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# GENERAL TECHNICAL SPECIFICATIONS

## 1.0 General : .

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

- (i) length and breadth... 10mm
- (ii) height, depth or thickness of earthwork,  
sub-base, bases, surfacing, and structural members...5mm
- (iii) areas,..... 0.01 Sq. Metre
- (iv) cubic contents..... 0.01 cubic metre

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

## 2.0 Measurement of lead for Materials :

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

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

## 3. Surface Regularity of Sub grade & Pavement Courses :

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

**PERMITTED TOLERANCES OF SURFACE REGULARITY FOR PAVEMENT COURSES**

Sr.	Type of Construction	Longitudinal Profile with 3 metre straight edge					Cross Profile
		Maximum Permissible undulation in mm	Maximum number of undulation permitted in any 300m. length exceeding in mm.				Maximum permissible variation from specified profile camber template – mm
			18	12	10	6	
1	2	3	4	5	6	7	8
1	Earth Sub grade	36	30	-	-	-	15
2	Granular / lime / Cement Stabilised Sub – base.	23	-	30	-	-	12
3	Water Bound Macadam with nominal size metal (20-50) mm	18	-	-	30	-	8
4	Semi – Dense Carpet @	15	-	-	-	20	6

## Notes:-

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

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

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

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

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

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

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

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

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

## 4. Quality Control Tests During Construction :

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

## 5. Tests on Earthwork for Embankment Construction :

### 5.1 Borrow Material :

- (a) Sand Content (IS : 2720 Part IV)  
Two test per 8000 Cubic Metres of soil.
- (b) Plasticity Test (IS : 2720 Part-V)  
Each type to be tested. Two tests per 8000 Cubic Metres of soil.

- (c) Density test (IS : 2720 Part VII)  
Each soil type to be tested. Two tests per 8000 Cubic Metres of soil.
- (d) Moisture Content Test (IS : 2720 Part-II)  
One test for every 250 Cubic Metres of soil.

## 5.2 Compaction Control :

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

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

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

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

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

## STANDARD TECHNICAL SPECIFICATIONS FOR ROADWORKS

### ITEM 1-A Earthwork for embankment including clods, dressing with all lead and lift (including watering and consolidation) (a) From 'borrow pits within Sand width.

1. The land width on which the earth work is to be done shall be cleared of all trees having a girth of 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 roads boundary or as directed at places within 50 metres lead, and handed over to the department in convenient sections. Unsuitable material shall be burnt or otherwise disposed off by the contractor at his own cost without causing any nuisance, inconvenience or damage to the 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, string, pegs, nails, bamboos, stones, mortar, concrete etc. required for setting out, establishing Bench Marks and giving profiles. The contractor shall be responsible for maintaining the B.M.S. profiles alignments and other marks as long as they are required for the work in the opinion of the Engineer-in-charge. If the contractor defaults in this respect they may be restored by the department at the cost of the contractor.
3. When an existing embankment is to be widened, continuous, horizontal benches, each at least 0.3 metre wide, shall be cut into existing slope for ensuring adequate bond with the fresh embankment material to be added. The material obtained from the cutting of benches can be utilised in the widening of the embankment. Where the width of the widened portions is insufficient to permit the use of usual rollers, compactions shall be carried out with the help of tandem/sheepfoot rollers, mechanical tampers or other approved plant. 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 materials considered suitable by the Engineer-in-charge shall be used for the construction and that considered unsuitable shall be disposed off as directed by him. The selection of materials to be used in the construction of embankment shall be made after soil survey and investigations are carried out by the Department. The embankment shall consist of earth available from road-side borrow pits on either side with all lead and lifts.
5. The materials satisfying the density requirements given in the table shall be employed for embankment construction.

Type of work	Laboratory Dry Density when tested as per IS : 2720 (Pt.VII)
- Embankment up to 3 metre height	Not less than 1.44 gm/cc
- Embankment exceeding 3 metre height or embankment of any height subject to long period of inundation.	Not less than 1.52 gm/cc
- Top 0.5 metre of embankment below the sub grade level and shoulder [Where earth shoulder are specified]	Not less than 1.65 gm/cc

Field density shall be a percentage of laboratory density as recommended by the Gujarat Engineering research institute. Location, shape and size of borrow pits shall be as indicated by the Engineer-in-charge. Pits shall not be dug continuously. Ridges of not less than 8 metres width should be left at intervals not exceeding 300 metre. Small drain shall be cut through the ridges of facilities drainage. The outer edge of borrow pits shall be so regulated that the bottom does not cut an imaginary line having a slope of 1 vertical to 4 horizontal projected from the edge of final section of the bank, the maximum depth in any case being limited to 1.5 metres. Also no pits shall be dug within 5 metres of the tow of the final section of the road embankment.

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

- (i) upto 30 metres on either side of C.D. Works;
- (ii) upto 15 metres on either side of cart rack crossing for which approaches are to be constructed
- (iii) in the length in which earth obtained from cutting is specified to be used in the embankment.

5.2 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 lower level will only be used in earthen embankment.

6. The embankment shall be constructed in uniform layers not exceeding 250 mm in loose thickness. The soil shall be spread uniformly over the entire width of the embankment. Unless otherwise directed by The Engineer-in-charge. The consolidation including watering and rolling of earthwork shall be carried out by the Department, The operation of laying the successive layer of earth shall have to be suitably synchronized with the consolidation work. If the soil as delivered to the road is too wet, it shall be dried by exposure to the sun till the moisture content is acceptable for compaction. 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 size of 5 cm. when being placed in the top 45 cm. of the embankment. The work of next layers shall be allowed only after the first layer below it has been thoroughly compacted to the density specified.

7. Where an embankment is to be placed on sloping ground, the surface of the ground shall be benched in the step 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 surface, the new material. However when the embankment is to be placed over an old concrete, 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 new subgrade 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 construction of abutments, wing walls or return 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 of damage to the bridge work. Unless directed otherwise the filling around 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 materials 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 simultaneously with the laying of fill material the material used for the filler shall conform to the requirement rollers or other heavy equipment, the compaction shall be carried out by mechanical tampers or other methods approved by the Engineer-in-charge. Care shall be taken to see that the compaction plant does not hit or come too close to any structural members so as to cause any damage to them.

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

10. The consolidation of earth work including rolling and watering at O.M.C. as per laboratory requirement shall be carried out by the Department, the field and laboratory investigations and testing of samples shall be carried out by the department. However, the contractor shall give full co-operation and shall bear the charges for layout and collection of samples for testing at authorized Government laboratory. The work of laying of earthwork in layers shall be synchronized with the work of compaction and consolidation of the earth work and the operations shall also be synchronized with the field and laboratory testing. When density measurements reveal any soft areas in the embankment, the Engineer-in-charge shall direct that these areas shall be compacted further. In spite of that, specified compactions is not achieved, the materials in the soft area shall be removed as directed and replaced by the approved materials. Deduction of 15% shall be made for the shrinkage from the sectional measurements to be paid to the contractor, if measured before first monsoon and 10% measured after one or more monsoon have passed over the earth embankment.

11. The earth work measurements shall be paid on cross sectional measurements and computing the volumes of earth-work in cubic metres by average area method. The contractor shall sign day to day leveling work and also original cross sections in token of his acceptance etc. The working sections both longitudinal and cross of the ground shall be taken by the Engineer-in-charge before the actual earth work is started. The contractor or his authorised representative shall attend day to day leveling work and sign with date the field book daily, in token of this acceptance. If there is any disagreement the contractor shall inform of it in writing to the officer concerned of any complaint shall be taken. Merely not signing of the level book shall not be deemed as disagreement. The Executive Engineer shall also verify leveling work to the extent of 5% before commencement of earth work and on finalisation. 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 measurement shall be taken on compacted earth work, no deduction for shrinkage shall be made from gross measured quantity of compacted earth work. However the contractor shall have to bear loss of quantity due to all settlement as well as other types of deformations etc. if any that might have taken place at the time of taking the final measurement of this item. If the Compaction as stipulated in para-10 is not done by the department in that case shrinkage from such earthwork quantity shall be deducted as per norms, i.e. 10% after monsoon and 15% before monsoon. 12. The rate of earthwork includes clearing jungles, dogbelling, fixing profiles, erecting necessary pillars or stones for bench mark for leveling purpose, excavating earth from borrow pits, breaking clods, conveying and spreading earth in layers with all lead and lift, finishing the entire embankment to the proper profile camber, grade and slopes. The rate also includes all labour, materials, tools, equipment and incidentals necessary to complete the work according to the specifications. 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 that particular item. No payment shall be made under this item for the cutting stuff used in the embankment but labour for cutting will be paid as per specifications in the particular item and only balance quantity brought from borrow pits will be paid in this item.

**ITEM 1-B Earthwork for embankment including breaking clods, dressing with all lead and lift (excluding watering and consolidation) (a) From borrow pits within land width.**

1. The land width on which the earth work is to be done shall be cleared of all tree having a girth of 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 material shall be burnt or otherwise disposed off by the contractor at his own cost without causing any nuisance, inconvenience or damage to the works property or people in the neighborhood. In all cases, the materials shall be disposed, off in a neat manner.
2. After 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 contractor shall be responsible for maintaining the B. Ms. profiles alignments and other marks as long as they are required for the work in the opinion of the Engineer-in-charge. If the contractor defaults in this respect they may be restored by the department at the cost of the contractor.
3. When an existing embankment is to be widened, continuous, horizontal benches, each at least 0.3 metre wide shall be cut into the existing slope for ensuring adequate bond with the fresh embankment 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 soil surveys and investigations carried out by the Department. The embankment shall consist of earth available from road side borrow pits on either side with all lead and all lifts.
5. Location, shape and size of borrow pits shall be as indicated by the Engineer-in-charge. Pits shall not be dug continuously. Ridges of not less than 8 metres width should be left at interval not exceeding 300 metres. Small drain shall be cut through the ridges of facilitate drainage. The outer edge of borrow pits shall be so regulated that the bottom does not cut an imaginary line having a slope of 1 vertical to 4 horizontal projected from the edge of final section of the bank, the maximum depth in any case being limited to 1.5 metres. Also no pits shall be dug within 5 metres of the toe of the final section of the road embankment.
  - 5.1 No borrow pits shall be allowed at the following sites along the road,
    - (i) up to 30 metres on either side of C.D. Works.
    - (ii) up to 15 metres on either side of cart track crossing for which approaches are to be constructed.
  - 5.2 If there is top layer of black cotton or other objectional soils, the same shall be removed and disposed off elsewhere and usable material found at lower level will only be used in the embankment.
6. The embankment shall be constructed in uniform layers not exceeding 250 mm in loose thickness. The soil shall be spread uniformly over the entire width of the embankment, unless otherwise directed by the Engineer-in-charge. The consolidation including watering and rolling of earth work shall be carried out by the

Department. The operation of Laying the successive layer of earth shall have to be suitably. 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 subgrade 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 granulate or bituminous type and lies within 1 mt. of the new subgrade 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 or return 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, bridges and other structures up to a distance of twice the height of the embankment. The fill material shall not be placed against any abutment or wing wall unless permission has been given for 14 days, the embankment shall be brought up simultaneously in equal layers on each side of the structure to avoid displacement it 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 simultaneously 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, 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 earth work in cubic metres by average area method. The contractor shall sign day to day leveling work and also original cross section, 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 is started. The contractor or his authorised representative shall attend day to day leveling work and sign with date the field book daily, in token of his acceptance. If there is any disagreement the contractor shall inform of it in writing to the officer concerned with specific reference to the sections before starting further work. Once the work is started, no cognizance of any complaint will be taken. Merely not signing of level book shall not be deemed as disagreement. The Executive Engineer shall also verify leveling work to the extent of 5% before commencement of earth work and on finalisation. 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. If the compaction as stipulated in para above is not done by the department in that case shrinkage from such earth work quantity shall be deducted as per norms i.e. 10 percent after monsoon and 15% before monsoon. However the contractor shall have to bear loss of quantity due to all settlements as well as other types of deformations etc. if any, that might have taken place at the time of taking the final measurements of this item.

11. The rate of earthwork includes, clearing jungles, bogoelling, fixing profiles, erecting necessary pillars for stones for bench marks for leveling purpose, excavating earth from borrow areas, breaking clods, conveying and spreading earth in layers with all lead and lift, finishing the entire embankment and incidentals necessary to complete the work to the specifications. The cutting stuff of cutting in ordinary soil, soft murrum, soft rock, hard murrum and hard rock shall be 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 the 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.

