an equivalent effective area. The hooks shall be suitably encased to prevent any spiting of the concrete.

10.6 All reinforcement bars shall be accurately placed in exact position shown on the drawings and shall be securely held in position during pacing of concrete by annealed binding wire not less than 1 mm in size and by using say blocks or metal chairs spacers, metal hangers, supporting wires or other approved devices at sufficiently close intervals, Bars shall not be allowed to seg between supports not displaced during concreting or any other operations of thw work All devices used for positioning shall be of not corrodible material wooden and metal supports shall not extended to the surface of the concrete, except where shown in drawings. Placing bars on layers of freshly laid concrete as the work progresses for adjusting bar spacing shall 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 pre-cast mortar blocks or other approved devices. Reinforcement after bending placed in position shall be maintained in a clean condition until completely embedded in concrete, Special care shall be exercised to prevent any displacement of reinforcement in concrete already placed. To prevent reinforcement from corrosion, concrete cover shall be provided as indicated on drawings. All bars protruding from concrete and to which other bars are to be sliced and which are likely to be exposed for a period exceeding 10 days shall be protected by a thick coat of neat cement grout.

10.7. 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 at the time of fixing and concreting.

As far 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 bars shall not touch each other, but kept apart by 25 mm Where no feasible overlapping bars shall be bound with annealed wires not less than 1 mm thick twisted tight. The overlaps shall be staggered for different

bars and located at points along the span where neither sheer not bending moments is maximum.

10.8. Whenever indicated on drawing of desired the Engineer in charge bars shall be jointed by coupling which shall have a cross section sufficient to transmit the full stresses of bars. The end of the bars that are jointed by coupling shall be upset for sufficient length so that the effective cross section at the base of threads is not less than the normal cross section of the bar. Threads shall be standards threads Steel for coupling shall conform to IS 226.

10.9. When permitted or specified on the drawings joints of reinforcement bars shall butt welded so as to transmit their full stresses Welded joints shall preferable by located at points when steel will not be subject to more than 75 percent of the maximum permissible stresses and welds so staggered that at any one section not more than 20 percent of the rods are welded Only electric are welding using a process which excludes air form the molten metal and conforms to any or other special provisions for the work shall be accepted Suitable means shall be provided for holding bars securely in position during welding It shall be ensured that no voids are left in welding and when welding is done in two or three stages previous surface shall be cleaned properly Ends of bars shall be cleaned of all loose scale rust stages 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 IS 814 Welded pieces of reinforcement shall be tested. Specimen shall be taken from the actual site and their number shall frequency to test shall be as directed by the Engineer in charge.

11.0 MODE OF MEASUREMENTS & PAYMENT

11.1 For the purpose of payment the bar shall be measured correct up to 10 mm length and weight payable works out at the rate specified below:

Sr. No.	Diameter of Steel	Weight of steel per running meter	Sr. No.	Diameter of Steel	Weight of steel per running meter
1	6 mm	0.22 Kg / Rmt	8	20 mm	2.47 Kg / Rmt
2	8 mm	0.39 Kg / Rmt	9	22 mm	2.98 Kg / Rmt
3	10 mm	0.62 Kg / Rmt	10	25 mm	3.85 Kg / Rmt
4	12 mm	0.89 Kg / Rmt	11	28 mm	4.83 Kg / Rmt
5	14 mm	1.21 Kg / Rmt	12	32 mm	6.32 Kg / Rmt
6	16 mm	1.58 Kg / Rmt	13	36 mm	7.99 Kg / Rmt
7	18 mm	2.00 Kg / Rmt	14	40 mm	9.86 Kg / Rmt

11.1. Excess consumption over 5% will be charged at penal rate.

11.2 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.

11.3. The contract unit rate for coated/uncoated reinforcement shall cover the cost of material, fabricating, transporting, storing, blending, 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.

11.4 The rate shall be for a unit of **One MT. basis of complete item.**

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Item No.34 Providing and laying - Fitter Media 600mm thick directed at the back of abutments, returns and wing walls as per detailed specifications.

1. Well graded pebbled or metal of 40 mm. to 63 mm. 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.	63 mm. to 40 mm.	90 mm.	100-00
		63 mm	85-100
		50 mm.	35-70
		40 mm.	00-15
		20 mm.	00-05

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

2. Materials shall be first stacked in boxed of 2 m. x 1½ m. x 0.5 m. size on fairly level ground and measured.

3. The measurement for payment shall be made on Sqmt. basis

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

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Item No.35 Providing parapet of cast in situ ordinary cement concrete M-200 as per detailed drawings with necessary reinforcement including, shuttering, laying vibrating and finishing to line and level complete.

1. Railings shall not be placed until the centering or false work for the span has been released and is self supporting,. The type of railing to be constructed shall be as shown on the drawing. The railing shall be carefully erected true the line and grade. Posts shall be tolerance not to exceed 6mm in 3 metres.

2. The portion of the railing or parapet which is to be casting in place shall be constructed in accordance with the relevant specification for reinforced cement concrete. Form shall either be of single width boards or shall be lined with suitable materials duly approved by the Engineer-in-charge From joints in plane surfaces will not be permitted. All moldings, panels in the finished work shall be constructed to the details shown no the drawings, All corners in the finished work shall be true, sharp and clean cut and shall be free from cracks, spell or other defects.

