Name of work : - **Improvement of Kanalus Railway station road (VRNP) of Lalpur Taluka under SCSP-MMGSY Yojana Package No.JAM/SCSP/MMGSY/RSNP/ 2023-24/P-13**

Taluka: Lalpur **Dist: Jamnagar**

TECHNICAL SPECIFICATIONS OF ITEMS

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Taluka:Lalpur **Dist: Jamnagar**

TECHNICAL

SPECIFICATIONS

OF ITEMS

Item No.01 Clearing and grubbing road land including uprooting rank vegetation grass bushes, shrubs, sapling and trees girth up to 300 mm removal of stumps of trees cut earlier and disposal of unserviceable materials and stacking of serviceable material to be use of ouctioned upto a lead of 1000mt. including removal and disposal of top organic soil not exceeding 150mm in thickness (C) by Mechanical means in area of light Jungle

201. CLEARING AND GRUBING

201.1. Scope

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

201.2. Preservation of Property/Amenities

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

During clearing and grubbing, the Contractor shall take all adequate precautions against soil erosion, water pollution, etc., and where required, undertake additional works to that effect vide Clause 306 (as per Page No. 77 in MORTH specification booklet). Before start of operations, the Contractor shall submit to the Engineer for approval, his work plan including the procedure to be followed for disposal of waste materials etc. and the schedules for carrying out temporary and permanent erosion control works as stipulated in Clause 306.3 (as per Page No. 78 in MORTH specification booklet).

201.3. Methods, Tools and Equipments

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

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

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

201.4. Disposal of Materials

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

201.5. Measurements for Payment

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

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

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

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

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

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

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

201.6. Rates

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

clearing and grubbing is to be done to a level beyond 150 mm, due to site considerations, as directed by the Engineer, the extra quantity shall be measured and paid separately.

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

201.6.3 The Contract unit rate for removal of stumps and roots of trees girth above300 mm shall include excavation and backfilling with suitable material to required compaction, handling, giving credit towards salvage value disposing of the cleared materials with all lifts and leads.

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

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

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Item No.02 Earthwork for embankment including breaking clods, dressing with all lead and lift (excluding watering and consolidation) From Borrow area within all lead

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.03 Rolling and watering of earthwork in layers with Vibratory roller including filling in depressions 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.04 Providing and laying asphalt painting on B.T. surface with bitumen VG-30 at rate 5.00Kg / 10Sq.mt. and spreading stone dust for painting surface at rate of 0.03 cu.mt. / 10 sq.mt.

1.0 SCOPE

This work shall consist of the application of a single coat of bitumen grade VG-30 Grade to an existing bituminous road surface in accordance with the following specifications.

2.0 MATERIALS

2.1 BITUMEN

The bitumen used for asphalt painting shall be VG-30 grade complying with Indian Standard Specifications for "Paving Bitumen" IS:73 or as directed by the Engineer-in-Charge.

2.2 STONE DUST

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

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

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

2.2.4 The fineness nodules of stone dust shall not be less than 1 80

3. WEATHER AND SEASONAL LIMITATIONS:

Bituminous material shall not be applied to wet surface or dust storm or when the weather so rain or windy or when the temperature in the shade is less than 10^0C

4. CONSTRUCTION:

4.1 The asphalt painting shall be applied through distributor and it shall be a self propelled or towed bitumen sprayer equipped for spraying the material uniformly at specified rate. The spraying of small area in accessible to the distributor in narrow strips shall be sprayed with pressure by hand sprayer or as directed by Engineer-in-Charge.

4.2 The surface on which the asphalt painting is to be applied shall be clean and free from dust, dirt and any extraneous material and otherwise prepared in accordance with the requirement of Clause : 501.8 & 513 of MORT & H if as appropriate. Immediately before the application of the asphalt painting the surface shall be swept clean with a mechanical prom and high-pressure air jet or by other means as directed by Engineer-in-charge.

4.3 Application of Asphalt Painting

The application of asphalt rating shall be at 5Kg./10Sqm. as specified and shall be applied uniformly. The asphalt shall be heated in the tanker and temperature of asphalt at time of spraying shall be in the range of 150^0C – 177^0C

The method of application of the bitumen will depend on the type of equipment to be used, size of nozzle, pressure at the spray bar and speed of forward movement. The contractor shall demonstrate a spraying trial that the equipment and method to be used is capable of producing a uniform spray within the tolerance specified.

5.0 SPREADING OF STONE DUST :

Soon after spraying asphalt, stone dust shall be spread evenly with a twisting motion of baskets at the rate of 0.03Cum/10Sqm. The entire surface shall be boomed to ensure uniform application of the stone dust. While the traffic may be allowed on the painted surface and at later stage if additional stone dust is required, it shall be carried out by the contractor without any extra payment.

6.0 OPENING TO TRAFFIC

Traffic may be allowed immediately after completion of flushing of stone dust on asphalt painted surface.

7.0 ARRANGEMENT OF TRAFFIC

The provision of MORT & H specification Clause : 112 shall be apply as regards the flow of traffic during construction.

8.0 MODE OF MEASUREMENT & PAYMENT

The item shall be measured and paid as finished work in Square meter. The rate shall include cost of all materials, labour, equipments etc. required for all the operations described above. The rate shall be for a unit of One Square Meter.

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Item No.05 **Providing and laying and rolling 37.50mm thick bituminous groutin with B.T. aggregate as per Required Gradation and using bitumen Grade VG-30 for Mixing at the rate of 1.99% i.e. 19.90 kg/M.T. of total mix and VG-30 for tack coat at the rate of 2.5 kg/10sq.mt on existing B.T. surface including heating and mixing in Drum mix plant ,trasporting spreading same by paver finisher and consolidation by viberated roller including necessary firewood, oil,kerosene, lubricants all equipments, tools, labour charges etc. complete using contractor's own machinary in accordance with the requirement of specification.**

Scope

The work shall consist of construction, in a single course, of compacted crushed aggregates premixed with a bituminous binder, to serve as base/binder course, laid immediately after mixing, on a base prepared previously in accordance with the requirement of these Specifications and in conformity with the lines, grades and cross sections shown on the drawing or as directed by the Engineer. Thickness of the course shall be 37.5mm materials.