**ITEM 1-C Earthwork for embankment for side shoulders including breaking clods, dressing with all lead and lift (excluding watering and consolidation) (b) From borrow pits within \_ kms. lead.**

1. The land width on which the earth work is to be done shall be cleared of all trees having a girth of 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 meters 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 any nuisance, inconvenience or damage to the works property or people in the neighborhood. In all cases, the materials shall be disposed off in a neat manner.

2. After 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 contractor shall be responsible for maintaining the B. Ms. profiles alignments and other marks as long as they are required for the work in the opinion of the Engineer-in-charge. If the contractor defaults in this respect they may be restored by the department at the cost of the contractor.

3. When an existing embankment is to be widened, continuous, horizontal benches, each at least 0.3 metre wide shall be cut into the existing slope for ensuring adequate bond with the fresh embankment materials to be added. The material obtained from the cutting of benches can be utilised 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 soil 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 or Panchayat land, if available. However. department is not responsible if not such area is made available to the contractor and in the case, contractor will have-to make his own arrangement to get borrow area for borrowing earth of the quantity even by making temporary arrangement with the private land owners.

6. The embankment shall be constructed in uniform 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 new sub grade level, the same shall be scarified to a depth of minimum 50mm.so as to provide ample bond between the old and the new material.

8-. To avoid interference with 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 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 earth work in cubic metres by average area method. The contractor shall sign day to day leveling work and also original cross sections longitudinal section etc, in token of his acceptance. The working 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 leveling work and sign with date the field book daily, in token of his acceptance. If there is any disagreement the contractor shall inform of it in writing to the officer concerned with specific reference to the sections. Before starting further work. Once the work is started, no cognizance of any complaint will be taken. Merely not signing of level book shall not be deemed as disagreement. The Executive Engineer shall also verify leveling work to the extent of 5% before commencement of earth work and on finalisation. 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 if measured before first monsoon and 10% if measured after one or more monsoon have been passed over the earth embankment. However the contractor shall have to bear loss of 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 the item.

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

- (i) The borrow pits will be so excavated as to form a road side longitudinal gutter to drain the water, interrupted by such gutter,
- (ii) The width of the drain shall be restricted to 1.5mts, only. The depth will be restricted to such grade so as to drain the water efficiently. All balance quantity of earth shall be brought from distant borrow areas only,
- (iii) If there is top layer of black cotton or other objectionable soils, the same shall be removed and disposed off elsewhere and usable material found at the lower level will only be used in the earthen embankment, if the contractor 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 be dug within 5 meters of the toe to the final section of the road embankment,
- (v) No borrow pits shall be allowed in the length in which earth obtained for cutting from cutting is specified to be used in embankment.

12. The rate of earthwork includes, clearing jungles, dogbelling, fixing profiles, erecting necessary pillars for stones for bench marks for leveling purpose, excavating earth from borrow areas, breaking clods, conveying and spreading earth in layers with all lead and lift, finishing the entire embankment and incidentals necessary to complete the work to the specifications. The cutting stuff of cutting in ordinary soil, soft murrum, soft rock, hard murrum and hard rock shall be 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.

**ITEM 1-D Earthwork for embankment including breaking clods, dressing with all lead and lift {including watering and consolidation} (b) From borrowpits within \_\_\_\_\_ kms. lead.**

1. The land width on which the earth work is to be done shall be cleared of all trees having a girth of 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 material shall be burnt or otherwise disposed off by the contractor at his own cost without causing any nuisance, inconvenience or damage to the works property or people in the neighborhood. In all cases, the materials shall be disposed off in a neat manner.

2. After 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 contractor shall be responsible for maintaining the B.Ms, profiles alignments and other marks as long as they are required for the work in the opinion of the Engineer-in-charge. If the contractor defaults in this respect they may be restored by the department at the cost of the contractor.

3. When an existing embankment is to be widened, continuous. Horizontal benches, each at least 0.3 metre wide shall be cut into the existing slope for ensuring adequate bond with the fresh embankment materials to be added. The material obtained from the cutting of benches can be utilised in the widening of the embankment. Where the width of the widened portions is insufficient to permit the use of usual rollers, compaction shall be carried out with the help of tandem/sheeps foot rollers, hand rollers, mechanical tampers or other approved plant. 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 soil surveys and investigations are carried out by the Department. The embankment shall consist of earth available from road-side borrow pits on either side with lead and all lifts, and within land-width in the manner specified in para 12 below. The road, if any, required for the purpose of haulage of earth by men, animals or vehicles will be constructed (if not existing) and maintained by the contractor at his own cost, the material satisfying the density requirements given in the table below shall be employed for embankment construction.

<b>Type of Work</b>	<b>Laboratory Dry Density when tested as per IS : 2720 (Pt. VII)</b>
- Embankment up to 3 metre height	Not less than 1.44 gm/cc
- Embankment exceeding 3 metre height or embankment of any height subject to long period of inundation.	Not less than 1.52 gm/cc
- Top 0.5 metre of embankment below the subgrade level and shoulder [Where earth shoulder are specified]	Not less than 1.65 gm/cc

Field density shall be percentage of laboratory density as recommended by Gujarat Engineering Research Institute

5. Department will extend all necessary co-operation in helping contractor to get borrow area from nearby Government or Panchayat land, if available. However, department is not responsible if no such area is made available to the contractor and in that case, contractor will have to make his own arrangement to get borrow area for borrowing earth of the approved quantity even by making temporary arrangement with the private land owners.

6. The embankment shall be constructed in uniform layers not exceeding 250mm in loose thickness. The soil shall be spread uniformly over the entire width of the embankment, unless otherwise directed by the Engineer-in-charge. The consolidation including watering and rolling of earthwork shall be carried out by the Department. The operation of laying the successive layer of earth shall have to be suitably synchronized with the consolidation work. If the soil as delivered to the road bed is too wet, it shall be dried by exposure to the sun till the moisture content is acceptable for compaction. All clods of hard lumps of earth shall be broken to have maximum size of 15cm when being placed in the embankment and a maximum of size 5 cm when being placed in the top 45 cm of the embankment. The work of next layer shall be allowed only after the first layer below it has been thoroughly compacted to the density specified.

7. Where an embankment is to be placed on sloping ground, the surface of the ground shall be benched in the steps of trenches or broken up in such a manner that the new material shall have perfect bond with the existing surface. Where the embankment is to be placed over an existing road surface, the surface shall be scarified to minimum depth of a 5 cm so as to provide ample bond between the old and new material. However when the embankment is to be placed over an old concrete pavement and lies within 1 metre of new subgrade 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 ml. of the new subgrade 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 or return 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, bridges 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 simultaneously 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. Where it may be impracticable to use power rollers or other heavy equipment, the compaction shall be carried out by mechanical tampers or other methods approved by the Engineer-in-charge. Care shall be taken to see that the compaction plant does not hit or come too close to any structural member so as to cause any damage to them

9. The embankment shall be finished in conformity with the alignment, levels, 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 consolidation of earth work including rolling and watering at O.M.C as per laboratory requirements shall be carried out by the department. The field and laboratory investigations and testing of sample shall be carried out by the Department. However, the contractor shall give full co-operation and shall be the charges for labours and collection of samples for testing at authorised Government laboratory. The work of laying of earthwork in layers shall be synchronized with the field and laboratory testing. When density measurements reveal any soft area as in the embankment the Engineer-in-charge shall direct that these areas shall be compacted further. If in spite of that, specified compaction is not achieved the materials in the soft areas shall be removed as directed and replaced by the approved materials.

11. The earthwork measurements shall be paid on cross sectional measurements and computing the volumes of earth work in cubic metres by average area method. The contractor shall sign day to day leveling work and also original cross section, 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 is started. The contractor or his authorised representative shall attend day to day leveling work and sign with date the field book daily, in token of his acceptance. If there is any disagreement the contractor shall inform of it in writing to the officer concerned with specific reference to the sectioned before starting further work. Once the work is started, no cognizance of any complaint will be taken. Merely not signing of level book shall not be deemed as disagreement. The Executive Engineer shall also verify leveling work to the extent of 5% before commencement of earth work and on finalisation. The contractor shall maintain the embankment by tilling 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. No deduction for shrinkage shall be made from gross measured quantity of compacted earth work. However the contractor shall have to bear loss of quantity due to all settlements as well as other types of deformations etc. if any, that might have taken place at the time of taking the final measurements of this item.

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

- (i) The borrow pits will be so excavated as to form a road side longitudinal gutter to drain the water. interrupted by such gutter,
- (ii) The width of the drain shall be restricted to 1.5 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 be removed and disposed off elsewhere and usable material found at the lower level will only be used in the earthen embankment, if the contractor chooses to utilize this material.
- (iv) The drain should be aligned along the boundary of the land width of the road. No pit, other than this drain, shall be dug within 5 metres of the toe to the final section of the road embankment,
- (v) No borrow pits shall be allowed in the length in which earth obtained from cutting is specified to be used in embankments.

13. The rate of earthwork includes clearing jungles, dogbelling, fixing profiles, erecting necessary pillars for stones for bench marks for leveling purpose, excavating earth from borrow areas, breaking clods, conveying and spreading earth in layers with all lead and Lift, finishing the entire embankment and incidentals necessary to complete the work to the specifications. The cutting stuff of cutting in ordinary soil, soft murrum, soft rock, hard murrum and hard rock shall be utilised in embankment construction under this item within the lead specified in that particular item. No payment shall be made under this item for the cutting stuff used in the embankment but labour

for cutting will be paid as per specifications in that particular item, and only balance quantity of earthwork brought from borrow areas will be paid in this item.

**ITEM 1 (E) Rolling and Watering of earth work in layer with power roller including filling in depression which occurs during the process.**

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

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

Moisture content of each layer of soil shall be checked in accordance with IS 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 IS 2720 (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 0.5 meter portion of the embankment below the subgrade.

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

Where the embankment is to be constructed on low area ground that will not support the weight of 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. COMPACTION** : Only compacting equipment approved by the Engineer-in-charge shall be employed to compact the materials The contractor shall demonstrate the efficiency of the plants he intends to use for carrying out compaction trials.

Each layer of the materials shall be thoroughly compacted to the densities specified in Table 1.2 Table 1.2 Compaction requirements for embankment.

<b>Sr. No.</b>	<b>Type of Work/materials</b>	<b>Field dry density as per centage of maximum laboratory dry density as per IS:2720 (Part-VII)</b>
1.	Top 0.5 meter portion of embankment below subgrade level and shoulders.	Not less than 100.
2.	Other portion of embankment.	Not less than 95
3.	Highly expansive class	85 to 90

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

When density measurements reveal any soft areas in the embankment further compaction shall be carried out as directed by the Engineer-in-charge. If insite 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. 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 are 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 froms one cubic meter of compacted fill and all bulking or shrinkage shall be ignored

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

4. The contract unit rate includes cost of mechanical roller required for consolidation including ail labour, equipments fuel, hire charges, tolls, and incidentals necessary.

**ITEM-2 Earth Work In cutting In all sorts ot Soil and Soft Murrum including conveying and putting the stuff spoil bank maintaining minimum distance of five meter between top edge of cutting and top of bank, (a) within 200 metres from the ends of the cutting with alt required Lead and Lift.**

1. The land width required for the roadway, gutter side slopes and catch water gutters shall be cleared of all trees having a girth of 30 cms and less, loose, stones, vegetation, bushes, stumps and all other objectionable materials. The roots of trees and stumps shall be removed to a depth of 30 cms below the grade formation and slopes and excavation filled up with excavated materials and compacted. All the materials cleared will be the property of Government. Useful materials shall be arranged in convenient stacks along the road boundary or as directed at places within 50 mts. lead, and handed over to the department in convenient sections. Unsuitable material shall be burnt or otherwise disposed off by the contractor at his own cost without causing any nuisance, inconvenience or damage to the work, property or people in the neighborhood. If the materials are to be disposed off outside the road land, necessary permission from the private land owners shall be taken by the contractor and royalty etc. If any paid by him without claiming compensations 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 lines, curves slopes, grades and sections as shown on the plans or directed by the Engineer-in-charge. The contractor shall provide all labour and materials such as lime, strings, pegs, nails, bamboos, stones mortar, concrete etc required for setting out alignment establishing bench marks and giving profiles. The contractor shall be responsible for maintaining the B. Ms. profiles alignments and other stakes and marks as long as they are required for the work in the opinion of the Engineer. If the contractor defaults in this respect even after the direction by the Engineer within the specified time. they may be restored by the Engineer at the levels etc. If there is any disagreement the contractor shall inform of it in writing to the officer concerned with the specific reference to the sections before starting further work. Once the work has started, no cognizance of any complaint shall be taken. Merely not signing of the book shall not be deemed as disagreement.