3. Railing shall be measured in running metres.

4. The rate of railing shall include the cost of all labour, material tools and plant required for doing the work complete in all respects in accordance with these specifications, and as shown on the drawing.

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Item No.36 Providing P.V.C. 100 mm diameter water spouts including necessary iron gratings as per drawings.

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

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

3. Measurement shall be per number of water of water spout fixed.

4. Unit rate includes cost of all materials labour and tools to complete the work.

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Item No.37 Providing & 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-Groves for up to all heights.

1. In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportions of cement, tine aggregates and coarse aggregates are specified by volume as given in table below for different grades of concrete designated as ordinary M. 100, M. 150, M.200 and M.250.
2. In the designation of a concrete mix, letter "M" refers to the mix and the number the specified 28 days works cube compressive strength of that mix on 150 mm cubes expressed in kg. / cm^2.
3. The ordinary concrete mix shall generally b6 specified by volume. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg of cement as 0.035 cubic metres 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 I.S.: 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 aggregate by volume per 50 Kg. / of cement to be taken as per sum of individual volume of fine and coarse aggregates, maximum**	**Proportion of fine aggregate to coarse aggregate.**	**Quantity of water per 50 Kg. of cement maximum.**
1	**2**	**3**	**4**	**5**
Ordinary	Liters			Liters
M-100	1:3:6	300	Generally 1 : 2	34
M-150	1:2:4	220	for aggregate	32
M-200	1:1 ½ :	160	to coarse	30
M-250	3	100	aggregate by	27
M-350	1 : 1 : 2		volume but subject to and upper limit of 1 : 1 ½ and a lower limit 1 : 3	

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

Example - For an average grading of fine aggregate (that is Zone II of I.S.: 383-1963) the proportions shall be 1:1.1/2, 1:2 and 1:3 for maximum size of aggregates 10 mm, 20 mm. and 40 mm. respectively (after carrying out sieve analysis).

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

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

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

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

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

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

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

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

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

11. When hand mixing is permitted by the Engineer-in-charge for small jobs or for certain other reasons. It shall be done on a smooth watertight platform large

enough to allow efficient turning over of the ingredients of concrete before and after adding water. Mixing platform shall be so arranged that no foreign material shall get mixed with concrete nor does the mixing water flow out. Cement in required number of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregate, which shall also be spread in a layer of uniform thickness on the mixing platform. Dry coarse and fine aggregate and cement shall then be mixed thoroughly by turning over to get a mixture of uniform colour. Enough water shall then be added gradually through a rose can and the mass turned over till a mix of required consistency is obtained. In hand mixing quantity of cement shall be increased by 10 per cent above that specified.

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

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

14. If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer-in-charge. Concreting being given, it shall proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly design agitators, operating continuously, when this time shall be within 2 hours of the addition of cement to the mix and within 30 minutes of its discharge from the agitator. Except where otherwise agreed to be the Engineer-in- charge, concrete shall be deposited in horizontal layers to neither a compacted depth of nor 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 13 mm layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened, all laitance shall be removed by scrubbing the 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 150 mm in thickness, and shall be well rammed against old work particular attention being given to corners and close spots.

16. All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrators, unless otherwise permitted by the Engineer-in-charge for exceptional cases, such as concreting under water, where vibrators 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, frost and driving out process. It shall be covered with wet sacking, Hessian or other similar absorbent material approved by the Engineer-in-charge soon after the initial set, and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonary work over the foundation concrete may be started after 48 hours of it's laying but the curing of concrete shall be continued for a minimum period of 14 days.

18. From work shall include all temporary or permanent forms required for forming the concrete together with all temporary construction required for their support. Form work shall however be divided into following two distinct categories:
(1) Shuttering i.e., form work required for forming the concrete.
(2) Scaffolding i.e., form-work required for supporting shuttering.
Forms for shuttering shall be constructed only in metal suitably lined. Forms for scaffolding shall be constructed of metal. Both shuttering and scaffolding shall be or 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. Only steel formwork shall be used.

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 lines occurring during and after placing the concrete. Screw jacks or hard wood wedges where required shall be provided to make up any settlement in the formwork either before or during the placing of concrete. Suitable comber shall be provided in horizontal members of structure, specially in long spans to counteract the effects of any fixed as to provide for such camber. Forms shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections. Unless otherwise specified or directed, chambers or fillets of sizes 25 mm x 25 mm shall be provided at all angles of formwork to avoid sharp corners.

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

21. Special measures shall be taken to ensure that the form work does not hinder the shrinkage of concrete because without these cracking could occur before the from 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 pre stressed structures. Where there are re-entrant angles in the concrete sections the form work should be removed at those sections as soon as possible after the concrete has set in order to avoid cracking due to shrinkage of concrete. From work shall be tight enough to prevent any appreciable loss of cement during vibrations, suitable tolerances should be provided in the harm work, immediately before concreting all farms 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 for results obtained.

22. The Engineer-in-charge shall be informed in advance be 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 soffits 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 refuse the formwork, it shall be cleaned and made good to the satisfaction of the Engineer-in-charge.