Materials

Bitumen: The bitumen shall be paving bitumen of suitable viscosity grade VG-30 as per IS:73. The actual grade of bitumen to be used shall be decided by the Engineer appropriate to the region, traffic, rainfall and other environmental conditions. Guidelines on selection of the grade of bitumen are given in *Appendix-4.*

Viscosity Grade (VG) Bitumen Specification as per IS 73 : 2013

Characteristics	VG - 10	VG-20	VG-30	VG-40
Absolute Viscosity 60□C, poises, min	800	1600	2400	3200
Kinematic Viscosity 135□C CSI, min	250	300	350	400
Flash point, C, min	220	220	220	220
Solubility in trichloroethylene, % min	99.0	99.0	99.0	99.0
Penetration at 25□C	80-100	60-80	50-70	40-60
Softening point, C min	40	45	47	50
Test on residue from thin film oven test / RTFOT :				
(A) Viscosity ration at 60□C, max	4.0	4.0	4.0	4.0
(B) Ductility at 25□C, cm, min after thin film over test	75	50	40	25

Aggregates

The aggregates shall consist of crushed stone, crushed gravel/shingle or other stones. They shall be clean, strong, durable, of fairly cubical shape and free from disintegrated pieces, organic or other deleterious matter and adherent coating. The aggregates shall preferably be hydrophobic and of low porosity. If hydrophilic aggregates are to be used, the bitumen shall preferably be treated with anti-stripping agents of approved quality in

suitable dose as per *Appendix-5.* The aggregates shall satisfy the physical requirements set forth in Table 500-3.

TABLE 500-3. PHYSICAL REQUIREMENTS OF AGGREGATES FOR BITUMINOUS GROUT

S. No.	Test	Test Method	Requirement
	Los Angeles Abrasion Value	IS:2386 (Part - 4)	40 percent Maximum
	Aggregate Impact Value*	-do-	30 percent Maximum
	Flakiness and Elongation Indices (Total)**	IS: 2386 (Part - 1)	30 percent Maximum
	Coating and Stripping of Aggregate Mixtures	AASHTO T 182	Minimum retained Bitumen coating 95 per cent
	Soundness:		
	Loss with Sodium Sulphate 5 cycles	IS: 2386 (Part – *5)*	12 percent Maximum
	Loss with Magnesium Sulphate 5 cycles		18 per cent Maximum
	Water absorption	IS: 2386(Part - 3)	2 per cent Maximum

* Aggregates may satisfy requirements for either of the two tests.

** To determine this combined proportion, the flaky stone from representative sample should first be separated out. Flakiness index is weight of flaky stone metal divided by weight of stone sample. Only the elongated particle be separated out from the remaining (non flaky) stone metal. Elongation index is weight of elongated particles divided by total non flaky particles. The value of flakiness index and elongation index so found are added up.

Proportioning of materials:

The bitumen content for premixing shall be 1.99 % (percent) by weight of the total mix except when otherwise directed by the Engineer.

The maximum compacted thickness of a layer shall be 37.5mm

The quantities of aggregates to be used shall be sufficient to yield the specified thickness after compaction.

AGGREGATE GRADING FOR BITUMINOUS GROUT

IS Sieve Designation	Percent by weight passing the sieve
53.0 mm	100
26.5 mm	75-100
22.4 mm	50-85
13.2 mm	20-40
5.6 mm	5-20
2.8 mm	0 – 5

Variation in proportioning of materials : The Contractor shall have the responsibility for ensuring proper proportioning of materials and producing a uniform mix. A variation in binder content ± 0.3 per cent by weight of total mix shall however be permissible for individual specimens taken for quality control tests vide Section 900.

Construction Operations:

Weather and seasonal limitations : The work of laying shall not be taken up during rainy or foggy weather or when the base course is damp or wet, or during dust storm or when atmospheric temperature in shade is 10 degree C or less.
Preparation of base : This work shall consist of preparing an existing granular or blacktopped surface bituminous course. The work shall be performed on such widths and lengths as shown in application drawing or as directed by the Engineer. The existing surface shall be firm and clean and treated with prime or tack coat as shown on the drawings as otherwise stated in the contract.
Materials:
For scarifying and re-laying the granular surface: The materials used shall be coarse aggregates salvaged from scarification of the existing granular base course supplemented by fresh coarse aggregates and screenings so that aggregates and screening thus supplemented correspond to Clause 404. Water Bound Macadam or Clause 406. Wet Mix Macadam, as the case may be.
For patching potholes and sealing cracks : Where the existing surface to be overlaid is bituminous, any existing potholes and cracks shall be repaired and sealed in accordance with Clauses 3004.2 and 3004.3 or as directed by the Engineer.
For Profile Corrective Course : A profile corrective course for correcting the existing pavement profile shall be laid to varying thickness as shown on the Drawings, or as indicated in the Contract Documents. The profile corrective course shall be laid to tolerances and densities as specified for wearing course if a single layer, or base course, if it is to be covered with a wearing course layer.
Profile corrective course and its application: The type of material for use as a profile corrective course shall be as shown on the drawing. If it is to be laid as part of the overlay/strengthening course, the profile corrective course material shall be of the same specification as that of the overlay/strengthening course. However, if provided as a separate layer, it may be of the same specification as the layer over which it is to be laid or intermediate between underlying layers, as shown on the Drawing.
Surface Levels:
The levels of the sub grade and different pavement courses as constructed shall not vary from those calculated with reference to the longitudinal and cross-profile of the road shown on the drawings or as directed by the engineer beyond the tolerances mentioned in Table 900-1.
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 10DC. Where the tack coat consists of emulsion the surface shall be slightly damp, but not wet. Where the tack coat is of cut back bitumen the surface shall be dry. Construction Equipment:
The tack coat distributor shall be self propelled or towed bitumen pressure sprayer, quipped for spraying the material uniformly at a specified rate. Hand spraying of small areas inaccessible to the distributor or in narrow strips shall be sprayed with a pressure and sprayer or as directed by the Engineer 503.4.2 of MORTH specification. 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 Clauses 501.8 and 902 as appropriate. Immediately before the application of the tack coat, the surface shall be swept clean with a mechanical broom, and high pressure air jet, or by other means as directed by the Engineer.
Application of tack coat:

The application of tack coat shall be at the rate specified in the Contract, and shall be applied uniformly. If rate of application of Tack Coat is not specified in the contract then it shall be at the rate specified in TABLE 500-2 of MORTH specification.The normal range of spraying.
TABLE 500-2 RATE OF APPLICATION OF TACK COAT:
The emulsion asphalt at the rate of 2.50 kg per 10 sq.m. shall be used for tack coat temperature for a bituminous emulsion shall be 20°C to 70°C and for a cut back 50°C to 80°C if RC-70/MC-70 IS used. Where geosynthetic IS proposed for use, the provisions of Clauses 703.3.2, and 703.4.4 of MORTH specification shall apply. The method of application of the tack coat will depend on the type of equipment to be used, size of nozzles, pressure at the spray ban and speed of forward movement. The Contractor shall demonstrate at a spraying trial, that the equipment and method to be used is capable of producing a uniform spray, within the tolerances specified.

Where the material to receive an overlay is a freshly laid bituminous layer, that has not been subjected to traffic, or contaminated by dust, a tack coat is not mandatorywhere the overlay is completed within two days.
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 pant or vehicles shall be allowed on the tack coat other than those essential for the construction.
Quality Control of Work :
TOLERANCES IN SURFACE LEVELS

1.	Sub grade		+	20mm
				25mm
2.	Sub-base 4 - 10 mm			
	(a)	Flexible pavement	-	20mm
	(b)	Concrete pavement	+	6mm
	[Dry clean concrete or Rolled-concrete]			10mm
3.	Base - course for flexible pavement		+	6mm
	(a)	Bituminous course	-	6mm
	(b)	Other than bituminous	+	10mm
		(i) Machine laid	-	10mm
		(ii) Manually laid	+	15mm
				15 mm
4.	Wearing course for flexible pavement			
	(a)	Machine laid	+	6mm
				6mm
	(b)	Manually laid	+	10mm
				10mm
5.	Cement concrete pavement		+	5mm
			-	6mm

TACK COAT :
Scope:
This work shall consist of the application of a single coat of high 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 bythe Engineer.

Materials:

The binder used for tack coat shall be bitumen emulsion complying with IS:8887 of a type and grade as specified in the Section 500 of MORTH specification Contract or as directed by the Engineer. The use of cut back bitumen as per IS:217 shall be restricted only for sites at sub-zero temperatures or for emergency applications as directed by the Engineer.

Weather and Seasonal Limitations:

For control of the quality of materials supplied and the works carried out for relevant provisions of Section 900 shall apply.

Specification: The rate shall cover the provision of tack coat at 0.25 kg per square meter with provision that the variation in actual quantity of bitumen used will be assessed and the payment adjusted accordingly.

Preparation and transport of mix:

Bituminous grout mix shall be prepared in a drum mix plant of adequate capacity and capable of yielding a mix of proper and uniform quality with thoroughly coated aggregates.

The plant shall be drum mix type. The plant shall have coordinated set of essential units capable of producing uniform mix within the job mix formula such as laiddown in Appendix 'A'.

In case of drum mix plant, the cold feed system shall have variable speed conveyors/or other suitable devices for regulating the accurate proportion of aggregate in to an even flood flow automatically from a control operation/Control Cabin.

Bitumen Control Unit: Capable of measuring/metering and spraying required quantity of bitumen at specified temperature with automatic synchronization of bitumenand aggregate feed.

Filler System : A fines feeder system suitable to receive bagged or bulk supply offiller materials and its incorporation to the mix in the correct quantity shall be necessary audiliary.

Dust Control : A suitable built in Dust Control Equipment for the dryer to contain the exhaust of fine dust in the atmosphere for environmental control wherever so specified by the Engineer.

Suitable auxiliary Bitumen Boiler of Adequate capacity with self heating arrangement and temperature control device. The boiler should be fitted withtemperature indicating instruments.

The temperature of binder at the time of mixing shall be in range of 150 Degree C to 163 degree and that of the aggregate in the range of 155 degree C - 163 degree C provided that the difference in temperature between the binder and aggregate at notime exceeds 14 Degree C.

Mixing shall be thorough to ensure that a homogeneous mixture is obtained in which all particles of the aggregates are coated uniformly and the discharge temperature of mix shall be between 130 Degree C to 160 degree C.

The mixture shall be transported from the mixing place to the point of use in suitable tipper vehicles. The vehicles employed for transport shall be clean and be

covered in transit if so directed by the Engineer. Any tipper causing excessive segregation of materials by its spring suspension or other contributing factors or thatwhich shows undue delay shall be removed from the work unit such conditions are corrected.