3. Profiles of the section including the road side gutters to be excavated shall be laid at suitable intervals of 10m to 50 m. or other intervals as directed by Engineer to conform t8 the curved or straight alignment, sections, grades and side slopes. The line out shall be clearly marked and profiles of embankments where excavated materials are to be used shall be set up with the toe line marked on each side. The road way section shall first be excavated with vertical side for each lift and the sides slopes for that lift shall be excavated in steps. These steps shall be smoothened to the required slope when the excavation reaches the road formation. The contractor shall on no account excavate beyond the slopes or below the specified grade unless so directed by the Engineer in writing. If excavation is done below the specified level or outside the section, it shall not be paid for and the contractor shall be required to fill up at his own cost such extra excavation in the road portion, with approved materials of the embankment grade in layers, watered and fully compacted to attain maximum density laid down for the embankment

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

4. If slides occur in the cutting they shall be removed as ordered by the Engineer. If finished slopes slide into the roadways before the final acceptance of the work, such slides shall be removed by the contractor and shall be paid for at the contract rate for the class of excavation involved provided the slides are not due to any negligence of the contractor. The classification of the material in slides shall conform to its conditions at the time of removal



and payment made accordingly regardless of its prior condition. Care shall be taken to see that excavation is arranged in a safe way so that there will be no risk to the workmen by slides, falling materials, boulders and collapsing sides etc.

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

6. All the excavated materials shall be property of Government. When the useful excavated material is to be used in embankment within a lead of 200 metre and all lift, it shall be directly deposited at the required location in specified layers. No handling or conveyance charges shall be paid if the material is temporarily deposited elsewhere and subsequently conveyed to site of deposition. The sequence of operations at convenient places, without interfering with the drainage in any way. If no Government land is available but the excavated useful stuff is to be stacked temporarily before use under the same agreement, the contractor shall make his own arrangements for the stacking of this material not required for use on embankment or unsuitable materials may be used on his own to uniformly widen embankment to flatten slopes and to fill low places in the road land, if so permitted by the Engineer. Material not required for any use whatsoever may be disposed off by the contractor at his own cost in a manner approved by the Engineer. The excavated material shall not be deposited within 3 m from the top edge of slope or toe of the bank. The lead shall be measured from the junction point of cutting and embankment up to 200 mt. on either side.

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

8. The Contract rate shall be a unit of one cubic metre for the work mentioned in the wording of the item of excavation acceptably completed, limited to the dimensions shown on the plans or as directed by the Engineer. Excavation shall be measured in its original positions by taking cross sections before the work starts and after it is entirely completed. The quality shall be worked by the average end area method. When the classification of the strata changes, the contractor shall bring this to notice of the Engineer, who will then verify and if necessary take levels for the changed strata for purpose of measurement.

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

**ITEM 3 Supplying and Stacking murrum binding materials including materials on road side including filling boxes with all lead & lift etc. complete.**

1. Material for the purpose shall be of approved quality. Any material which is found inferior shall be rejected and the contractor shall remove such rejected material from the site at his own cost. The material shall be collected from quarries approved by the Executive Engineer. The material shall be granular and gritty\*.

2. The material shall be got approved by the Executive Engineer prior to collection on site. It shall be free from all rubbish, dust and any organic materials as well as clods of black cotton soils. Materials shall not be allowed to be collected from within the road boundary. Material to be used as crust and for side shoulders shall be as per C.B.R. report and that to be used as bindaga in W.B.M. road construction shall have P.I. value of less than 6 as determined in accordance with IS 2720 (Part-V). The material to be used should be got tested prior to its use in road construction. Testing charges shall be borne by the contractor.

3. River or nala or sea sand required for the work shall be clear, sound, properly, graded, free from organic materials silt clay etc. and shall be got approved by the Engineer-in-charge. The sand shall be obtained and brought from the source approved by the Engineer-in-charge. The sand shall be well graded.

The payment shall be made on Cubic Metre basis

4. Stacking shall be done by filling in the standard steel boxes of 2 m x 1.5 m x 0.5 m size which shall be supplied by the Department if available on rent. Otherwise contractor shall make his own arrangement. No deduction for voids shall be made from the grade measurements. Where any doubt exists as to whether the quantity of slacks of murrum in an hectometre is not confirming with the cubic content of the standard pharas (2 x 1.5 x 0.5 M) the same shall be got corrected by the contractor if so ordered by the Engineer-in-charge for which no extra payment shall be claimed by the contractor. If the quantity of murrum in any stack in a particular hectometre is found to be less than the standard measurements viz.. 1.5 cmt the entire collection in the

hectometre shall be paid on the basis of the quantity so found. Regular stacks shall be done by the Contractor on a fairly level ground. Stacking of the murrum shall be done in a manner as directed by the Engineer-in-charge. 5. For road work completed stacking of murrum as per requirement shall be earned out in 2 K.M. length before spreading. The collection shall always, be commenced at one end of the K.M. and be carried continuously toward the other end unless the Engineer-in-charge shall direct otherwise.

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

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

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

**Item-3(A) Supplying and Stacking hard murrum / sand/yellow earth/ binding materials on road site including filling boxes with all leads and lifts etc. complete on site of work as per specification.**

1. The materials for the purpose shall be of approved quality. Any materials which is found inferior shall be rejected and the contractor shall remove such rejected materials from the site at his own cost. The material shall be approved by the Executive Engineer or his authorised agent Para 3 to 8 of Item No. 3 shall apply. The sand used as crust shall be as per C.B.R. Report

9. The measurements shall be taken on cubic metre basis.

**ITEM NO 4 : Supplying standard size stone aggregate.**

**ITEM NO.4(A) Supplying and stacking of hand broken stone coarse aggregates shippings etc of hard stone of size 25mm.to 90 mm size nominal size free of disintegrated pieces, deleterious and organic matter including Filling boxes with all lead and lift etc complete for W.B.M. road.**

1. The stone metal shall be obtained from quarries approved by the Executive Engineer prior to collections. The metal shall be of approved quality with all leads and lift. The metal shall be obtained from hard tough, sound durable .stone of close texture as is locally available and reasonably free from decay and weathering. Pieces of the stone shall be angular and roughly cubical in shape and round .elongated or flaky materials shall be allowed. The size of metal shall be 25 mm to 90 mm and shall be hand broken. All unsound weathered or disintegrated stone obtained form the upper surface layer of the quarry or other layers of boulders shall be rejected.

2. The samples of metal collected from approved quarries shall be got tested at Government recognized laboratory as may be directed to the contractor at his own cost. The test results shall conform to the standard requirements laid down for metal to be used for W.B.M. work.

3. The physical requirement for standard size metal shall conform to the test results indicated in the Table below :-

Type of Const,	Test	Test Method	Requirement
Base	(a) Los Angeles Abrasion Value	IS 2386 Part IV	50% (Maximum)
	(b) Flakiness Index	IS 2386 Part- IV IS 5640 IS 2386 Part - 1	or 40% (Maximum) 15% (Maximum)

Frequency of test shall be as per Ministry of Surface Transport Specifications. The

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

Sr. NO	Size Range	Sieve designation	Percentage by weight Passing through the sieve
1.	25 mm to 90 mm	100 mm	100
		90 mm	90-100
		50 mm	40-60
		25 mm	0-10
		20 mm	0-5

The size of metal for W.B.M shall be 25 mm to 90 mm. wherein tolerance limit for oversize shall be up to 10% and that for lower size should be up to 10%.

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

6. Stacking shall be done by filling in the standard steel boxes of 2 m x 1.5 m x 0.5 m size which shall be supplied by the Department if available on rent. Otherwise contractor shall make his own arrangements. No deduction for voids shall be made from the gross measurements. Where any doubt exists as to whether the quantity of stacks of metal in any hectometre is not confirming with the cubical content of the standard pharas ( 2 m x 1-5 m x 0.5 m) shall be got corrected by the contractor if so ordered by the Engineer-in-charge for which no extra payment shall be claimed by the contractor. If the quantity of metal in any stack in a particular Hectometre shall be paid on the basis of the quantity so found. Regular stacks shall be done by the contractor on a fairly level ground. Stacking of the metal shall be done in a manner as directed by the Engineer-in-charge. Collection of metal shall be completed in two hectometre wise as per the final requirement and measurement shall be recorded two hectometre-wise. Until the quantity of metal as per the final requirement is not collected in any two consecutive HM. and std. boxes are not filled in completely in two hectometres, measurements shall not be recorded and payments shall not be done.

7. For road work complete staking of metal as per requirement shall be carried out in 2 Km. length before spreading. The metal stacks shall be measured and recorded and got cross checked by other Deputy Executive Engineer as per rules before spreading. The collection shall always, commence at one end of the Km. and be carried continuously towards the other end unless the Engineer-in-charge shall direct otherwise.

8. The payment shall be on cubic metre basis without deduction for voids. The contractor shall maintain all stacks in regular and proper size till the whole materials shall not measured and finally accepted by the Department.

The spreading of materials shall not be allowed till the materials are fully stacked and completed kilometer wise.

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

**ITEM 4 (B) Supplying & stacking of hand broken crushed stone aggregate Chippings etc of hard stone of 40mm to 63mm size nominal size free of disintegrated pieces, deleterious and organic matter including filling boxes with all lead and lift etc. complete for road work.**

Para to 1 to 9 of item of hand broken metal size 25 mm to 90 mm size will apply except the size of metal mentioned in para 1 and the table of grading requirements. These will be as under

(i) Para 1 to size will be 40 mm. to 63 mm. instead of 25 mm. to 90 mm. in para 1.

**(4)** The grading requirements of the metal to be used for W.B.M shall be as under:-

Sr. No.	Size range	Sieve Designation	Percentage by weight Passing through the sieve
1	2	3	4
1.	40 mm to 63 mm	75 mm 63 mm 50 mm 40 mm 25 mm	100-100 90-100 60-80 0-15 0-5

The size of metal for W.B.M shall be 40 mm. to 63 mm. wherein tolerance limit for oversize shall be 10 percent and that for lower size should be upto 15 percent and below 25 mm it shall be upto 5 percent. 10. Standard for acceptance at reduced rates and rejection shall be as under :-

(a) Retained on 63 mm. square mesh sieve :  
Not more than 30%

(b) Retained on 75 mm. square mesh sieve :  
Nothing will be retained & 100% metal shall be pass through the sieve. For the over size metal, payment at reduced Rate should be made as under;

(A) 90% of accepted tender rates for the metal retained between 10% and 20% square mesh sieve of 63 mm. gauge.

(B) 75% of accepted tender rates for the metal retained more than 20% and upto 30% on square mesh sieve of 63 gauge.

If more than 30% of metal is retained on specified sieve, (i.e. 63 mm. square sieve) the stack shall be

rejected. Also if any stone aggregate retained on 75 mm. sieve the stack shall be rejected.

The quality for which reduced rate will be applicable is the quantity retained on the above mentioned square mesh sieve and not the whole quantity.

For example in a stack of 1.5 cum. metal if 18% is retained on square mesh sieve of the prescribed size (i.e. 63 mm) the reduced rate of 90% will be applicable to 0.27 cu.m. only and the balance quantity size shall be paid for the accepted rates for standard size metal.

Before any secured advance for metal is paid to the contractor, the metal shall have to be tested for its quality in the laboratory. Contractors' request for such secured advance will be considered only after test results of metals are received and results are satisfactory.

[As per Government circular No. SSR 1070-1B-191-22-S of 5-3-92]

**ITEM 4 (C) Supplying and Stacking of machine Crushed Stone aggregate Chipping etc of hard Stone of 20 to 50 mm nominal size free of disintegrated pieces, deleterious and organic matter (for bitumen surface dressing etc.) as per I.R.C. Code including filling the boxes with all toad and lift etc. complete.**

1. The field of M.C. metal shall be of approved quarry as shown on the quarry chart as well as approved by the Executive Engineer prior to collection.
2. The M.C. metal shall be hard, tough, sound, durable, black trap field metal of close texture, free from decay and weathering. Each piece of the stone shall be angular and roughly cubical in shape and round elongated or flaky material shall be rejected. No round or oblong pebbles or angular chips larger or smaller than specified size shall be allowed.
3. All unsound, weathered or disintegrated stone obtained from the upper surface layer of the quarry or other layer of boulders shall be rejected. The physical requirement for standard size metal shall conform to the test results indicated in para 3 of item 4.
4. The M.C. metal shall be as nearly uniform in size as possible and shall conform to following minimum requirements of passing through the rings :

Sieve Size.	Percentage Passing through
63mm	100
50mm	95-100
40mm	35-70
20mm	0-10

5. Wherever and doubt exists as to whether the above requirement are satisfied in whole or part, the collection of M.C. metal shall be got screened by the contractor if so ordered by the Executive Engineer and for which no extra payments shall be claimed by the contractor.