23. Immediately after the removal of forms, all exposed bars or bolts passing through the Cement concrete member and used for shuttering or any other purpose shall be cut inside the cement concrete member to a depth of at lest 25 mm below the surface of the concrete and the resulting holes be filled by cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties and all other holes and depressions, honeycomb spots, broken edges or corners and other defects, shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry as consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which have been pointed shall be kept moist for a period of twenty four hours. If rock pockets/honeycombs, in the opinion of the Engineer-in-change 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 nay declare the concrete defective and require the removal and replacement of the portions of the structure affected.

31. 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 up on 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.

Sr. No.	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	10 mm to 25 mm	80 mm
(ii)	Beams, slabs and columns simply reinforced	25 mm to 40 mm	100 mm to 120 mm
(iii)	Thin R.C.C. section or section with congested steel.	40 mm to 50 mm	125 mm to 150 mm

25. Works strength tests shall be made in accordance with I.S.: 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 meter, the minimum number of cubes can be reduced to 6 with the specific permission of the Engineer-in-charge. Similar works tests shall be carried out whenever the quality and grading of materials is charged irrespective of the quantity of concrete proud. 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 specifies strength.

27. R.C.C. work shall have exposed concrete surface. Centering design and its erection shall approved by he 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 provide so that steel reinforcement in position is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, Kapchi or metal pieces shall not be used for this purpose. Concreting of important structural members shall always be done in the presence and under the supervision of departmental person not below the rank of Assistant Engineer / Additional Assistant 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 expressed 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 cumt basis of the finished work.

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

******

Item No.38 **Providing and casting in situ ordinary trimix cement concrete M-250 for average 200mm thick road work laid as directed including adding super platisizer admixture of IS make and providing and laying M.S. side rail of road thickness with necessary nut bolts plates fixing as per width applying plate vibrator (electric or diesel) on channel compressor with vacuum dewatering system by using all necessary equipments and materials and machinery such as running screed vibrator on prelaid M.S. channel for leveling ,Vacume pump, floating and power towelling etc with filling the joints with bitumen as directed etc complete.**

The Work shall be carried out as per this tender item no. 37 except that concreting shall be done in M-250 grade and other changes as below.

I] MATERIALS :-

Water shall conform to M-1, Cement shall conform to M-3, Sand shall conform to M-6, Grit shall conform to M-8 and coarse aggregate shall conform to M-12, 200 Micron thick LDPE membrance shall be of approved quality. CONPLAST P-211 water reducing concrete materials shall be approved quality.

[II] WORKMANSHIP :-

Cutting for sub-base shall be done in proper grade and camber as directed by Engineer-in-Charge. Care must be taken that all slopes are evenly and truly dressed. Cutting shall be done instruction. Useful stuff shall be carefully stacked separately as directed. The stuff received from the cutting shall be utilized for filling cuts and correcting side slopes with all lead and lifts as directed.

Sub-base with M.C Metal & murrum shall be prepared as directed by Engineer-in-Charge.

Before placing concrete, a minimum 200-Micron thick plastic over the prepared sub-base as per instruction which act as a separation layer to protect the floor against humidity and capillary water from the earth.

11.5 thicker M-200 grade concrete is being placed over the prepared sub-base. Complast P-211 (Water reducing concrete admixture) @ 100Mt. per bag of cement and Recron-35 fibbers at 125 Gms. per bag of cement shall be use in M-200 concrete mix. The relevant Specification of Item No.5.8.2 (General

Specification for building) shall be followed for M-200 mix concrete and relevant specification No. 91(A) shall be followed form work required for concreting.

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.

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.

Immediately after dewatering, the surface is floated with a skim power floater as per instruction Engineer-in-Charge. The surface shall be prepared as per requirements and instructions. For smoother surface requirement, the surface is trowelled with same machine mounted with trowelling blades. If required floor hardener "Nitoflor Hardtop" a Fasroc product shall be used at the rate of 3 to 5 Kg./Sqm. to get hard wearing surface.

Construction joints upto ¼ of the slab depth are cut after wards. They give clear and straighter theoretical cracking line in the case of unexpected sresses. Groove cutting is done within 48 hour from casting at the floor.

After surface vibrator and finishing the surface with power floater and trowel light brooming on the surface, expansion joints size 20 x 115mm shall be provided with filling the expansion joint having size 20 x 20mm by using COLPOR-200 as per manufacturers specification and directed by Engineer-in-Charge. The expansion joints filled with Nitogoal 200.

Making a construction joints by cutting of joints of size 3mm x 20mm by using of concrete cutter machine construction joint are filled with "MITOSEAL-280" an elastomaric cold applied joint sealent, which ensures performance of expected functions at the joints.

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 7 dayse or as per directed by Engineere-in-Charge.

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.)

The Workmanship and process for vacuumed dewatering, water cement ration, concrete placing, surface vibration, vacuum processing, floating, Trowelling and curing shall be carried out as per attached filteratures and as per instruction of Engineer-in-Charge.

[III] MODE OF MEASUREMENT :

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

The rate shall be for a unit of one Cum.

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Item No.39 Applying two coats of putty & two coats of primer of approved brand and manufacture on new wall surface to give an even shade including thoroughly brushing the surface free from mortar dropping and other foreign matter and sand papered smooth.