Spreading: The mix transferred from the tipper at site to the paver shall be spread immediately by means of self-propelled mechanical paver with suitable screeds capable of spreading, tamping and finishing the mix true to

the specified lines, grades and cross sections. The paver finisher shall have the following essential features:
Loading hoppers and suitable distributing mechanism.
All drives having hydrostatic drive/control.
The machine shall have a hydraulically extendable screed the appropriatewidth requirement.
The screed shall have tamping and vibrating arrangement for initial compaction to the layer as it is spread without rutting of otherwise marring the surface. It shall have adjustable amplitude and variable frequency.
The paver shall be equipment with necessary control mechanism so as to ensure that the finished surface is free from surface blemishes.
The paver shall be fitted with an electronic sensing device for automatic leveling and profile control within the specified tolerances.
The screed shall have the internal heating arrangement.
The paver shall be capable of laying either 2.5 to 4.0 m width or 4.0 to 7.0 m width as stipulated in the Contract.
The paver shall be so designed as to eliminate skidding/slippage of thetyres during operation.
However, in restricted locations and in narrow widths where the available plantcannot be operated in the opinion of the Engineer, he may permit manual laying of the mix.
The temperature of the mix at the time of laying shall be in the range of 120°C to 160°C. In multi-layer construction, the longitudinal joint in one layer shall offset that inthe layer below by about 150 mm. However, the joint in the top-most layer shall be atthe lane line of the pavement.
Longitudinal joints and edges shall be constructed true to the delineating line parallelto the centre line of the road. All joints shall be cut vertical to the full thickness of thepreviously laid mix and the surface painted with hot bitumen before placing fresh material. Longitudinal and transverse joints shall be offset by at least 250 mm from those in the lower courses and the joint on the top-most layer shall not be allowed to fall within the wheel path. All transverse joints shall be cut vertically to the full thickness of the previously laid mix with asphalt cutter/pavement breaker and surface painted withhot bitumen before placing fresh material. Longitudinal joints shall be preferably hotjoints. Cold longitudinal joints shall be properly heated with joint heater to attain a suitable temperature of about 80□C before laying of adjacent material.
Compaction: After the spreading of mix, rolling shall be done by 80 to 100 kN vibratoryroller. Rolling shall start as soon as possible after the material has been spread deploying a set of rollers as the rolling is to be completed in limited time frame. The roller shall move at a speed not more than 5 km/h. Rolling shall be done with care to avoid unduly roughening of the pavement surface.
Rolling of the longitudinal joints shall be done immediately behind the paving operation. After this, the rolling shall commence at the edges and progress towards the centre longitudinally except that on super relevated and uni-directional cambered portions, it shall progress from the lower to the upper edge parallel to the centre line of the pavement.
The initial or break-down rolling shall be done with 80-100 kN static weight smooth wheel roller (3 wheels or tandem) as soon as it is possible to roll the mix withoutcracking the surface or having the mix pick up on the roller wheels.
The second or intermediate rolling shall follow the break-down rolling with vibratory roller of 80 to 100 kN static weight or pneumatic tyred roller of 150 to 250 kN weight, with minimum 7 wheels and minimum tyre pressure of 0.7 MPa as closely as possible to the paver and be done while the paving mix is still at a temperature that will result in maximum density. The final rolling

shall be done while material is still workable enough for removal of roller marks with 60 - 80 kN tandem roller. During the final rolling, vibratory system shall be switched off. The joints and edges shall be rolled with a 80 to 100 kN static roller.

When the roller has passed over the whole area once, any high spots or depressions which become apparent shall be corrected by removing or adding mix material. The rolling shall then be continued till the entire surface has been rolled to 95 per cent of the average laboratory density (obtained from Marshall specimens compacted as defined in Table 500-10), there is no crushing of aggregates and all roller marks have been eliminated. Each pass of the roller shall uniformly overlap not less than one-third of the track made in the preceding pass. The roller wheel shall be kept damp if necessary to avoid bituminous material from sticking to the wheels and being picked up. In no case shall fuel, lubricating oil used for this purpose, nor excessive water poured on the wheels.

Rolling operations shall be completed in every respect before the temperature of the mix falls below 100°C.

Roller(s) shall not stand on newly laid material while there is a risk that surface will be deformed thereby. The edges along and transverse of the bituminous grout laid and compacted earlier shall be cut to their full depth so as to expose fresh surface which shall be painted with a thin surface coat of approximate binder before the new mix is placed against it.

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.

The built-up spray grout shall be provided with next surfacing without any delay. If there is to be any delay, the course shall be covered by a seal coat to the requirement of Clause 513 before allowing any traffic over it. The seal coat in such cases shall be considered incidental to the work and shall not be paid for separately.

Arrangement for Traffic:

During the period of construction, arrangement of traffic shall be done to Clause 112 of MORTH Specification.

Passage of Traffic along a part of the Existing Carriageway under Improvement:

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

In case of widening existing two-lane to four-lane the additional two lanes would be constructed first and the traffic diverted to it and only thereafter the required treatment to the existing carriageway would be carried out. However, in case where on the request of the Contractor work on existing two lane carriageway is allowed by the Engineer with traffic using part of the existing carriageway, stipulations as in para above shall apply.

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

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 placeat his cost as directed. Weight of empty and weight of loaded dumper will be recorded in bound and numbered register on plant site. Department will be free to get some loaded dumpers test checked at other weight bridge. Weigh bridge will be periodically got calibrated and verified from weight and measure authorities.

For the purpose of application of tack coat, if the theoretical area as per sanctioned estimate for basis of tonne differs with the actual area of work done in thefield, the reduction in or addition to payment shall have to be exceed respectively.

Weight of mix materials will be done in presence of responsible person, not less than the rank : of supervisor of department and the measurement shall be recorded by the Deputy Engineer or Assistant Engineer or Addl. Asst. Engineer. If so authorized, record of each dumper will be maintained separately in bound and numbered register, which will be maintained by the departmental representative and signed by the 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 kilometer, hectometerand meter in which individual dumper are unloaded shall be recorded carefully.

RATE :

The contract unit rate for the work shall be payment in full for carrying out therequired operations including full compensation for

Making arrangements for traffic to Clause 112 of MORTH specification except orinitial treatment to verge, shoulders and construction of diversion.

Preparation of base except for laying of profile corrective course but includingfilling of potholes.

Providing all materials to be incorporated in the work including arrangement for stock yards, all royalties, fees, rents where necessary and all leads and lift.

All labour, tools, equipment, plant including installation of drum mix plant, power supply units and all machineries, incidental to complete the work to the specifications.