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

7. Stacking shall be done by filling in the standard steel pharas of 2.00 x 1.50 x 0.50 metre and no deduction of voids shall be made from the gross measurements.-

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

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

**ITEM - 4 (d) Supplying & stacking machine crushed stone aggregate chipping etc. of hard stone of 25 mm to 40 mm nominal size free of disintegrated pieces, deleterious and organic matter including filling the boxes with all lead and lift etc. complete on site of the work for bituminous surface dressing etc. as per I.R.C. Code.**

as per item No. 4 (c) except that gradation of Aggregate shall be as under.

Sieve Size	% by weight passing through
50mm	95-100
40mm	65-90
20mm	0-10
10mm	0-5

**ITEM-4(e) Supplying and stacking of quarry spauls materials at site including filling boxes with all lead and lift.**

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

11. The measurements shall be recorded in on Cum, basis & shall be paid accordingly,

**ITEM-4(f) Supplying and stacking rubble of hard stone on road side with all leads and lift as directed.**

1. The rubble stones shall be black in colour, shall be hard, tough, sound durable and of close texture, free from cracks and it shall be obtained from the approved quarries.
2. The rubble obtained from the top surface of the quarry is soft one and hence such soft variety shall not be accepted. All unsound weathered or disintegrated stones obtained from the upper portion of the quarry shall be rejected.
3. The quarry shall be well protected shall be dug by removing all the katcha and weathered stuff till approved quality of materials is available.
4. The length and breadth shall not exceed 1/t (f .2) times the thickness of the stones.
5. The rubble stacks shall be made on a fairly level ground and stacks shall be so made that rubble stones are stacked as close as possible so as to leave no excessive voids and no hollows are left out.
6. The tendency to prepare the stacks by keeping excessive voids or keeping hollow places shall not be tolerated.
7. The stacks shall be uniform in length and breadth and top portion shall be in level so that height at any point is uniform.
8. All the stacks shall be of standard dimensions which shall be prescribed by the Executive Engineer deduction for voids shall not be made.
9. The rubble shall be got approved by the Executive engineer, prior to collector on site or otherwise it is liable to rejection for which no claim shall be entertained.
10. The contractor shall maintain all stacks in regular and proper sizes till the whole material is collected Measured and finally accepted by the department. 15 percent spauls will be allowed for filling in interstices.
11. The rubble shall be stacked in quantities as per hectometre wise requirement as directed by the Executive Engineer or his agent.
12. Measurement shall be given only when the full quantity of a half kilometer is stacked measurements shall be recorded and paid only once in a hectometre and no piecemeal measurements shall be recorded and paid.

13. Stacks shall be made as per actual requirements and any material in excess shall have to be transported by the contractor at the places directed by the Executive Engineer at the risk and cost of the contractor.

**ITEM-4A { As approved by R & B. D Circular No. SSR / 080 / IB / 547 (28) C dl. 15.3.88}**

**1.0 Specifications for W.B.M. : (Sub base/Base Course)**

**1.0 Item :** Providing and laying water bound macadam of crushed/broken stone aggregates of .... mm compacted thickness mechanically interlocked by rolling and bonded together with screenings/approved quality of murrum or gritty material and water in accordance with the requirements of specifications, etc. complete.

**2.0 Materials :**

**2.1 Coarse aggregates : General requirements :** The coarse aggregates shall be stone metal obtained from quarries approved by the Executive Engineer prior to collection. The metals shall be of approved quality with all leads and lifts The metal shall be obtained from hard, tough, sound, durable, stone of close texture as is locally available and reasonably free from decay and weathering. Pieces of the stone shall be angular and roughly cubical in shape and round, elongated or flaky materials shall be rejected. No round or oblong pebbles or angular chips larger or smaller than specified size shall be allowed. The size of metal shall be 40 mm to 63 mm and shall be crushed/hand broken. All unsound weathered or disintegrated tone obtained from the upper surface layer of the quarry or other layers & boulders shall be rejected.

**2.1.1 Physical requirements :** The aggregates shall conform to the physical requirements as indicated in the Table No. 1 hereafter.

**Table No. 1 :  
Physical requirements of Coarse Aggregates for Water Bound**

S.N.	Type of Construction	Test	Test Method	Requirement
1 .	Sub Base	(a) Los Angeles Abrasion value Or Aggregate Impact Value	IS : 2386 (Part IV)	50% (Max.)
			IS : 2386 (Part IV) or IS : 5640**	40% (Max.)
2.	Base	(a) Los Angeles Abrasion value *	IS : 2386 (Part IV)	50% (Max )
		Or Aggregate Impact Value	IS : 2386 (Part IV) or IS : 5640**	40% (Max.) 15% (Max.)
		(b) Flakiness Index	IS : 2386 (Part 1)	

\* Aggregates may satisfy requirements of either Two tests.

\*\* Aggregates like vricks, metal kankar laterite etc. which get softened in presence of water, shall be tested for impact value under wet condition in accordance with IS : 5640

**2.1.2 Grading requirement :** The coarse aggregates shall conform to the grading requirement as indicated in Table No. 2 below :

**Table No. 2 :  
Grading Requirements of Coarse Aggregates**

Grading No.	Size range	Sieve Designation	Percent by weight
2	63 mm to 40 mm	80	100
		63	85-100
		40	0-15

**2.2 Screenings/approved quality of murrum/gritty materials :** Screenings/murmm/gritty materials to fill voids in the coarse aggregate and to act as binding materials shall generally consist of predominantly non-plastic material such as murrum or gravel (other than rounded river borne material) provided the liquid limit and plasticity index of the material is below 20 & 6 respectively & fraction passing 75 micron sieve does not exceed 10 percent.

**2.2.1** As far as possible, screening/murrum/gritty materials shall conform to the gradings set forth in Table No. 3 below :

**Table No. 3 :**  
**Grading for Screenings/approved quality or murrum/gritty materials.**

Grading Classification	Size of Screenings	Sieve Designation	Percent by weight passing the Sieve
A	12-5 mm	12.5 mm	100
		10.0 mm	90-100
		4.75 mm	10-30
		1 50 micron	0-8
B	10 mm	10 mm	100
		4.75 mm	85-100
		150 mm	10-30

### **3.0 Construction Operations :**

**3.1 Preparation of base :** The subgrade/sub-base/base to receive the water bound macadam course shall be prepared to the specified grade and camber and made free of dust and other extraneous material. Any ruts or soft yielding places shall be corrected in an approved manner and rolled until firm. Where water bound macadam is to be laid over an existing black topped surface.50 mm x 50 mm furrows shall be cut at an angle of 45 degrees to the road at 1 metre intervals in the latter before laying the coarse aggregate.

**3.2 Spreading course aggregate :** The coarse aggregates shall be spread uniformly upon the prepared base in such quantities that the thickness of the compacted layer is 100 mm for grading 1 and 75-100 mm for gradings 2 and 3 as specified.

The spreading shall be done from stock piles along the side of the roadway or directly from vehicles. In no case shall the aggregate be dumped in heaps directly on the surface prepared to receive the aggregate nor shall hauling over uncompacted or partially compacted base be permitted.

The surface of the aggregates spread shall be carefully checked with templates and all high or low spots remedied by removing or adding aggregate as may be required. No segregation of large or fine particles shall be allowed and the coarse aggregate as may be required. No segregation of large or fine particles shall be allowed and the coarse aggregate as spread shall be of uniform gradation with no pockets of fine material.

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

**3.3 Rolling :** Immediately following the spreading of the coarse aggregate, rolling shall be started with three wheeled power rollers of 6 to 10 tonne capacity or tandem or vibratory rollers of approved type. The weight of the roller shall depend upon the type of the aggregate and as may be indicated by the Engineer-in-charge.

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

Rolling shall continue until the aggregate are thoroughly keyed and the creeping of aggregates ahead of roller is longer visible. During rolling slight sprinkling of water may be done, if necessary. Rolling shall not be done when the sub grade is soft or yielding or when it causes a wave-like motion in the subgrade or sub-base course.

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

**3.4 Application of screenings/ murrum/ gritty material :** After the coarse aggregate has been rolled to Clause 3.3 screenings/murrum/gritty material to completely fill the interstices shall be applied gradually over the surface. These shall not be damp or wet at the time of application. Dry rolling shall be done while the screenings/murrum/gritty material are being spread so that vibrations of the roller cause them to settle into the voids of the coarse aggregate. The screenings/murrum/gritty material shall not be dumped in piles but spread uniformly in successive thin layers either by the spreading motion of hand shovels or by mechanical spreaders or directly from trucks. Trucks operation for spreading the screenings/murrum/gritty material shall be driven as not to disturb the coarse aggregate.

The screenings/approved quality murrum/gritty material shall be applied at a slow and uniform rate (in three or more applications) so as to ensure filling of all voids. This shall be accompanied by dry rolling and brooming with mechanical brooms, hand-brooms or both. In no case shall the screenings; be applied so fast

and thick as to form cakes or ridges on the surface in such a manner as would prevent filling of voids or prevent the direct bearing of the roller on the coarse aggregate. These operations shall continue until no more screenings can be forced into the voids of the coarse aggregate.

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

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

**3.6 Setting and drying :** After the final compaction of water bound macadam course, the road shall be allowed to dry overnight Next morning hungry spots shall be filled with screenings/murum/gritty material as directed, slightly sprinkled with water if necessary and rolled. No traffic shall be allowed on the road until the macadam has set. The Engineer-in-charge shall have the discretion to stop having traffic from using the completed water bound macadam course if in his opinion it would cause excessive form to the surface.

#### **4.0 Surface Finish :**

The surface finish of construction shall conform to the following requirements :

**4.1 General :** All works performed shall conform to the lines, grades, cross sections and dimensions shown on the drawings or as directed by the Engineer-in-charge subject to the permitted tolerances described hereinafter.

**4.2 Horizontal Alignments :** Horizontal alignments shall be reckoned with respect to the centre line of the carriage way as shown on the drawings The edges of the carriage way as constructed shall be correct within a tolerance of  $\pm 25$  mm therefrom. The corresponding tolerance for edges the roadway and lower layers of payments shall  $\pm 40$  mm.

**4.3 Longitudinal profile :** The levels of the subgrade and different pavement course 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-in-charge, beyond the tolerances mentioned below:

Subgrade	$\pm 25$ mm
Sub-base	$\pm 20$ mm
Base course	$\pm 15$ mm
Wearing course	$\pm 10$ mm

provided, however, that the negative tolerance for wearing coarse shall not be permitted in conjunction with the positive tolerance for base course if the thickness of the former is thereby reduced by more than 6 mm.

**4.4 Surface Regularity :** The surface regularity of completed sub-base, base course and wearing surface in the longitudinal and transverse directions shall be within the tolerance indicated in Table No.4 below:

**Table No. 4:  
Permitted tolerance of surface Regularity for payment course**

Sr.No.	Type of Construction		Longitudinal Profile	Cross Profile
	Template	Maximum Permissible undulation mm	With 3metre Straight edge Maximum number of undulations permitted in any 300 mm length exceeding mm	Maximum Permissible variation from specified Profile under camber
1	2	3	4	5

1 . Water Bound Macadam with normal size metal (20-50 mm and 40-63 mm size)

12

30

8

The longitudinal profile shall be checked with a 3 metre long straight edge at the middle of each traffic lane along a line parallel to the centre line of the road. The transverse profile shall be checked with a set of three camber at intervals of 10 metres.

**4.5 Rectification :** Where the surface irregularly of subgrade and the various pavement course fall outside the specified tolerances the shall be liable to rectify these in the manner described below and to the



satisfaction of the Engineer-in-charge

When the surface is high or low, the top 75 mm shall be scarified, reshaped with added material as necessary and recompact as per the specification of W.B.M. The area treated at a place shall not be less than 5 metres long and 2 metres wide.

## **5.0 Quality Control tests during Construction :**

**5.1 General :** The materials supplied and the works carried out by the contractor shall conform to the specification prescribed in the preceding Clauses

For ensuring the requisite quality of Construction, the materials and works shall be subjected to quality control test as describe hereinafter, by the Engineer-in-charge. The testing frequencies set forth are desirable minimum and the Engineer-in-charge shall have the full authority to carry out tests as frequently as he may deem necessary to satisfy himself that the materials and works comply with the appropriate specifications.