1.0 MATERIALS :

The Lapi paste shall be of birla putty shall conform to I.S. 712-1973. The turpentine shall confirm to I.S.712-1973. The turpentine shall confirm to I.S. 3536-1966. The enamel Paints & Primer shall confirm to I.S. 1932-1964 manufacturer brand of each material of Lapi paste shall be as per instruction of Engineer-in-charge.

2.0 WORKMANSHIP :

The surface to be finished lapi shall be thoroughly cleaned , dusted . All rust, dirt "Loose plaster Papadi" shall removed Horizontally & Vertically by sand paper all un. Necessary nails , shall be removed , the holes , cracks , patches etc shall made good with pali paste in perfect trus line level and smooth just like a glassed surface . The mixing of Different components of lapi like chowk powder, turpentine , Varnish , enemal paint ,primer shall be done strictly according to instruction of Engineer-in-charge.

3.0 MODE OF MEASUREMENTS AND PAYMENTS.

3.1 The rates shall includes the cost of all materials containing in Lapi paste , including mixing , applying , carting and scaffolding for apply of lapi . The protective measurement for application of work shall be included.

3.2 Rates shall be for a unit of one Sq. meter. for whole item.

****

Item No.40 Supplying and fixing reinforced concrete heavy duty 1200mm dia NP-3 pipes with collars for culverts including setting and joining the pipes in C.M. 1:2 watering and laying with all lead and lift.

1. The work shall consist of furnishing and installing reinforced cement concrete pipe of the type 1200mm 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 NP-3 type conforming to the requirements of I.S. 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.

   NP-3, NP-2, NP-1 pipes are used for R.C.C. pipes where testing of pipes. Where testing of pipes will not be feasible the contractors will have to produce a certificate from the manufacturers on company's latter head the given hereinafter form.

   Production of such certificate will not however relieve the contractor from his responsibility of supplying pipes of required standard and will have to bear the loss or damage caused to the work on 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 tests as per I.S. 458 at his factory.

FORM OF CERTIFICATE FOR NP3, NP2, NP1 PIPES

We_____manufacturer of R.C.C. pipes produce R.C.C. pipes as per the requirement of IS: 458 and also carry out the required test at our place. We have acquired equipments for carrying cut test and are prepared to carrying 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 I.S. 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 450 mm. The laying of pipes on the prepared foundation shall start from the outlet and proceed towards the inlet and be

completed to the specified lines and grades. The pipes shall be fitted and matched so that when laid in work they from a culvert with a smooth uniform invert: Any pipe found defective or damaged during laying be removed at there cost of Contractor.

4. The pipes shall jointed either by collar joint or by flush joint. In the former case, the collars shall be of R.C.C., 150 to 200 mm wide and having the same strength as the pipes to be jointed. Caulking space shall be between 13 and 20 mm according to the diameter of the pipes. Caulking material shall be slightly wet mix of cement and sand in 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 even annular space is left between the collar and the pipes. Flush joint may be shaped to form a self centering joint with a joining space 13 cm wide. The jointed space shall be filled with cement mortar 1 cement to 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 joints shall be kept covered and damp for at least four days.

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

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

   The payment shall be made on Rmt. basis for completed item as per item description or as directed.

****

Item No.41 Providing and fixing flood gauge marks of C angle size 100mm x 50mm x 6mm thick of length 1.50mt height fixed in head wall 0.50mt and 1.00mt outside with painting and lettering as directed.

The flood gauge is to be fixed as per I.R.C. Standard Specification having 100mm. x 100 mm. x 6mm. size, M.S. Angle having height equal to 1.50 Mt. It shall be fixed in C.C. 1:2:4 as per drawing. The painting shall be done applying one primer coat & three coats of oil paint as per requirement & as per drawing using approved paints including lettering for flood gauge marking as per I.R.C. std. & drawings.

The work shall be carried out and materials used shall be to the entire satisfaction of the Engineer-in-charge.

The rate inclusive of all materials and labour with carriage, fixing, panting etc. complete as per drawing and direction of the Engineer-in-charge.

The measurement & Rate paid shall be on Number basis of flood gauge fixed.

****

Item No.42 Providing and fixing ordinary Kilometer stone of precast C.C. 1:2:4 including necessary reinforcement as per I.R.C. type design in C.C. 1:4:8 including painting,lettering etc. complete.

1. Kilometer stone shall be of approved quality and shall be either black Rajula stone or of precast 1:2:4 R.C.C. as specified in the item.

2. The size, manner of fixing, painting and lettering of K.M. stone shall conform specification as per I.R.C. - 8 (Type design for Highway kilometer stones). The fixing of K.M. stone shall be carried out in ordinary concrete of grade specified in the item using hand broken metal field metal or gravel. The measurement for payment shall be made per No. of K.M. stone fixed in position.

3. Unit rate for kilometer stone includes the cost of all materials, labour, tools, fixing, finishing curing, lettering and painting as directed by the Engineer-in-charge.

The Payment shall be made on No. basis for complete item.

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Item No.43 Providing and fixing 5th Kilometer stone of precast C.C. 1:2:4 including necessary reinforcement as per I.R.C. type design in C.C. 1:4:8 including painting,lettering etc. complete (For N.H., S.H. and M.D.R.)