Carrying out the work in part widths of the road where directed.

Carrying out all tests for control of quality.

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Item No.06 **Providing and laying 50.00 mm thick B.M. With BT Aggregate VG-30 grade bitumen for Tack coat @ 2.50 kg/10 sqm using crushed stone aggregate 0.66 cum/ MT as per MORTH&H Specification & VG-30 grade bitumen for mixing @35.00 Kg/1 MT i.e. 3.5% of by weight of total mix incl. heating and mixing by drum mix plant and spreading the same with paver finisher consolidation with vibratory roller including cost of fuel, hire charges, all necessary equipments, tools and plant, fire wood, oil, kerosene labour changes etc complete.(Using contractor's own Machinery)**

504 BITUMINOUS MACADAM

504.1 Scope

This work shall consist of construction in a single course having 50 mm to 100 mm thickness or in multiple courses of compacted crushed aggregates premixed with a bituminous binder on a previously prepared base to the requirements of these Specifications. Since the bituminous macadam is an open-graded mix, there is a potential that it may trap water or moisture vapour within the pavement system. Therefore, adjacent layer (shoulders) should have proper drainage quality to prevent moisture-induced damage to the BM.

504.2 MATERIALS

504.2.1 BITUMEN

The bitumen shall be viscosity graded paving bitumen complying with Indian Standard Specification for paving bitumen, IS:73 or as specified in the Contract. The type and grade of bitumen to be used would depend upon the climatic conditions and the traffic. Guidelines for selection of bitumen are given in Table 500-1.

504.2.2 COARSE AGGREGATES

The coarse aggregates shall consist of crushed rock, crushed gravel or other hard material retained on 2.36 mm sieve. It shall be clean, hard, durable and cubical shape, free from dust and soft organic and other deleterious substances. The aggregate shall satisfy the physical requirements specified in Table 500-6. Where crushed gravel is proposed for use as aggregate, not less than 90 percent by weight of the crushed material retained on 4.75 mm sieve shall have at least two fractured faces resulting from crushing operation. Before approval of the source, the aggregates shall be tested for stripping. Where the Contractor's selected source of aggregates have poor affinity for bitumen, as a condition for the approval of that source, the bitumen shall be treated with approved anti-stripping agents, as per the manufacturer's recommendations, without additional payment.

504.2.3 FINE AGGREGATES

Fine aggregates shall consist of crushed or naturally occurring mineral material, or a combination of two, passing 2.36 mm sieve and retained on 75 micron sieve. It shall be clean, hard, durable, free from dust and soft organic and other deleterious substances. Natural sand shall not be used in the binder course.

TABLE 500-6 : PHYSICAL PROPERTIES OF COARSE AGGREGATE

Property	Test	Requirement	Test method
Cleanliness	Grain size analysis	Max. 5% passing 0.075 micron	IS:2386 Part I
Particle shape	Combined Flakiness and Elongation Indices	Max. 35%	IS:2386 Part I
Strength	Los Angeles Abrasion Value or	Max. 40%	IS:2386 Part IV
	Aggregate Impact Value	Max. 30%	IS:2386 Part IV
Durability	Soundness (Sodium or Magnesium)	5 cycles	
	Sodium Sulphate	Max. 12%	IS:2386 Part V
	Magnesium Sulphate	Max. 18%	IS:2386 Part V
Water absorption	Water absorption	Max. 2%	IS:2386 Part III
Stripping	Coating and Stripping of Bitumen Aggregate	Min. Retained Coating 95%	IS:6241
Water sensitivity	Retained Tensile strength*	Min. 80%	AASHTO 283

- **If the minimum retained tensil strength falls below 80 percent, use of anti stripping agent is recommended to meet the minimum requirements.**

504.2.4 AGGREGATE GRADING AND BINDER CONTENT

The combined grading of the coarse aggregates and fine aggregates, when tested in accordance with IS:2386 Part 1, wet sieving method, shall conform to limits given in Table 500-8. The type and quantity of bitumen and appropriate thickness is also given in Table 500-7.

504.2.5 PROPORTIONING OF MATERIAL

The combined aggregate grading shall not vary from the lower limit on one sieve to the higher limit on the adjacent sieve to avoid gap grading. The aggregate may be proportioned and blended to produce a uniform mix complying with the requirements in Table 500-7. The binder content shall be within a tolerance of 0.3 percent by weight of total mix when individual specimens are taken for quality control tests in accordance with the provisions of Section 900.

504.3 CONSTRUCTION OPERATION

504.3.1 Weather and Seasonal Limitations

The provisions of Clause 501.5.1 shall apply.

TABLE 500-7: AGGREGATE GRADING AND BITUMEN CONTENT

Table 500-7 : Aggregate Grading and Bitumen Content

Grading	1	2
Nominal maximum aggregate size*	40 mm	19 mm
Layer thickness	80 -100 mm	50 -75 mm
IS Sieve size (mm)	Cumulative % by weight of total aggregate passing	
45	100	
37.5	90-100	
26.5	75-100	100
19	–	90 – 100
13.2	35-61	56 – 88
4.75	13 – 22	16 – 36
2.36	4 – 19	4 – 19
0.3	2 – 10	2 – 10
0.075	0 – 8	0 – 8
Bitumen content ** percent by mass of total mix	3.3**	3.5**

* Nominal maximum aggregate size is the largest specified sieve size upon which any of the aggregate material is retained.

** **Corresponds to specific gravity of the Aggregate being 2.7. In case aggregates have specific gravity more than 2.7, bitumen content can be reduced proportionately. Further, for regions where highest daily mean air temperature is 30°C or lower and lowest daily mean air temperature is -10°C or lower, the bitumen content may be increased by 0.5 percent.**

504.3.2 PREPARATION OF THE BASE

The base on which bituminous macadam is to be laid shall be prepared, shaped and compacted to the required profile in accordance with Clauses 501.8 and 902.3 as appropriate, and a prime coat, shall be applied in accordance with Clause 502 where specified, or as directed by the Engineer. The surface shall be thoroughly swept clean by a mechanical broom, and the dust removed by compressed air. In locations where mechanical broom cannot get access, other approved methods shall be used as directed by the Engineer.