Test procedures for the various quality control tests are indicated in the sections of the specifications or for certain test within this section. Where no specific testing procedure is mentioned the tests shall be carried out as per the prevalent engineering practice to the directions of the Engineer-in-charge

### **5.2 Test on Sub-bases & Bases :**

**5.2.1** The tests and their frequencies for W.B.M. types of Bases & sub-base shall be as given in Table No.5 below :

**Table No. 5**  
**Control tests & their frequency for sub-base & bases of water bound macadam**

<b>Sr. No.</b>	<b>Type of Construction</b>	<b>Test</b>	<b>Frequency</b>
1 .	Water Bound Macadam	(i) Agregate impact value	One test per 1200 cu.m.
		(ii) Grading	One test per 100 cu.m.
		(iii) Flakiness index	One test per 200 cu.m.
		(iv) Atterberg limit	One test per 25 cu.m. of materials for screenings.

**5.2.2 Compaction Control :** Control shall be exercised by tacking at least one measurement of density for each 1000 square metres of compacted area, or closer as required to yield the minimum number of test results for evaluating a day's work on statistical basis. The determination of density shall be in accordance with IS 2720 (Part XX VIII). Test locations shall not be based on the results of any one test but on the mean value of a set of 5-10 density determinations. The number of tests in one set of measurements shall be 5 as long as it is felt that sufficient control over materials and the method of compaction is being exercised. If considerable variations are observed between individual density results, the minimum number of tests in one set of measurement shall be increased to 10. The acceptance of work shall be subject to the condition that the mean dry density equals or exceeds the specified density and the standard deviation for any set of results is below 0.08 gm/cc. **6.0 Arrangement of Traffic during Construction :**

**6.1 General :** The contractor shall at all times carry out work on the highway in a manner creating least interference to the flow of traffic while consistent with the satisfactory execution of the same .For all work involving improvements to the existing highway the contractor shall, in accordance with the directives of the Engineer-in-charge, provided and maintain, during the execution of the work, a passage for traffic along a part of the existing way under improvement, or along a temporary diversion constructed close to the highway.

**6.2 Passage of Traffic along a part of the Existing Carriage way Improvement :** This method shall be adopted where, in the opinion of the Engineer-in-charge, the improvement works, namely widening of the existing pavement or reconstruction/repairs to cross-drainage works, could be carried out on part widths at a time and the traffic could simultaneously be passed without undue delay and difficulty on the other part. The road shoulder shall be dressed and brought in line with the pavement and maintained throughout the duration of the work to the satisfaction of the Engineer-in-charge. Where works is in progress in continuous long stretches, passing places, at least 20 metre long 6 metre wide, inclusive of the width of the existing carriage way shall be provided at half to one kilometer intervals as directed by the Engineer-in-charge. Extra treatment to shoulders where necessary, shall be given as ordered by the Engineer-in-charge.

**6.3 Passage of traffic along a Temporary Diversion :** If in the opinion of the Engineer-in-charge it is not possible to pass the traffic on part width of the carriage way for any reason, a temporary diversion close to the highway shall be constructed as directed. It shall be paved with locally available materials such as hard murrum. gravel, brick or stone metal to the specified thickness and provided with bituminous surfacing, where directed. In all case, the alignment. gradients and surface type of the diversion, including its junctions, shall be

approved by the Engineer-in-charge before the highway is detoured and closed to traffic. At cross drainage points, the contractor shall provide temporary crossings for the diversion according to the designs approved by the Engineer-in-charge.

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

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

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

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

On both sides suitable regulatory/warning signs shall be installed for the guidance of road users, On each approach at least two signs shall be put up one close to the point where transition of carriage way begins and the other 120 metres away. The signs shall be of approved design and of refractory type if so directed.

**6.5 Maintenance of Diversion and traffic control Devices :** Signs, lights, barrier and other traffic control devices, as well as the riding surface of diversions shall be maintained, in satisfactory conditions till such time they are required as directed by the Engineer-in-charge. The temporary travel way shall be kept free of dust by frequent application of water if necessary.

**6.6 Measurements for payment traffic Arrangement:** All arrangements for traffic during construction including maintenance thereof but excluding initial dressing and/or extra treatment of the shoulders and construction of temporary diversions shall be considered as incidental to the works and Contractor responsibility.

Construction of temporary diversions, initial dressing of the shoulders and extra paving at passing places shall, however be paid for as provision sum, if written order is issued to do so by the Engineer-in-charge.

## **7.0 Measurements for payments for W.B.M.**

**7.1** Water bound macadam shall be measured as finished work in position in cubic metres. The finished thickness of sub-base and base courses to be paid on volume basis shall be computed in the following manner:

Levels shall be taken before and after construction, at a grid of points 10 metres centre to centre longitudinally in straight reaches but 5 metres at curves. Normally, on two-lane roads the levels shall be taken at four positions transversely, at 0.75 and 2.75 metres from either edge of the carriage way and on single lane roads these shall be taken at two positions transversely being at 1.25 metre from either edge of the carriage way.

Suitable reference for the transverse grid line should be left in the form of embedded bricks on either ends or by the oilier means so that it is possible to locate the grid points for level measurements after each successive course is laid.

For pavements courses laid only over widening portion, at least one line of levels shall be taken on each strip of widening or more depending on the width of widening as decided by the Engineer-in-charge; notwithstanding the above, if the need may arise particularly in the case of estimation of the volume of the material for leveling course. The average thickness of the pavement source in any area shall be the arithmetical mean of the difference of levels before and after construction at all the grid points falling in that area; provided that thickness of finished work shall be limited to those shown on the drawings or approved by the Engineer-in charge.

As supplement to level measurement, the Engineer-in-charge shall have the portion to cut cores/holes to check on the depth of construction.

The contractor shall sign day to day leveling work and also original cross section, longitudinal section in token of his acceptance etc. The working sections both longitudinal and cross of the sub-grade shall be taken by the Engineer-in-charge before the actual W.B.M. work is started, The contractor, or his authorised representative shall attend day to day leveling work and sign with date the field book daily in token of his

acceptance. If there is any disagreement the contractor shall inform of it in writing to the officer concerned with specific reference to the sections before starting further work. Once the work is started no cognizance of any complaint taken. Merely not signing of the level book shall not be deemed as disagreement. The Executive Engineer shall also verify leveling work to the extent of 5 percent before commencement of WBM. WBM shall be maintained by the contractor to proper formation and grade till this item is finally measured and accepted by the Department. The measurement shall be taken on compacted WBM.

Any crack formation or screenings observed in between any layer of WBM work shall be deducted from the measurements so taken and net quantity of WBM work shall be considered for payment.

## **8.0 Rate**

**8.1** The contract unit rate for water bound macadam sub-base/base course shall be payment in full for carrying out the required operations including full compensation for all components listed below :

- (j) Making arrangements for traffic to Clause-6 except for initial treatment to shoulders and construction of diversions.
- (ii) Furnishing all materials to be incorporated in the work including all royalties, fees, rents where necessary and all leads and lifts.
- (iii) All labour, tool, equipment and incidentals to complete the work to the specifications and
- (iv) Carrying out the work in part widths of roadway where directed.

### **ITEM - 5 Spreading Soft murrum/murrum/sand/yellow/earth/bindage or road crust filling the gaps in metal and leveling to camber and gradient as directed.**

Spreading of material shall be started after the full supply in a particular K.M. is collected, measured and recorded in the measurement books. Permission of the Engineer-in-charge shall be obtained before spreading. It shall be seen that the formation is dressed to the required camber and grade. If the murrum is to be spread over the metaled surface then the spreading shall be uniform and as it has to act as binding surface it shall be used for filling the interstices of metal and forming a smooth running surface as far as possible. Murrum blindage shall be specified as blindage shall be spread evenly with a twisting motion of the baskets. No more Murrum shall be used than specified as blindage. The rate is for gross measurements and no deduction of voids shall be made. I. the murrum is to be spread over earthen embankment as a sub-base or for side shoulders or as blindage it shall be spread in a manner as directed by the Engineer-in-charge and as per required width and thickness. The contractor shall make good all unevenness, depression, projections etc. during consolidation work. Rate of this item includes all these operations except consolidation. The payment shall be made on cmt. basis.

### **ITEM - 6 Spreading the stone aggregates for soiling and W.B.M. including filling the interstices to required camber and gradient (excluding spreading of blindage) (i) 40 mm to 63 mm size H.B. Stone aggregates (H.B.) (ii) 25 mm to 90 mm size H.B. stone aggregate, (iii) Chipping varying from 6 mm to 25 mm size (iv) 20 mm to 50mm size crushed.**

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

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

3. The spreading of metal shall proceed only 200 mt. (max.) advance of the rolling operations. The collection and spreading of the metal shall not be carried out in one and the same kilometer.

4. At the time of rolling all surface irregularities, hollows, depressions, humps etc. shall be straight. The spreading of metal in required layer shall be done by the contractor. The rate for this item shall be paid on cmt. basis and includes all the above operations with all lead and lift except consolidation.

**Item-6(A) Spreading the stone aggregates for soiling and W.B.M. including tilling the interstices forming the surface to required camber and gradient by paver finisher (Labour charges only but including hire and operating charges of paver)**

Specification same as item No.6 except that metal or stone aggregate shall be spread by paver finisher and not manually. Besides all the labour charges, the rate also includes the hire and operating charges of paver. The contractor shall have to make his own arrangement for procuring appropriate paver.

**Item-6(B) Spreading quarry spalls in grade & camber complete.**

1. The quarry spalls shall only be allowed to be spread after the written permission of the Executive Engineer is obtained.
2. The permission for spreading the metal shall be given by the Executive Engineer if
  - (i) The full quantity of a particular mile(kilometer) is completely collected.
  - (ii) The collection of metal is also completed in the adjoining two miles (Kilometers)
  - (iii) The measurements are recorded in the Measurement book.
3. Q. S. shall, if required, be screened, if containing rubbish dust, grass etc. it shall then be filled in basket & conveyed where required and spread evenly on the prepared surface by given twisting motion to the basket at the time of spreading. The surface shall then (15 m) by means of templates and strings as well as with camber boards and spirit level.
4. Between the straight length and curves and at the meeting points of the convex and concave portions of the reverse curves, the change in camber of the road, due to super elevations shall be made as well as with camber boards and spirit level.
5. At the time of spreading Q. S. a small quantity (about 4 to 5 percent) of metal as directed, shall be retained at the first instance. It shall be spread later 0:1 after partial consolidation as required to rectify the camber and to fill up the hollows if any. No extra amount shall be paid for this.
6. Measurements shall be paid as per the measurements of collection less the quantity remained to be spread and on cubic metre basis.
7. The rate includes the cost of screening the Q. S. if any spreading, sectioning, with template and adding reserved quota of metal, while oiling is in progress for making good hollows and camber.
8. The surface shall be brought to the required camber which shall be checked at every 50 ft. (15 M) by means of templates while the necessary of the in between shall be tested by strings and corrected as required.
9. The centre line shall first be marked in the subgrade which is properly consolidated and has uniform camber and grade as required.
10. The Q. S. shall be laid for a small length on 25 ft. (8 M.) and then the edge stones shall be laid.
11. Pegs shall be driven on either side of the road and joined with strings true and parallel with a distance between them equal to the width to be laid with over <sup>r<jit7</sup> the metal. Similarly.
12. The Q. S. shall be laid as close as possible so as to leave minimum possible interstices and voids.
13. Before rolling is allowed on soling the side berms shall be filled up to the top of the soling and at least 3'-0" (1 m.) on either side so as to prevent metal layer getting disturbed at times during rolling. The rate is inclusive of all the operations as stated above.

**ITEM-7 Rolling & Consolidating water bound macadam (except laterite & kankar) incl. watering not exceeding 150 mm thickness (main layer including binding materials) including filling in depression which occur during the process with power roller exceeding 8.0 M.T. but not exceeding 12.0 M.T.**

1. Immediately following the spreading of the coarse aggregates rolling shall be with three wheeled power rollers of 8 to 10 tonne capacity or tandem roller or equivalent vibratory roller. The weight of the roller shall depend upon the type of the aggregate and be indicated by Engineer in-charge.
2. Except on super elevated portions where the rolling shall proceed from inner edge to outer, rolling shall begin from the edges gradually progressing towards the centre. First the edge/edges shall be compacted with roller running forward and backward. The roller shall then move inwards parallel to center line of the road in successive passes uniformly lapping preceding tracks by at least one half the width.
3. Rolling shall continue until the aggregate is thoroughly keyed and the creeping of the aggregate ahead of the roller is no longer visible. During rolling slight sprinkling of water may be done, if necessary. Rolling shall not be done when the sub-grade is soft or yielding or when it causes a wave like motion in the sub-grade or sub-base course.
4. The rolled surface shall be checked transversely and longitudinal with templates and any irregularities corrected by loosening the surface, adding or removing necessary amounts of aggregate and rerolling until, the entire surface conforms to desired camber and grade. In no case shall the use of screening be permitted to make up depression.