1. 5th Kilometer stone shall be of approved quality and shall be either black Rajula stone or of precast 1:2:4 R.C.C. as specified in the item.

2. The size, manner of fixing, painting and lettering of K.M. stone shall conform specification as per I.R.C. - 8 (Type design for Highway kilometer stones). The fixing of K.M. stone shall be carried out in ordinary concrete of grade specified in the item using hand broken metal field metal or gravel. The measurement for payment shall be made per No. of K.M. stone fixed in position.

3. Unit rate for kilometer stone includes the cost of all materials, labour, tools, fixing, finishing curing, lettering and painting as directed by the Engineer-in-charge.

The Payment shall be made on No. basis for complete item.

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Item No.44 Providing and fixing Hectometer fixing in C.C. 1:5:10 as per I.R.C. type design including painting, lettering etc. complete.

The work shall be carried out as per the item of ordinary kilometer stone except that the size of hectometer stone shall be smaller than that of ordinary kilometer stone as per I.R.C. 26 (Type design for 200 metre stones) and fixing shall be in C.C. 1:5:10 which will consist of one part of cement, five part of good sand and ten parts of good brick bats or H.B. metal 40mm size. The measurement for payment as well as the operations included in the unit rate shall be as per ordinary kilometers stone as per item No. . Rate includes all labour and curing etc. necessary for concrete.

The Payment shall be made on No. basis for complete item.

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Item No.45 Providing and fixing guard stone in earth as per I.R.C. type design including white washing etc. complete.

1 The guard stone shall be of approved quality and shall be either Rajula stone or of Precast C.C.M-100 R.C.C.and 20 x 15 cm. size and its length shall not be less than 75 cms. The top portion shall be rounded. The top 38 cm. shall be chisel dressed on all sides. The size shape and dimensions of the guard stones shall be exact and shall be nearly dressed and finished.

2 The guard stone shall be fixed in position as directed by the Engineer-in-charge in earth if the guard stone shall be fixed in wearing coat the equivalent volume covered by the guard stone shall be deducted from the gross measured quantity of wearing coat. The exposed part of the guard stones shall be given threes coats of white wash. Any excavation necessary for fixing of the guard stones shall be done by the contractor at his own cost. The measurement for payment shall be per number of guard stone fixed in position.

3 Unit rate of guard stone includes the cost of all materials, labours, tools, fixing and white washing as directed by the Engineer-in-charge.

4 In case of Deep / Causeway the guard stone shall be fixed in masonry of head wall as directed by the Engineer-in-charge.

The Payment shall be made on No. basis for complete item.

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Item No.46 Providing and fixing Village name boards as per standard I.R.C. type design of steel plate including painting lettering etc. complete with fixing in C.C. 1:4:8 block with necessary excavation.

1. The work shall be carried out as per the item of sign boards except that there shall not be top plate of 38 cm x 38 cm triangular shape and lower plate of 38 cm x 61 cm rectangular plate of 6mm thickness shall be fixed at top fencing towards the direction of the village.

2. The boards plate shall be painted in black color, letter & figures shall be painted in white color with an arrow direction towards the village. Painting & lettering shall be done on both side. The size of the letters and figures as well as thickness of errow will be as directed by the Engineer – in - Charge.

3. The measurement for payment as well as operations included in the unit rate shall be as per item of sign boards.

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Item No.47 Providing and fixing indicator stone fixing in earth of approved stone as per I.R.C. type design in C.C. 1:4:8 including white washing etc. complete.

1.0 Indicator stones shall be of approved quality and of the size 20cm. x 20cm. its length shall not be less than 80cms. The top, 38cm. shall be chisel dressed on all sides. The size shape and dimension of the indicator stone shall be exact and stones shall be neatly dressed and finished before fixing. The indicator stones shall be fixed firmly in position in embankment or cutting as the case may be. The exposed part of the indicator stone shall be done by the contractor at his own cost. The measurement for payment shall be per number of indicator stone fixed in fixed in position.

2.0 Unit rate indicator stone includes the cost of all materials, labour, tools, fixing and white washing as directed by the Engineer-in-charge.

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Item No.48 Providing and fixing Junction board of M.S. plates and angles as per standard I.R.C. design including fixing in C.C. 1:4:8 with necessary excavation painting figuring and lettering on board etc. complete.

1. The size of the board shall be 110 c. in length the iron post shall be 2.1 metres. The posts shall be fixed to the board by welding. The shall be true & strong and neat in appearance .

The board shall be fixed in C.C. 1:4:8 concrete. The concrete block for each post shall be 30cm x 30 cm in size the depth of the concrete block shall be 85 cm of which 60 cm will be below ground & 25 cm above ground level. The exposed concrete block i.e. its portion above ground level shall be neatly finished & its shape should be truly square

The post shall be painted with two coats of paint, alternatively in black& white strips 23 cms. in height after applying one coat of Anticorrosive paint. The paint shall of approved quality. The board shall be painted with colour as directed by Engineer – in –Charge. The information as per instruction of Engineer-in Charge shall be written on board with letter and signs in accordance with I.R.C. the information maybe one or more of the three scripts viz. Hindi English and Gujarati.

The board shall be fixed truly vertical and workmanship of the board shall be neat, clean and good in appearance.