504.3.3 TACK COAT

A tack coat in accordance with Clause 503 shall be applied as required under the Contract or as directed by the Engineer.

504.3.4 PREPARATION AND TRANSPORTATION OF THE MIX

The provisions of Clauses 501.3 and 501.4 shall apply.

504.3.5 SPREADING

The provisions of Clause 501.5.3 Shall apply.

504.3.6 ROLLING

Compaction shall be carried out in accordance with the provisions of Clauses 501.6 and 501.7.

Rolling shall be continued until the specified density is achieved, or where no density is specified, until there is no further movement under the roller. The required frequency of testing is defined in Clause 903.

504.4 SURFACE FINISH AND QUALITY CONTROL OF WORK

The surface finish of the completed construction shall conform to the requirements of Clause 902. For control of the quality of materials and the works carried out, the relevant provisions of Section 900 shall apply.

504.5 PROTECTION OF THE LAYER

The bituminous macadam shall be covered with either the next pavement course or wearing course, as the case may be, within a maximum of forty-eight hours. If there is to be any delay, by the Contractor the course shall be covered by a seal coat to the requirement of Clause 512 before opening to any traffic. The seal coat in such cases shall be considered incidental to the work and shall not be paid for separately.

504.6 ARRANGEMENTS FOR TRAFFIC

During the period of construction, arrangements for traffic shall be made in accordance with the provisions of Clause 112.

504.7 MEASUREMENT FOR PAYMENT

Bituminous macadam shall be measured as finished work in cubic metres, or by weight in metric tonnes, where used as regulating course, or square metres at the specified thickness as indicated in the Contract or shown on the drawings, or as otherwise directed by the Engineer.

504.8 RATE

The contract unit rate for bituminous macadam shall be payment in full for carrying out the required operations as specified. The rate shall include cost for all components listed in Clause 501.8.8.2.

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Item No.07 **Providing and laying 20 mm thick Mix seal surface using stone chips @66% by weight, gradation as per MORTH specification and using bitumin VG 30 grade for mixing rate not less then 50.90KG/MT on BT surface using stone chips as per MORTH specification including heating the ashphalt and aggregates by hot mix plant and spreading the same with paver finisher including consolidation wit vibratory roller and providing, operating plant machinaries, equipments, tools, plants, oil, fire wood, kerosene and all labour charges etc. complete.**

508 CLOSE-GRADED PREMIX SURFACING/MIXED SEAL SURFACING

508.1 SCOPE

508.1.1 The work shall consist of the preparation, laying and compaction of a close- graded premix surfacing material of 20 mm thickness composed of graded aggregates premixed with a bituminous binder on a previously prepared surface, in accordance with the requirements of these Specifications, to serve as a wearing course.

508.1.2 Close graded premix surfacing shall be of Type A or Type B as specified in the Contract documents. Type A grading is recommended for use in areas having rainfall more than 150 cm per year. In other areas Type B grading may be used.

508.2 MATERIALS

508.2.1 BINDER

The provisions of Clause 510.1.2.1 shall apply.

508.2.2 COARSE AGGREGATES

The provisions of Clause 511.1.2.2 shall apply.

508.2.3 FINE AGGREGATES

The fine aggregates shall consist of crushed rock , or natural sand or a mixture of both . These shall be clean, hard durable, un-coated, mineral particles, dry: and free from injurious , soft or flaky particles and organic or deleterious substances.

508.2.4 AGGREGATE GRADATION

The coarse and fin aggregates shall be so graded or combined as to conform to on or the other gradings given in Table 500-19 as specified in the contract.

Table 500-19 : Aggregate Gradation

IS Sieve Designation (mm)	Cumulative Percent by Weight of Total Aggregate Passing	
	Type A	Type B
13.2 mm	–	100
11.2 mm	100	88 – 100
5.6 mm	52 – 88	31 – 52
2.8 mm	14 – 38	5 – 25
0.090 mm	0 – 5	0 -5

508.2.5 PROPORTIONING OF MATERIALS

The total quantity of aggregates used for Type A or B close-graded premix surfacing shall be 20mm thick. The quantity of binder used for premixing shall be 50.90 Kg/MT for Type A and Type B surfacing respectively.

508.3 CONSTRUCTION OPERATIONS

The provisions of Clause 510.1.3.1 through Clause 510.1.3.5 shall apply.

508.4 OPENING TO TRAFFIC

Traffic may be allowed after completion of the final rolling when the mix has cooled down to the surrounding temperature. Speed restrictions may be imposed at initial stages.

508.5 SURFACE FINISH AND QUALITY CONTROL OF WORK

The surface finish of construction shall conform to the requirements of Clause 902. For control on the quality of materials and the works carried out, the relevant provisions of Section 900 shall apply.

508.6 ARRANGEMENTS FOR TRAFFIC

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

508.7 MEASUREMENT FOR PAYMENT

Close-graded premix surfacing, Type A or B shall be measured as finished work, for the area specified to be covered, in square metres at a specified thickness. The area will be the net area covered.

508.8 RATE

The contract unit rate for close-graded premix surfacing, Type A or B shall be payment in full for carrying out the required operations including full compensation for all components listed in Clause 501.8.8.2.

509 SURFACE DRESSING

509.1 SCOPE

This work shall consist of the application of one coat or two coats of surface dressing, each coat consisting of a layer of bituminous binder sprayed on a previously prepared, base, followed by a cover of stone chips rolled in to form a wearing course to the requirements of these Specifications.

509.2 MATERIALS

509.2.1 BINDER

The binder shall either be bitumen conforming to IS:73 or rapid setting cationic bitumen emulsion (RS-2) conforming to IS:8887. Grade of bitumen shall depend upon the climatic condition. For selection of grade of bitumen guidance may be taken from Table 500-1. The type of binder to be used shall be stated in the Contract, or as directed by the Engineer.