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

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

7. Payment will be made on Smt. basis of the finished work and shall include cost of watering rent of machinery cost fuel, wages of drivers and cleaners and murrum bund etc.

**ITEM-8 Providing and fixing indicator stone of approved stone as per I.R.C. type design in C.C. 1:4:8 including whitewashing etc. complete.**

**(1) Fixing in earth.**

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

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

**(2) Fixing in C.C. 1:5:10**

Specification same as 8(1) above except that the indicator stone shall be fixed 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. Rate includes all labour and curing etc necessary for concrete.

**ITEM-9 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 and paints and letter etc. complete, (for N.H., S.H. and M.D.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 kilometre 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 kilometre stone includes the cost of all materials, labour, tools, fixing, finishing curing, lettering and painting as directed by the Engineer-in-charge.

**ITEM-10 Providing and fixing fifth kilometre 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 and lettering etc. complete, (for N.H., S.H. and M.D.R.)**

1. The work shall be carried out as per the item of ordinary kilometre stone except that the size of the fifth kilometre stone shall be bigger than that of ordinary kilometre stone as per I.R.C.-8 (Type design for highway kilometre stones). The fixing of K. M. stone shall be in ordinary concrete of grade specified in the item. The measurement for payment as well as the operation included in the unit rate shall be as per ordinary kilometre stone.

**ITEM-11 Providing and fixing hectometre stone as per I.R.C. type design including painting lettering etc. complete.**

**(1) Fixing in Earth :**

The work shall be carried out as per the item of ordinary kilometre stone except that the size of Hectometre stone shall be smaller than that of ordinary kilometre stone as per I.R.C. 26 (Type design for 200 metre stones) and fixing shall be in earth. The measurement for payment as well as the operations included in the unit rate shall be as per ordinary kilometres stone.

**(2) Fixing in C. C. 1:5:10**

Specification same as 11 (1) above except that the indicator stone shall be fixed 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. Rate includes all labour and curing etc. necessary for concrete.

**ITEM-12 Providing and fixing guard stone as per I.R.C. type design including white washing etc. Complete.**

**(1) Fixing in Earth/Wearing Coat:**

1. The guard stone shall be of approved quality and of 20 cm x 15 cm. size and its length shall not be less than 75 cms. The top portion shall be rounded. The top 38 cm. shall be chisel dressed on all sides. The size, shape and dimensions of the guard stones shall be exact and shall be neatly dressed and finished.

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

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

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

**(2) Fixing in C.C. 1:5:10**

Specification same as 12 (1) above except that the indicator stone shall be fixed 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. Rate includes all labour and curing etc. necessary for concrete.

**ITEM-13 Supplying and fixing road sign board of M.S. Plates and angle iron including painting, lettering etc. complete including fixing in C.C. 1:4:8 with necessary excavation etc. complete as per I.R.C. design.**

**(1) Non reflective type :**

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

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

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

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

**(2) Reflective Type**

Specifications will be same as 13 (1) above except that signs shall be reflective type.

**ITEM-14 Providing and fixing village name boards as per standard I.R.C. type design of steel plate including painting, lettering etc. complete with fixing in C.C. 1:4:8 block with necessary excavation.**

1. The work shall be carried out as per the item of sign boards except that there shall not be top plate of 90 cm x 90 cm triangular shape and lower plate of 90 cm x 61 cm rectangular plate of 6 mm thickness shall be fixed at top facing towards the direction of the village.

2. The board plate shall be painted in black colour Letters & figures shall be painted in white colour with an arrow directing towards the village painting & lettering shall be done both sides. The size of the letters & figures as well as thickness of arrow will be as directed by the Engineer-in-charge.

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

**ITEM-15 Supplying of machine crushed stone aggregate chipping etc. of hard stone following nominal size free of disintegrated pieces deleterious and organic matter including filling the boxes with all lead and lift etc. complete on site of road.**

**(a) Kapchi and (b) Grit**

1. Stone chips shall consist of regular fragments of clean, hard, tough and durable rock of uniform quality throughout. They shall be obtained by crushing rock, and shall be free of elongated and flaky pieces, soft and disintegrated materials, and vegetable or deleterious matter They shall satisfy the quality requirements set forth as shown hereafter.

Sr.No.	Test	Test Method.	Requirement.
1	Los Angeles Abrasion Value	IS : 2386 (part IV)*	35% Maximum
2.	Aggregate Impact Value	-do-*	30% Maximum
3	Flakiness Index	IS : 2385 (Part I)	30% Maximum
4.	Stripping Value	IS : 6241	25% Maximum
5.	Water Absorption	IS : 2386 (Part III)	2% Maximum

\* Aggregate may satisfy requirement of either of the two tests.

Size of stone chips shall be as under :-

(a) Kapchi : 12 mm size : Passing 20 mm sieve and retained on 10 mm sieve.

(b) Grit : 5 mm size : Passing 10 mm sieve and retained on 2.36 mm sieve.

3. The samples of stones chips collected from approved quarries shall be got tested at Government recognised laboratory as may be directed to the contractor at his own cost. The result shall conform to the standard requirements laid down in para (i) above. Collection of stone chips as per approved samples shall be allowed by the Engineer-in-charge. Testing charges shall be borne by the contractor Payment at full rates for the stones chips shall not be made till the test results from the laboratory are received and found acceptable

4. Stacking shall be done by filling in standard steel boxes of 2.0 m x 1.5 m x 0.5 m size which shall be supplied by the Department if available on rent, otherwise contractor shall make his own arrangements. No deduction for voids shall be made from the gross measurements. Where any doubt exist as to whether the quantity of stacks in any hectometre is not confirming with the cubic content of the standard pharas (2.5 m x 1.5 m x 0.5 m) it shall be got corrected by the Contractor if so ordered by the Engineer-in-charge for which no extra payment shall be claimed by the Contractor If the quantity in any stack in a particular hectometre is found to be less than the standard measurements viz.. 1.5 cmt. the entire collection in the hectometre shall be paid on the quantity of the smallest stack so found Regular stacks shall be done by the Contractor on a fairly level ground. Stacking shall be done in a manner as directed by the Engineer-in-charge.

5. The collection shall always commence at one end of the Kilometre and be carried out continuously towards the other end, unless the Engineer-in -charge directs otherwise.

6. Control on quality of material shall be exercised by the Engineer-in-charge by carrying out the following tests at the frequencies shown against each.

Sr. No.	Type of Construction Material	Test	Frequency
1.	Grit/Kapchi for open graded Carpet and seal coat.	(i) Aggregate impact value (ii) Flakiness Index of aggregate (iii) Stripping value & water absorption of aggregates  (iv) Grading of aggregates	One test per 100 cu.m. One test per 100 cu.m. initially one set of 3 representative specimens for each source of supply subsequently when warranted by changes in the quality of aggregates One test per 100 cu.m. of aggregate

8. The payment shall be made on cubic metre basis without deduction for voids. The contractor shall be responsible for preserving the materials throughout the period the contract remains in force The use of materials shall not be allowed till the materials conveyance to the site with al' lead and lift and filling boxes including all labour, tools, equipment and other incidental expenses.

**ITEM - 16(A)Supplying and Stacking 80/10C asphalt as per requirement including carting, stacking, and protecting on road side etc. complete. (If asphalt is supplied by Department)**

1. Bitumen shall be issued by the Department at the rate and place mentioned in Schedule 'A' of the tender. It shall have to be carted by the contractor to the site of work at his own cost Empty asphalt drums shall have to be returned free of cost to P.W.D. store from where they are issued or as directed, if so provided in

Schedule 'A' Any damage caused to the asphalt drum or loss of asphalt after issue from the store shall be the responsibility of the contractor. Drums of asphalt shall be so stored as to allow easy inspection and in such place a will not damage the drums and cause leakage or allow water and other foreign matter to enter, (dilute may be included in labour)

2. Bitumen shall be issued by department in bulk at the rate and places as shown in Schedule-A. For bulk asphalt contractor shall have to make adequate arrangement taking bulk asphalt at plant site according to requirement.

Bulk asphalt shall be used as per instructions of the Engineer in charge of work. The tanker of bulk asphalt should be unloaded in asphalt tank or in empty drums on site of work as directed. Proper rate for carting shall be deducted as per carting rate, if the bulk asphalt is given on site of work instead of place shown in Schedule-A. The carting of bulk asphalt shall be made by the contractor from Koyali Refinery as per Schedule-A.

**Keeping Records : -**

The department shall keep a day to day account of the supply and use of the asphalt in separate bound registers having number pages and in the proforma prescribed by the department. The contractor's responsible representatives shall also sign day to day in the register

3. The payment shall be made on tonnage basis.

4. The contract unit rate of supplying bitumen shall include

(1) Obtaining the bitumen from the Department.

(2) Transporting to- site.

(3) Storing, stacking and protecting

(4) Keeping record of supply and use and

(5) Returning of handing over the empty drums in good condition to the Department if so provided in Schedule -'A'.

**ITEM - 16(B) Supplying and Stacking 80/100 asphalt as per requirement including carting, stacking, testing and protecting on road side etc. complete. (If asphalt is supplied by Contractor)**

1. Bitumen shall be procured directly from refinery by the Contractor. The contractor shall make adequate arrangements for storing bulk asphalt at plant site. The Contractor will produce in original the bill of Refinery all the gate passes issued by the refinery and the number of transport tanker. The Contractor will also produce the Test Certificate regarding the grade of asphalt issued by Refinery. The Department does not undertake to furnish "P" form (regarding Sales Tax Concessions) for purchase of asphalt.

2. On receipt and storage of bitumen, The bitumen shall be got tested in GERI Laboratory or other Laboratories approved by R. & B Department. The frequency of test is specified in Para 5.

3. The Contractor will establish OR site of work site laboratory in area not less than 25 sq.m. with pucca construction and equipped with instruments to enable to carry out the following tests.

1. Penetration test as per I.S. 1203
2. Softening point test as per I.S. 1204
3. Ductility test as per I.S. 1208
4. Viscosity test as per I.S. 1206
5. Specification Gravity test as per I.S. 1202

The above instruments should be certified as per I.S. standard, the same should be regularly calibrated and should be maintained in efficient condition.

4. The Registers for use, temperature and other quality requirements of bitumen will be maintained at Plant site. The registers will be printed, as per formats approved by R.&B. Department and authorised for use by the Engineer-in-charge. The entries in the registers will be made by the departmental representative and signed by the contractor or his authorised representative.

5. Frequency of Tests :

As regards quality of binder, three tests of one sample per two tankers will be done on plant site. The tests will be carried out as per Table 900.4 of Section 900 of M.O.S.T. standard specifications. The frequency of use of specifications will be as under:

No. of Tanker	No. of Tests	No. of Tanker	No. of Tests
Upto 10	One	50. to 100	Four
11 to 20	Two	For further every 50 tanker	One
20 to 50	Three		

**ITEM-17 2 cm thick open graded pre-mix carpet surfacing with 0.27 cum. of stone chipping (12 mm size 0.18 cum and 10 mm size 0.09 cum) mixed with 14.4 kg. of bitumen per 10 sq.m. of road**



**Surface excluding rolling and consolidation etc. complete. ( Stone chipping and bitumen shall be paid seperately).**

**1. With tack coat at rate of 5.00 Kg/10 sq.m.**

**2. With tack coat at rate of 10.0 kg/10 sq.m.**

1. This work shall consist of laying an open graded carpet of 2 cm thickness in a single course and seal coat ( excluding cost of asphalt, stone chips and rolling) composed of suitable small size aggregates premixed with a bituminous binder on a previously prepared base.

2. The materials shall be proportioned as per quantities given in the following table.

Quantities of materials required for 10 smt. of road surface for 2 cm. thick open – graded premix carpet with seal coat.

**Aggregate for Carpet**

(A)	Stone Chipping	12mm size	0.18 cubic metre
(B)	Stone Chipping	6mm size	0.09 cubic metre

**Total 0.27 cubic metre**

**Aggregate for seal coat :**

Stone chipping	6mm size	0.12 cubic metre
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**Binder for premixing ( Quantities in terms of straight run bitumen)**

**(i) For Carpet**

(A)	For 0.18 cmt of 12mm size stone chipping at 52Kg/cmt	9.36	Kg.
(B)	For 0.18 cmt of 6mm size stone chpping at 64kg/cmt	5.04	Kg.

**Total 14.40 Kg.**

**(ii) For Seal coat**

(A)	For 0.12 cmt 10mm size stone chipping at 64kg/cmt.	7.68	Kg.
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3. Carpet shall not be laid during rainy weather or when the base course is damp or wet or when the atmospheric temperature in shade is 16 degree centigrade or below.