The measurement for payment shall be for number of board fixed in position and complete in all respects.

The unit rate includes cost of materials labour tools welding concreting, painting ,lettering etc complete

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Item No.49 **Providing and fixing of typical MMGSY Project informatory sign board with Logo as per MORD specifications and drawing. Three MS plates of 1.6mm thick, top and middle plate duly welded with MS flat iron 25 x 5mm size on back on edges. The lower plate will be welded with MS angle iron frame of 25mmx25mmx5mm , The angle iron frame of the lower most plate and lfat iron frame of middle plate will be welded 2 nos. 75 x 75mm of 12SWG sheet tubes posts duly embedded in cement concrete M-15 grade block of 450 x 450x600mm , 600mm below ground level . The top most diamond plate will be welded to middle plate by 47mm x 47mm of 12SWG steel plate tube . All M.S. will be stove enamelled on both sides. Lettering and printing arrows, board etc will be painted with ready mixed synthetic enamel paint of superior quality in required shade and colour. All sections of framed posts and steel tubes will be painted with primer and two coats of epoxy paints as per drawing clause 1701 and Annexure 1700.1**

ABOVE ITEM SPECIFICATION IS ATTACHED HERE WITH

Item No.50 Supplying and fixing Reflective type road sign board of M.S. plates and angle iron including painting, lettering etc. complete including fixing in C.C. 1:4:8 with necessary excavation etc. complete as per I.R.C. type design.

1. The board shall consist of a 90 cm x 90 cm triangular plate of 6 mm thickness at the top and a 90 cm x 61 cm rectangular plate of 6 mm thickness below if fixed at suitable distance. This shall be fixed to the angles iron post. of 75 mm x 75 mm x 6 mm size by means of welding or reveting as directed by the Engineer-in-charge. The angle iron post shall be split at the bottom end to 10 cm (minimum) in length and shall be fixed at right angle to the central line of the road in ordinary concrete of grade as specified in the item, using hand broken metal, field metal or gravel., Two steel bars 12 mm dia, shall also be embedded in concrete for fixing as directed by the Engineer-in-charge. The top of the post shall be at a height of 25 cm. as above the ground level. Concrete platform shall be of the size 45cm x 45 cm and shall project 2.5 cm above ground level and shall be at least 60 cm below ground level. Total height of post shall be 3 Mt. (minimum). The exposed platform shall be neatly finished and its shape shall be as directed by the Engineer-in-charge.

2. The post will be painted with two coast altematively in black and white strips 23 cm in height after applying one coat of anticorrosive paint. The paint shall be of approved quality. The board shall be painted with approved colour and lettering shall be in accordance with I.R.C. 30 (Standard Letters and Numerals of Different Heights for use on Highway designs) and as per notified sighs of Motor Vehicle Act. respectively.

3. The Measurement for payment shall be per number of sign board fixed in position.

4. The unit rate includes the cost of materials, labour tools, drilling of holes, riveting of welding, fixing, curing , lettering painting as directed by the Engineer-in-charge.

******

Item No.51 Hazard Marker Sign :-Providing and fixing sing boards made out of 2mm aluminium sheet; size 90 x 30cms. rectangle as as per the design/drawing attached (IRC) pretreated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint; reflectorised with retro refiective 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 & 50 x 50 x 5mm painted with best quality epoxy coatings The fixing at site shall be in 1:2:4 CC block of size 45x45x 60cms. for each leg. including excavation curing etc. complete under the supervision of engineer in charge.(B)High Intensity Grade

1.0 SCOPE :

The work shall consist of providing and fixing in C.C. 1:2:4 (45x45x60cm. size) the road sign boards as per specification as under and as directed by Engineer-in-charge.

2.0 MATERIALS:

The boards shall be made from 2mm alluminium sheet. The sheet shall be of good quality approved by Engineer-in-charge. Stand post and frames should be made of M.S. angle of 50x50x5mm size. Epoxy paint and epoxy primer shall be of approved quality and shade as approved by Engineer-in-charge. The retro-reflective sheeting of Engineer-in-charge shall be encapsulated lens type.

3.0 TRAFFIC SIGNS HAVING RETROREFLECTIVE SHEETING:

4.0 GENERAL REQUIREMENTS:

The retro-reflective sheeting used on the sign shall consist of white or coloured sheeting having a smooth outer surface which has to property of retro-reflection over its entire surface. It shall be weather resistance and show colour fastness. It shall be new and unused and shall shown no evidence of cracking scaling pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having tested the sheeeting for these properties in an unprotected outdoor exposure facing the sun for two years and its having passed these testes 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 encapsualted lens/micro prismatic type. The type of sheeting to be used would depend upon the type, functional hierchy and importance of the road.

5.0 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 none 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 of retro reflection (determined in accordance with ASTM Standard E-81) as indicated in Table 800-2)

TABLE 800-2

ACCEPTABLE MINIMUM CO-EFFICIENT OF RETRO REFLECTION FOR ENGINEERING GRADE SHEETING

CANDEL AS PER LUX PER SQUARE METRE

Observation Angle (in Degress.)	Entrance Angle (in degress)	White	Yellow	Orange	Green	Red	Blue
0.2^0	4	70	50	2.5	9.0	14.5	4.00
0.2^0	30	30	22	7.0	3.5	6.0	1.7
0.5^0	-4	30	25	13.5	4.5	7.5	2.0
0.5^0	-30	15	13	4.0	2.2	3.0	0.8

When totally wet, the sheeting shall bet show less than 90% of the values of retro reflection indicated in Table 800-1(a) and 800-1 (b) respectively. At the end of 7 years, the sheeting shall retain at least 80% of its original retro reflectances except for orange colour.