509.2.2 AGGREGATES

The stone chips (cover aggregate) shall conform to the requirements of Clause 505.2.2.. except that their water absorption shall be restricted to a maximum of 1 percent and they shall have a Polished Stone Value of minimum 60. [in BS:812 (Part-114)], of not less than 60. The size of the aggregate shall depend upon the type of surface on which it is laid and the traffic intensity. The chips shall be single sized, clean, hard, durable, of cubical shape: and free from dust and soft or friable matter,

organic or other deleterious matter and conform to one of the gradings given in Table 500-21. Thee siz of the aggregate shall depend upon the type of surface on which it is laid and the traffic intensity . Table 500-20 may be used as guidance.

PRE-COATED CHIPS: As an alternative to the use of an adhesion agent or wherever specified in the Contract, the chips may be pre-coated before they are spread except when the sprayed binder film is a bitumen emulsion. Pre-coating the chips may be carried out by mixing aggregates with 0.75 to 1.0 percent of bitumen by weight of chips in a suitable mixer. The chips shall be heated to 160°C and mixed with the binder heated to its application temperature. The pre-coated chips shall be allowed to cure for at least one week or until they become non sticky and can be spread easily.

Table 500-20 : Recommended Nominal Size of Aggregates (mm)

Type of Surface	Traffic Intensity in Terms of Number of Vehicles Per Day in the Lane Under Consideration		
	1000-2000	200-1000	20-200
Very hard	10	6	6
Hard	13	10	6
Normal	13	10	6
Soft	19	13	13
Very soft		19	13

Table 500-21 : Grading requirements for Aggregates used for Surface Dressing

IS Sieve Designation (mm)	Cumulative Percent by Weight of Total Aggregates Passing for the Following Nominal Sizes (mm)			
	19	13	10	6
26.5	100			
19	85-100	100		
13	0-40	85-100	100	
9.5	0-7	0-40	85-100	100
6.3		0-7	0-35	85-100
4.75			0-10	
3.35				0-35
2.36	0-2	0-2	0-2	0-10
0.60				0-2
0.075	0-1.5	0-1.5	0-1.5	0-1.5
Minimum 65% by weight of aggregate	Passing 19 and retained on 13.2	Passing 13.2 and retained on 9.5	Passing 9.5 and retained on 6.3	Passing 6.3 and retained on 3.35

509.2.3 RATES OF SPREAD OF BINDER AND CHIPS

The rate of spread of binder and chips will depend upon the nominal size of the aggregate and the extent of its embedment into the surface. The rate shall be determined as per the procedure given in Manual for Construction and Supervision of Bituminous Construction. Approximate rate of application of aggregates, and binder under average conditions are given in Table 500-22.

Table 500–22 : Approximate Rate of Application of Binder and Aggregates

Nominal Aggregate Size mm	Binder (Kg/m²)			Aggregates Cu.m/m²
	Uncoated Aggregates		Coated Aggregates	
	Bitumen	Emulsion	Bitumen	
19	1.2	1.8	1.0	0.014-0.015
13	1.0	1.5	0.8	0.009-0.011
10	0.9	1.3	0.7	0.007-0.009
6	0.75	1.1	0.6	0.003-0.005

Note : Bitumen for coated aggregates excludes quantity of bitumen required for coating.

509.2.4 ANTI-STRIPPING AGENT

Where the proposed aggregate fails to pass the stripping test then an approved anti-stripping agent (Appendix 4 for details) may be added to the binder in accordance with the manufacturer's instructions. The effectiveness of the proposed anti-stripping agent must be demonstrated by the Contractor, before approval by the Engineer.

509.3 CONSTRUCTION OPERATIONS

509.3.1 Weather and Seasonal Limitations

Clause 501.5.1 shall apply.

509.3.2 PREPARATION OF BASE

The base on which the surface dressing is to be laid shall be prepared, shaped and conditioned to the specified lines, grade and cross section in accordance with Clause 501 or as directed by the Engineer. Prime coat, where needed, shall be provided as per Clause 502 or as directed by the Engineer. Where the existing surface shows signs of fatting up, the excess bitumen shall be removed as directed by the Engineer. The bituminous surface to be dressed shall be thoroughly cleaned either by using a mechanical broom and/or compressed air, or any other approved equipment/method as specified in the Contract or directed by the Engineer. The prepared surface shall be dust free, clean and dry , (except in the case of cationic emulsion where the surface shall b slightly damp)

509.3.3 APPLICATION OF BINDER

After preparation of base, paving grade binder heated to an appropriate temperature or bitumen emulsion shall be sprayed uniformly using mechanical sprayers. During the operation the ratio between truck speed and pump revolution shall be maintained constant with the help of automatic control. When work resumes, the binder shall not be sprayed on the earlier completed surface. This can be done by covering the completed work with bitumen impregnated paper. Excessive deposit of bituminous material shall be immediately removed. The equipment described in IRC:SP:34 with synchronized spraying and compaction shall be preferred for better control and uniformity in construction.

The spraying temperatures for binder are given below:

Binder Grade	Whirling Spray Jets		Slot Jets	
	Min°C	Max°C	Min°C	Max°C
VG 30	180	200	165	175

509.3.4 APPLICATION OF STONE CHIPS

Immediately after application of the binder, clean, dry chips (in the case of emulsion the chippings may be slightly damp) shall be spread uniformly by means of a mechanical chip spreader on the surface so as to cover the surface completely with a single layer of chips.

509.3.5 ROLLING

Rolling of the chips should preferably be carried out by a pneumatic tyre roller in accordance with Clauses 501.6 and 501.7. Rolling shall commence at the edges and progress towards the centre except in super-elevated and uni-directional cambered portions where it shall proceed from the lower edge to the higher edge. Each pass of the roller shall uniformly overlap not less than one-third of the track made in the preceding pass. While rolling is in progress, additional chips shall be spread by hand in necessary quantities required to make up irregularities. Rolling shall continue until all aggregate particles are firmly embedded in the binder and present a uniform closed surface.