4. The underlying base on which the bituminous carpet is to be laid shall be prepared, shaped and conditioned to the specified lines, grade and cross – section as directed by the Engineer in charge. The surface shall be well cleaned with wire brushed, sweeping with brooms and finally dusting with sacks as necessary.

5. **Tack coat** : This work shall consist of application of a single coat of bituminous material to an existing road surface preparatory to another bituminous construction. The temperature of bitumen at the time of application shall be in the range of 160.0 deg. Centigrade to 175.0 deg. Centigrade.

6. Binder shall be heated to temperature appropriate to the grade of bitumen used and approved by the Engineer in charge at the rate specified hereafter. The rate of spread in terms of straight run bitumen shall be 5 kg per 10 square metre area for untreated water bound macadam surface. The binder shall be applied uniformly. The tack coat shall be applied just ahead of the on coming bituminous construction. For the purpose of calculating consumption, wastage of bitumen will not be permitted beyond 2.5% Excess consumption over 2.5% will be charged at panel rate.

7. Mixers of approved type shall be employed for mixing the aggregates with the bituminous binder. The binder shall be heated to the temperature approved by the Engineer in charge, avoiding local overheating and ensuring a continuous supply. The aggregates shall be dry before they are placed in the mixer. After about 15 seconds of dry mixing, the heated binder shall be distributed over the aggregates at the rate specified. Kerosene to an extent of 4% to 6% of asphalt shall be provided by the contractor according to the requirement at the contractors cost. The mixing of binder with chipping shall be continued until the chipping are thoroughly coated with the binder. The mix shall be immediately transported from the mixer to the point of use in suitable vehicles or wheel barrows. The vehicles employed for transport shall be clean & be covered over in transit, if so directed.

8. The premixed material shall be spread on the road surface with rakes to the required thickness and camber, or distributed evenly with the help of a drag spreader, without any undue loss of time. The chamber shall be checked by means of camber boards and inequalities evened out. As soon as sufficient length of bituminous material has been laid rolling shall commence ( Rolling shall be done departmentally) 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 premixed materials. The contractor shall provide necessary labour for keeping the roller wheels damp during rolling so as to prevent the premix from adhering to the wheels and being picked

up. The edges along and transverse of the carpet 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 appropriate binder before the new mix is placed against.

9. Seal coat for preparation of premix and spreading, etc Para 7 & 8 above shall apply. The coat shall be applied immediately after the laying of bituminous course of carpet. Before application of seal coat, materials surface shall be cleaned free of any dust or other extraneous matter.

10. Coarse sand or stone dust flushing at the rate of 0.03 cmt/10 smt shall be done on asphalt surface at the contractors own cost.

11. Traffic may be allowed soon after final rolling when the premixed materials has cooled down to surrounding temperature.

12. Control on quality works shall be exercised by the Engineer-in-charge by carrying out the following tests at the frequencies shown against each :

Sr.No.	Type of Const. Material.	Test.	Frequency.
1	Tack Coat	(i) Binder temperature for application	At regular close intervals.
		(ii) Rate of Spread of binder of aggregate.	Two test per day.
2	Open graded premix carpet with seal coat.	(i) Temperature of binder at application.	At regular close intervals.
		(ii) Binder content (vide As/TM : D2172).	Two tests per day for work of every 3km length in one lane.
		(iii) Rate of spread of mixed material.	Regular control throughout checks on material & layer thickness.

13. Para 13 to 17 : As regards arrangements for traffic para 29 of 33 of semidense carpet shall apply.

18. Open graded carpet and seal coat shall be measured in cubic metres on the basis of stone chips actually used.

19. The contract unit rate for open grade carpet and seal coat (excluding cost of asphalt. stone chips and rolling) shall be payment in full for carrying out the required operations including full compensation for

- (1) Preparation of base.
- (2) Providing all materials like fuel, lubricants, kerosene and coarse sand or stone dust for flushing with all-leads and lifts.
- (3) All labours, tools, equipment and incidentals.
- (4) Making arrangements for control and safety of traffic.

**ITEM-18 Providing and laying 20/25mm thick bituminous open graded carpet with B.T. aggregates 0.66 cm/M.T. using bitumenious for tack coat at the rate of @ rate of 10 Kg./10 Smt. on W.B.M. surface and 5 Kg.710 Smt. for B.T. surface and for mixing at the rate of 32.8 kg/M.T. of total mix i.e.3.28 per M.T. of total mix and heating asphalt & aggregate by continuous batching hot mix plant and spreading the same by paver finisher including consolidation with power road roller including providing equipment T & P oil, fire wood ,kerosene labour charges etc. compt. using contractor's own machineries hot mix plant and paver finisher including . flushing of sand 0.30 cmt/100 sq.mt.**

The work shall consist of construction in a single course of 20/25 mm. thick premixed carpet as course, on a previously prepared base Single course shall also include additional thickness if any to remove unevenness of the existing surface.

1. The coarse aggregates shall consist of crushed stone only. These, shall be clean, strong durable of fairly cubical shape. free of disintegrated pieces, organic or other deleterious matter and adherent coatings. The aggregates shall preferably be hydrophobic and of low porosity and shall satisfy the physical requirements set forth as under.

#### Physical Requirements of Aggregates for Bituminous Macadam.

Sr. No.	Test	Test Method	Requirement.
1	Los Angles Abrasion Value	IS : 2386 (Part IV)*	35% Maximum
2	Aggregate Impact Value	-do-	30% Maximum
3	Flakiness Index	IS : 2386 (Part I)	30% Maximum
4	Stripping Value	IS : 6241	25% Maximum
5	Water Absorption	IS : 2386 (Part III)	2% Maximum

\* Aggregate may satisfy requirements of either of the two tests.

3. The fine aggregates shall consist of crushed run screening, natural sand or mixture of both. There shall be clean hard durable, uncoated, dry and free from injurious, soft or flaky pieces and organic or deleterious substance.
4. The filler, where required, shall be an inert material, the whole of which passes 600 micron sieve at least 90 percent passing 150 micron sieve and not less than 70 percent passing 75 micron sieve. The filler shall be cement, stone dust, hydrated lime or fly ash approved by the Engineer in charge.
5. The mineral aggregates, including fillers, shall be so graded or combined as to conform to the grading as under.

**Table Aggregate gradation for Asphalt carpet.**

Sieve Size	% by weight passing the Sieve for 20/35 mm
20 mm	100
12.5 mm	70-100
10.0 mm	20-40
4.75 mm	0-5
2.36 mm	

6. The samples of aggregate of requires gradings for the work shall be got approved from the Engineer-in-charge prior to transportation and collection on plant site. Unapproved materials shall have to be removed from the plant site by the contractor at his own cost. If contractor fails to remove the inferior type of materials from the plant site, the same will be removed by the Department at the cost of the Contractor. Collection of aggregate shall be in different stacks according to various sizes of aggregates.

7. For the purpose of collection of materials, plant site shall be established at suitable place, where hot mix plant shall be installed. Department will extend all necessary co-operation in helping Contractor to get nearby Government land of establishing plant site. However, department is not responsible if no such land is made available to the Contractor and in that case, the Contractor will have to make his own arrangement for the same. Incoming material shall be recorded in a register for the purpose of record.

8. The binder shall be straight run bitumen of a suitable grade satisfying the requirements of IS:73. Bitumen shall be 60/80/100 grade and shall be supplied by the department at the rate and place as mentioned in Schedule "A" of the tender and it shall have to be carted, by the Contractor to the site of work at his own cost. Empty asphalt drums shall have to be returned free of cost to P.W.D. Store from where they are issued or as directed, if so provided in Schedule 'A' Any damage caused to the asphalt drums or loss of asphalt after issue from store shall be the responsibility of the Contractor. Drums of asphalt shall be so stored so as to allow easy inspection and in such place as will not damage the drums and cause the leakage of allow water and other foreign matter to enter For the purpose of calculating consumption, wastage will not be allowed beyond 2.5 percent Excess consumption over 2.5 percent will be charged at a panel rate.

9. In case bitumen is to be issued by department in bulk, the same shall be issued to the Contractor at plant site by tankers at the same rate as shown in Schedule 'A'. Contractor shall have to make adequate arrangement for slacking bulk asphalt at plant site according to the requirement No deduction in rate will be made for supplying heated bulk asphalt.

10. The asphalt should not be used as a fuel. If however, Contractor is found to be using asphalt as fuel, The quantity of asphalt utilised shall be assessed, by the Executive Engineer whose decision will be final and binding to the Contractor who will be charged at double the rate provided in Schedule 'A' of the agreement even though the total consumption of asphalt may be within the theoretical consumption.

11. Department shall keep a day to day account of the supply and consumption of bitumen in a separate bound register having numbered pages and the proforma prescribed by the Department. Day to day signature of the Contractor's representative shall be obtained in this register Issue rate of bitumen includes (i) Obtaining asphalt from Department's store, (ii) Transporting to site, (iii) Storing and stacking, (iv) Keeping records of supply and consumption and (v) returning the empty drums in good condition to the Department.

12. Semi dense carpet shall not be laid during rainy weather or when the base course is damp or wet.

13. The base on which semidense carpet is to be laid shall be thoroughly swept and scraped clean and free of dust and foreign matter.

14. The work shall consist of application of a single coat of bituminous to an existing road surface preparatory to another bituminous construction. The temperature of bitumen at the time of application shall be in the range of 160 Degree centigrade to 175 degree centigrade.

15. Binder shall be heated to the temperature appropriate to the grade of bitumen used and approved by the Engineer-in-charge and sprayed on the base at the rate specified hereafter. The rate, of spread of straight run" bitumen for tack coat shall be 5 kg per 10 square meter area for an existing bitumen treated surface. The binder shall be applied uniformly. The tack coat shall be applied just ahead of the on coming bituminous construction. In case carpe Us to be laid on W.B.M. surface. rate of spread of Bitumen for tack cost will be 40 kg./10smt.

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

17. The contractor shall get the job-mix formula for the mix approved, by the Engineer-in-charge before starting the work. In order to obtain the required type of mix, the department may change the proportion of bitumen and gradings of aggregate and contractor shall have to collect the materials accordingly. In case of increase in proportion of bitumen the increased or decreased quantity will be adjusted at the rate provided in Schedule 'A' The contractor shall have the responsibility of ensuring proper proportioning of materials in accordance with the approved job-mix formula and producing a uniform mix,

18. Hot mix plant of adequate capacity and capable of producing a proper and uniform quality shall be used for preparing the mix. The plant may be either a batch type or a continuous one, having coordinated set of essential unit such as dryer for heating the aggregates, a binder heating and control unit for metering out the correct quantity of heated binder together with a paddle mixer for intimate mixing of the binder and aggregate. .

19. The temperature of binder at the time of mixing shall be the range of 150 -177 degree centigrade and of "aggregates in the range of 155 - 163 degree centigrade. .Provided also that, at no time shall the difference in temperature between the aggregates and the binder exceed 14 degree centigrade.

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

21. The mix shall be transported from the mixing plant to the point of use in suitable vehicles. The vehicles employed for transport shaft be clean and be covered over during transit if so directed by the Engineer-in-charge.

22. The mix transported from the hot mix plant to the site, shall be spread by means of a self propelled mechanical paver with suitable screeds capable of spreading, tamping and finishing the mix, to specified grade, lines and cross sections. The temperature of mix at the time of laying shall be in range 121-163 degree centigrade.

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

24. Immediately after the spreading of mix, it shall be thoroughly compacted by 8-10 tonnes 3 Wheel . roller moving at a speed not exceeding 5 km per hour.

25. The roller wheels shall be kept damp to prevent the mix from adhering to them but in no case shall fuel lubricating oil be used for this purpose. Rolling shall commence longitudinally from the edge arid progress towards the centre except on super elevated portions. When it shall progress from the lower to upper edge parallel to the centre line of the pavement. The roller should/proceed on the fresh material with rear or mixed wheel leading or as to minimise the pushing of the mix and each pass of the roller shall uniformly overlap not less than one third of the track made in the preceding pass. Rolling shall continue until the entire surface has been rolled to compaction and all the roller marks eliminated.