6.0 Message (legends, letters, numerals etc.) and borders shall either be screen printed or of cut-outs screen printing shall be processes 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 be bounded with the sheeting in manner specified by the manufacturer.

7.0 For Screen printed transparent coloured areas on white sheeting the coefficient of retro-reflection shall not be less than 50% (Fifty) of the value of corresponding colour in Table 800.1(a), 800.1(b) and 800-2 as applicable.

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

9.0 COLOUR

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

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 colour shall be durable and uniform in acceptance hue when viewed in day light or under normal headlights at night.

10.0 **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 clear surface. or a tack free adhesive activated by heat, applied in a heat vacuum applicator in a manner recommended by the sheeting manufacturer. The sheeting shall be protected by the sheeting manufacturer. The sheeting 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 place by use of sharp instrument. In case of pressure sensitive adhesive sheeting the sheeting shall be applied in accordance with the manufacturer's instructions.

11. 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 Alternatively, the aluminium blank shall be re-cycled to a finished condition and new sheeting's put on in an approved manner.

12.0 FABRICATION

12.0.1 Surface to be rectories shall be effectively prepared to received the retro reflective sheeting. The aluminium sheeting shall be degreased 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 handed, except by suitable divide or clean canvas gloves between all cleaning and preparation operation and application of reflective sheeting primer. There shall no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro reflective sheeting.

12.0.2 Complete sheets or the material shall be used on the sign except where it is unavoidable, at slices, sheeting with pressure sensitive adhesives shall be overlapped not less than 5mm sheeting with heat activated adhesives may be spliced with an overlap not less than 5mm or butted with a gap not exceeding 0.75mm. Where sreen printing with transparent colours is proposed, only butt joining shall be used. The materials 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.

13.0 WARRANTY AND DURABILITY:

For each lot of sheeting's procured the contractor shall obtain from the manufacturer a 7 years warranty for satisfactory field performance including stipulated retro-reflectance of the sheeting of high intensity grade and 5 years warranty for the Engineering grade and submit the same to the Engineer. In addition, a 7 years and five years 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 letter/legends and their pending to the retro reflective sheeting shall be obtained from the contractor/supplier and passed on to the Engineer. 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 meet all the stipulated requirement and carry the stipulated warranty. All signs shall be dated during fabrication with indelible markings to indicate the start of warranty. The warranty shall also cover the replacement obligation by the sheeting manufacturer as well as contractor for replacement/repair/ restoration of the retro-reflective efficiency.

14.0 INSTALLATION:

14.0.1 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 up to 0.9 Sq.M. shall be mounted on a single post and for greater area two or more supports a shall be provided. Sign supports may be or mild steel, reinforced concrete or galvanized iron (G.I.) Posts end(s) shall be firmly fixed to be the ground by means of properly designed foundation.The work of foundation shall conform to relevant specification as specified.

14.0.2 All Components of signs and supports, other than the reflective portion and G.I. Posts shall be thoroughly descaled cleaned, primed 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.

14.0.3 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.

MEASUREMENT FOR PAYMENT:

The measurement for standard Stop sign boards shall be in numbers of difference types of sign supplied and fixed. Direction and place identification signs, also shall be measured in numbers of different types of sign supplied and fixed.

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

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SPECIAL TERMS AND CONDITIONS OF CONTRACT

FOR
SIGN BOARDS

1. Warranty certificate for seven years for respective grades of signs from the sheeting manufacturer should be attached with the bid.

2. A Certificate of authorization from the sheeting manufacturer shall be submitted with the bid.

3. The responsibility for handling, upkeep and safety of the boards lies with the contractor until the completion of work and final payments are released.

4. The contract is valid for three months from the date of work order. The required quantity has to be supplied and fixed as and when intimated by the Division.

5. The measurement for payment will be done only after fulfilling condition up to the satisfaction of Executive Engineer. The 100% quantity of supply and fixing will be checked by Deputy Executive Engineer and at least 10% quantity of supply and fixing will be checked by the Executive Engineer to ensure quality and workmanship, before passing for payments.

6. The contractor will have to ensure how he is going to arrange repair or replacement of defective boards after intimation from the Division.

Executive Engineer,
Panchayat (R&B)Division
Jamnagar.

Item No.52 **Informatory Signs :-Providing and fixing sing boards made out of 2mm aluminium sheet; size 80 x 60cms. rectangle as per the design of IRC-67-1977 pre treated with phospheting process & acid teching; coated with one coat of epoxyprimer and two coats of best qualityepoxy paint; reflectorised with retro refiective sheeting as per latest M.O.S.T. Specifications; 3.1m long stand postand frame fabricated from suitable sizeiron angle of 35 x 35 x 3mm75x75x6mm as required; painted with best qualityepoxy coatings in black and whitebends. the details of symbol for eachboard shall details of symbol for eachboard shall be as per the instruction ofengineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x45 x 60cms. for each leg. including excavation curing tec. complete under the supervision of engineer in charge.(A) Engineer Grade**

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.