509.3.6 APPLICATION OF SECOND COAT OF SURFACE DRESSING

Where surface dressing in two coats is specified, the second coat should not be applied until the first coat has been open to traffic for two weeks. The surface on which the second coat is laid must be clean and free of dust. The construction operations for the second coat shall be the same as described in Clauss 510.3.3 to 510.3.5.

509.4 OPENING TO TRAFFIC

Traffic shall not be permitted to run on any newly surface dressed area until the following day. In special circumstances, however, the Engineer may allow the road to be opened to traffic immediately after rolling, but in such cases traffic speed shall be limited to 20 km per hour until the following day.

509.5 SURFACE FINISH AND QUALITY CONTROL OF WORK

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

For control on the quality of materials and the works carried out, the relevant provisions of Section 900 shall apply.

509.6 ARRANGEMENTS FOR TRAFFIC

During the period of construction, arrangements for traffic shall be made in accordance with the provisions of Clause 112.

509.7 MEASUREMENT FOR PAYMENT

Each coat of surface dressing shall be measured as finished work for the area instructed to be covered, in square metres.

509.8 RATE

The Contract unit rate for surface dressing, based on the approximate rates of application for binder given in Table 500-22 and each size of chippings given in Clause 509.2.3, shall be adjusted, plus or minus, for the difference between the approximate rate of spread and the rate of spread determined based on design and approved by the Engineer. The adjusted rate shall be payment in full for carrying out the required operations including full compensation for all components listed in Clause 501.8.8.2.

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Item No.08 Box cutting the road surface to proper slope and camber for making a base for road work including removing the excavated stuff and depositing on the road side slope as directed upto all lead.

1.0 This work shall consist of excavation removal and satisfactory disposal of all materials necessary for the construction of roadway and the lines, grades and cross sections shown in the drawing or as a indicated by the Engineer.

2.0 CLEARING AND GRUBBING THE SITE

2.1 S C O P E

This work shall consisting removing and disposing of all materials such as trees bushed, shrubs, slumps, roots, grass, weeds, top organic soil not exceeding 150 mm in thickness rubbish etc. Which in the opinion of the Engineer are unsuitable from incorporation in the works. From the area of road Land containing road embankment, drains, cross drainage structures and such other areas as may be specified on the drawing or by the Engineer. It shall include necessary excavation, back filling of pits resulting from uprooting of trees and slumps to required compaction handing salvaging and disposal of cleared materials, clearing and grubbing shall be performed in advance of earth work operations and accordance with the requirements of these specifications.

2.2. PRESERVATION OF PROPERTY / AMENTITES

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

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

2.3. METHOD, TOOLS AND EQUIPMENT

Only such methods, tools and equipment as are approved by the Engineer and which will not affect the property shall be adopted for the work. If the area has thick vegetation roots/trees a crawler or pneumatic tyred dozer of adequate capacity may be used for clearance purpose. The dozer shall have ripper attachments for removal of tree slumps. All trees slumps, etc. falling within excavation and fill lines shall be cut to such depth below ground level that in no case these fall within 500mm of the sub grade. Also all vegetation such, as roots, undergrowth, grass and other deleterious matter unsuitable for incorporation in the embankment/slab grade shall be removed between fill lines to the satisfaction of the Engineer on areas beyond these limits, trees and slumps required to be removed as directed by the Engineer shall be cut down to 1 m. below ground level so that these do not present and unsightly appearance.

All braches of trees extending above the roadway shall be trimmed as directed by the Engineer

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

The payment shall be made on Cubic Meter basis.

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Item No.09 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 ઓ z +az2 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,	10 mm to 25	80 mm

	footings and retaining walls	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.10 **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. 13 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. 13 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.11 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 (for O.D. road V.R.)

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.12 Providing and fixing Hectometer as per I.R.C. type design including painting, lettering etc. complete.(i) Fixing in C.C. 1:5:10

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.13 Providing and fixing guard stone as per I.R.C. type design including white washing etc. complete.(ii) Fixing in Earth

The work shall be carried out as per the item of ordinary kilometer stone except that the size of Guard 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.14 Providing and fixing indicator stone of approved stone as per I.R.C. type design in C.C. 1:4:8 including white washing etc. complete.(ii) Fixing in Earth

The work shall be carried out as per the item of ordinary kilometer stone except that the size of Incidcator 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 indicator 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.15 **Village name Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 90x60 cms. rectangular as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ; reflectorised with High Intensity Prismatic Grade retro refiectivesheeting of Type-4 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.3mtr long stand post of Iron Angle 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. the details of symbol or inscription / numerals for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 7 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (B) Class-B Type-4 Retro Reflective sheeting**

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.

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Item No.16 **Cautionary Warning Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 90 x 90 x 90 cms. equilateral triangle as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ; reflectorised with High Intensity Prismatic Grade retro refiectivesheeting of Type-4 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.6mtr long stand post of Iron Angle 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 7 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (B) Class-B Type-4 Retro Reflective sheeting**

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.

11.0 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.

15.0 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.

16.0 INSTALLATION:

14.0.1Sign 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.

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Item No.17 **Direction (Junction) Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 244x122 cms. rectangular as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ; reflectorised with High Intensity Prismatic Grade retro refiectivesheeting of Type-4 as per ASTM D-4956 and latest M.O.S.T.Specifications; 4.0mtr (2 Nos.) long stand post of Iron Angle 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50x50x5mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 7 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (B) Class-B Type-4 Retro Reflective sheeting**

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.

12.0 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.

17.0 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.

18.0 INSTALLATION:

14.0.1Sign 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.

Deputy Executive Engineer
Panchayat (R&B) Sub Division
Jamnagar.

Executive Engineer
Panchayat (R&B) Division
Jamnagar.