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

801.2.2. 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 onthe base sheeting as directed by the Engineer.

Materials

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

Concrete : Concrete shall be of the grade shown on the Contract drawings or otherwise as directed by the Engineer. fixing at site shall be in 1:2:4 C.C. block of size 45x45x60cms. for each leg. including excavation curing complete under the supervision of Engineer-in-Charge.

801.2.2.Reinforcing steel : Reinforcing steel shall conform to the requirement of

IS:1786 unless otherwise shown on the drawing. 3.1m long (2 Nos) stand post and frame fabricated from suitable size iron angle of 50x50x5mm, 75x75x6mm as required **Bolts, nuts, washers:** High strength bolts shall conform to IS : 1367 whereas precision bolts, nuts, etc., shall conform to IS: 1364.

801.2.2.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.

801.2.2.Aluminum: Aluminum sheets used for sign boards shall be of smooth, hard and corrosion resistant aluminum alloy conforming to IS : 736-Material designation 24345 or 1900. 2mm alluminium sheet size 180x120cms rectangle as per the design of IRC-67-1977 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 and its support and shall be such that it does not bend or deform under the prevailing wind and other loads.

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

Traffic Signs Having Retro-reflective Sheeting

801.2.2.General requirements: The retro-reflective sheeting used on the sign shall consist of the white or colored sheeting having a smooth outer surface which has the property of retro-reflection over its entire surface. It shall be weather-resistant and show color fastness. It shall be new and unused and shallshow no evidence of cracking, scaling, pitting, blistering, edge lifting or curling and shall have negligible shrinkage or 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.

801.2.2.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 water-proof 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-rep_ec4ion (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 LUX PER SQUARE METRE)

Observation angle (in degrees)	Entrance Angle Red (in degrees)	White	Yellow	Orange	Green	Blue
0.2	-4	250	170	100,	45	20
0.2	+30	150	100	60	25	11
0.5	-4	95	62	30	15	7.5
0.5	+30	65	45	25	10	5.0

When totally wet, the sheeting shall not show less than 90 per cent of the values of retro-reflectance indicated in Table 800-1. At the end of 7 years, the sheeting shall retain at least 75 per cent of its original retro-reflectance.

801.2.2.**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 900-2. ACCEPTABLE MINIMUM COEFFICIENT OF RETROREFLECTION FOR ENGINEERING GRADE SHEETING (CANDELAS 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

When totally wet, the sheeting shall not show less than 90 per cent of the values, of retro-reflection indicated in Table 800-2. At the end of 5 years, the sheeting shall retain at least 50 per cent 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 be bonded with the sheeting in the manner specified by the manufacturer.

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

801.2.2. 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.

801.2.2.Colour: Unless otherwise specified, the general colour schbm6 shall be as stipulated in IS 5 "Colour for Ready Mixed Paints", viz.

Blue	-	is	ColourNo. 166: French Blue
Red	-	is	ColourNo. 537: Signal Red
Green	-	is	ColourNo. 284: India Green
Orange	-	IS	ColourNo. 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. Sheeting with adhesives requiring use of solvents or other preparation for adhesive shall be applied strictly in accordance with the manufacturer's instructions.

Refurbishment: Where existing signs are specified for refurbishment, the sheeting shall have a semi-rigid aluminum 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

Surface to be refectories shall be effectively prepared to receive the retro-reflective sheeting. The aluminium sheeting shall be degreased 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 lea than 5 mm. Sheeting 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 sip 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 discoloration, cracking, blistering or dimensional change and shall not have less than 50 per. cent of the specified minimum reflective *intensity values (Tables 800-1 and

800-2) when subjected to accelerated weathering for 1000 hours, using type E or EH Weatherometer (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 by vandalism. Normally, signs with an area up to 0.9 sq. in. shall be mounted on a single post, and for greater area two or more supports shall be provided. Sign supports may be of mad steel, reinforced concrete or galvanized iron (G.1). 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 discalced, 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 posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or GI posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

Measurements for Payment

The measurement of standard cautionary, mandatory and information signs shall be in numbers of different types of signs supplied and fixed,

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.

SPECIAL TERMS AND CONDITIONS OF CONTRACT

FOR

SIGN BOARDS

1. Warranty certificate for seven years for respective grades of signs from the sheeting manufacturer should be attached with the bid.
2. A Certificate of authorization from the sheeting manufacturer shall be submitted with the bid.
3. The responsibility for handling, upkeep and safety of the boards lies with the contractor until the completion of work and final payments are released.
4. The contract is valid for three months from the date of work order. The required quantity has to be supplied and fixed as and when intimated by the Division.
5. The measurement for payment will be done only after fulfilling condition up to the satisfaction of Executive Engineer. The 100% quantity of supply and fixing will be checked by Deputy Executive Engineer and at least 10% quantity of supply and fixing will be checked by the Executive Engineer to ensure quality and workmanship, before passing for payments.
6. The contractor will have to ensure how he is going to arrange repair or replacement of defective boards after intimation from the Division.

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