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

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

28. Surface finish and quality control of work : Control on the quality of materials and works shall be exercised by the Engineer-in-charge by carrying out the following test at the frequencies shown against each :-

Sr. No.	Type of Construction	Test	Frequency.
1.	Tack Coat	(i) Binder temperature for application	At regular close intervals.
2.	Semi-Dense Carpet	(ii) Rate of spread of binder	Two test per day
		(i) Aggregate Impact Value	One test per 100 Cu. m. of aggre.
		(ii) Flakiness Index of Aggre.	-Do-
		(iii) Stripping Value	-Do-
		(iv) Mix Grading	One set of test on individual constituents and mixed aggregates from the dryer for each 100 tonnes of mix subject to a minimum of two test per day
		(v) Temperature of binder in the boiler, aggregate in the dryer and mix at the time of laying and rolling	At regular close intervals.
		(vi) Control of binder content and gradation in the mix (Binder Content test vide ASTM D-2172)	One test for each 100 tonnes of mix subject to max. of two test per day per plant
		(vii) rate of spread mix material	Regular control through checks on layer thickness

29. The contractor shall at all times carry out work on the highway in a manner creating least interference to the flow of traffic while consistent with the satisfactory execution of the same. For all work involving improvements to the existing highway, the contractor shall in accordance with the directives if the Engineer-in-charge provide and maintain, during the execution of the work, a passage for traffic either along a part of the existing carriage way under improvement or on diversion.

30. In case of the improvement works, namely widening strengthening of the existing pavement or reconstruction repairs-to cross-drainage works. Where such works could be carried out on part widths at a time and the traffic could simultaneously be passed without undue delay and difficulty on the other part; the road shoulder shall be dressed and brought in-line with the pavement and maintained throughout the duration of the work to the satisfaction of the Engineer-in-charge. Where work is continued on long stretches, passing places, at least 20 metre long and 6 metre wide inclusive of the width of the existing carriage way shall be provided at

half or one kilometer intervals as directed by the Engineer-in-charge. Extra treatment to shoulders where necessary, shall be given as ordered by the Engineer-in-charge

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

32. The barricades erected on either side of the carriage way/portion of the carriage way closed to traffic shall be strong to resist violation, and painted with alternate black and white stripes. Red lanterns or warning lights of similar type shall be mounted on the barricades at night and kept lit throughout from sunset to sunrise. At the points where traffic is to deviate from its normal path the channel for traffic shall be clearly marked with the aid of pavement marking painted drums or a similar device to the direction of the Engineer-in-charge. At night the passages shall be delineated with lanterns or other suitable light source.

33. One way traffic operation shall be established whenever the traffic is to be passed over part of the carriage way inadequate for two lane traffic. This shall be done with the help of flagmen kept positioned on opposite side during all hours. For regulation of traffic, the flagmen shall be equipped with red and green flags and lanterns lights. On both sides, suitable regulatory/warning signs shall be installed for the guidance of carriage way begins and the other 120 metres away. The signs shall be of approved design and the refractory type if so directed.

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

Department will be free to get some loaded dumpers test checked at other weigh bridges. Weigh bridge will be

periodically got calibrated and verified from weight and measure authorities.

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

36. The contract unit rate for semidense carpet shall be in full for carrying out the required operation including lull compensation for :-

- 1 . Making arrangements of control and safety of traffic.
2. Preparation of base.
3. Providing all materials to be incorporated in the works with all lead and lifts.
4. All labour, tools, equipment and incidentals to complete the work to the specification.

#### **ITEM 19 Semi Dense Carpet**

(As standardized by R & B Circular No. SSR-1087-205 (21) (C) dated : 29-10-1987.

##### **1 . Description**

The work shall consist of construction in a single course of 20/25 mm. thick semi-dense carpet as wearing course, on a previously prepared base, to the requirements of these specifications.

##### **2. Materials**

**2.1 Binder** : The binder shall be straight run bitumen of 60/70 or 80/100 grade satisfying the requirement of IS . 73. The actual grade of the binder to be used shall be decided by the Engineer-in-charge.

**2.2 Coarse aggregates** : The coarse aggregate shall consist of crushed stone or crushed gravel. These shall be clean, durable, of cubical shape, free from disintegrated pieces, organic or other deleterious matter and adherent coatings. The aggregates shall preferably be hydrophobic and of low porosity and shall satisfy the physical requirements set forth in Table given in Item No. 18 Para 2.

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

**2.4 Filler** : The filler, where required, shall be an inert material the whole of which passes 600 micron sieve at least 90 percent passing 150 micron sieve and not less than 70 percent passing 75 micron sieve. The filler shall be cement, stone dust, hydrated lime, fly ash and other non-plastic mineral matter approved by the Engineer-in-charge.

**2.5 Aggregate gradation** : The mineral aggregates, including mineral filler, shall be so graded or combined as to conform to gradings set forth in tables below :

**Table : Aggregate gradation For Semi-Dense Carpet**

Sieve Designation	% by weight passing the Sieve		Sieve Designation	% by weight passing the Sieve	
	For 25 mm thickness	For 20 mm thickness		For 25 mm thickness	For 20 mm thickness
20 mm	100		600 micron	10-22	10-22
12.5 mm	75-100	100	300 micron	6-16	6-16
10 mm	60-85	75-100	1 50 micron	4-12	4-12
4.75 mm	35-55	35-55	75 micron	2-8	2-8
2.36 mm	20-35	20-35			

**2.6 Proportioning of materials** : The binder content for premixing shall be 4.28 percent by weight of the total mix.

The quantities of aggregates shall be sufficient to yield the specified thickness after compaction. The contractor shall get the job-mix formula for the mix approved by the Engineer-in-charge before starting the work.

**2.7 Variation in Proportioning of material** : The Contractor shall have the responsibility of ensuring proper proportioning of materials in accordance with the approved job mix formula and producing a uniform mix. variation in binder content of  $\pm 0.3$  percent by weight of total mix shall, however, be permissible in individual specimen taken for quality control tests vide MOST Specification Section 900.

### **3. CONSTRUCTION OPERATIONS**

**3.1 Weather and seasonal limitation :** Semi dense carpet shall not be laid during rainy weather or when the base course is damp or wet.

**3.2 Preparation of base :** The base on which semi-dense carpet is to be laid shall be prepared shaped and conditioned to the specified, lines grade and cross section in accordance with MOST Specification Clause 601 as directed by the Engineer-in-charge. The surface shall be thoroughly swept and scraped clean and free of dust and foreign matter.

**3.3 Tack coat : Application of binder :** Binder shall be heated to the temperature appropriate to the grade of bitumen used and approved by the Engineer-in-charge and sprayed on the base at the rate specified hereafter. The rate of spread in terms of straight run bitumen shall be 5 kg per 10 square metre area for an existing bitumen treated surface and 10 kg per 10 per square metre area for an untreated water bound macadam surface. The binder shall be applied uniformly with the aid of sprayers. The tack coat shall be applied just ahead of the oncoming bituminous construction.

**3.4 Preparation of the mix :** Hot mix plant of adequate capacity and capable of producing a proper and uniform quality shall be used for preparing the mix. The plant should be continuous type having a co-ordinated set of essential units such as dryer for heating the aggregates, device for feeding by weight or volume the required quantities of aggregates, a binder heating and control unit for metering out the correct quantity of heated binder together with a paddle heating and control unit for metering out the correct quantity of heated binder together with a paddle mixer for intimately mixing of the binder and aggregates. For details regarding Hot mix plant the Annexure 'A' may be referred.

The temperature of binder at the time of mixing shall be in the range of 150° C - 177° C and aggregates in the range of 150° C – 163° C provided also that at no time shall the difference in temperature of the aggregates and the binder exceed 14° C.

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

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

**3.5 Spreading :** The mix, transported from the hot mix plant to the site, shall be spread by means of self propelled mechanical paver with suitable screens capable of spreading, tamping and finishing the mix, true to specified grade, line and cross sections. The temperature of mix at the time of laying shall be in the range of 121° C- 163° C.

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

**3.6 Rolling :** Immediately after the spreading of mix, it shall be thoroughly compacted by rolling with a set of rollers moving at a speed not exceeding 5 km per hour. The initial or break-down rolling shall be with 8-12 tonne three wheeled rollers and the surface finished by final rolling with 8-10 tonne tandem rollers, or suitable pneumatic rollers.

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

#### **4. OPENING TO TRAFFIC**

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

#### **5. SURFACE FINISH AND QUALITY CONTROL OF WORK**

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

#### **6. ARRANGEMENT FOR TRAFFIC**

The provision of MOST Specification Clause 112 shall apply as regards the flow to traffic during construction.

## 7. MEASUREMENT 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 weigh bridge of suitable capacity, for the purpose of weighing of dumpers at suitable place, at his cost as directed. Weight of "empty dumper and weight of loaded dumper will be recorded in bound and numbered register on plant side.

Department will be free to get some loaded dumpers test checked at other, weigh bridge. Weigh bridge will be periodically got calibrated and verified from weight and measure authorities.

For the purpose of application at tack coat if the theoretical area as per sanctioned estimate for basis of tonne differs with the actual area of work done in the field, then the reduction in or addition to payment shall have to be effected to the contractor on proportionate basis depending upon the area, reduced or exceeded respectively.

Weight of mix materials will be done in presence of Responsible person, not less than the rank of-supervisor of Department Deputy Executive Engineer or Assistant Engineer or Addl. Assistant Engineer if so authorised. Record of each dumper will be maintained separately in bound and numbered register which will be maintained by the departmental representatives and signed by the contractor, proper gate pass system shall be established for the vehicles coming to the plant site and but going from the plan site. The location of the kilometer, hectometer in which individual dumper are unloaded will -be recorded\* carefully.

## 8. RATE

The Contract unit rate for semi-dense carpet shall be payment in full for carrying out the required operations including full compensation for all components listed in MOST Specification Clause 503.8.

### ANNEXURE-A

#### TECHNICAL REQUIREMENTS OF HOT MIX PLANT

**Composition of plant :** The Hot Mix Plant shall conform generally to IS Specifications No. I S 3066/ 1965 as amended from time to time and shall be equipped with the following arrangements :-

1 . **Cold Aggregate Feeder :** The cold aggregate feeder shall have minimum three independent bins or compartment, each provided with accurate mechanical pre-determined rate to the cold elevator-or to some intermediate conveyor or directly into the dryer. The feeder shall provide for the adjustment of total and proportional feed and shall be capable of being locked in any setting.

2. **Dryer :** The dryer shall be capable of 'continuously agitating the aggregates while heating to the desired temperature. At the discharge end of the dryer or any other -suitable location, means, shall be provided for ascertaining the temperature of the heated aggregate.

3. **Screening Unit and Gradation Control :** The dried aggregate shall be screened into not less than three size. The plant shall include means for accurately proportioning each bin size of aggregate-either by weight or volumetric measurement, When the gradation control is by volume, ,the unit shall include a feeder mounted under the compartment bins. Each bin shall have an accurately controlled, individual gate to form an orifice for proportioning the material drawn from each respective bin compartment. The orifice shall have positive mechanical adjustment and provided with a lock Indicators shall be provided on each gate to show the opening in centimeters.

4. **Mixer Unit :** The plant shall include a mixer of an approved twin shaft pugmill type capable of producing a uniform mix. If not enclosed, the mixer box shall be equipped with-a dust hood to prevent loss of fines.

5. **Mineral Filler Supply Unit :** There shall be an Independent arrangement to feed mineral filler directly into the pugmill. The hopper to bin for mineral filler shall provide for the adjustment to proportion the feed with the aggregate and bitumen feeds and shall be capable of being locked in any setting.

6. **Bitumen Heating :** A heating system for bitumen always with effective and positive control of temperature shall be provided, to maintain proper temperature and for allowing continuous circulation between storage tank and proportioning units during the entire operating period. Suitable arrangements shall be provided for recording the temperature at the tanks and in the circulating system.

7. **Synchronization :** For Synchronization of Aggregate, Bitumen and filler feeds satisfactory means shall be provided to afford positive inter-locking control between the flow of aggregate from the bins or compartment, flow of bitumen from the tank and flow of mineral filler.

### ITEM - 20 40 mm Thick Asphaltic Concrete

#### 1. DESCRIPTION

The work shall consist of construction in a single course, of 40 mm thick asphaltic concrete as wearing surface, on a previously prepared base to the requirements of these specifications



## 2. MATERIALS

**2.1. Binder** : The binder shall be straight run bitumen of 60/70 or 80/100 grade satisfying the requirement of IS: 73. The actual grade of the binder to be used shall be decided by the Engineer in charge.

**2.2 Coarse aggregate** : The coarse aggregate shall consist of crushed stone or crushed gravel. These shall be clean, durable, of cubical shape, free of disintegrated pieces, organic or other deleterious matter and adherent coatings. The aggregates shall preferably be hydrophobic and of low porosity and shall satisfy the physical requirements set forth in Table given in Item No.18 Para 12.

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

**2.4 Filler** : The filler, where required, shall be an inert material the whole of which passes 600 micron sieve at least 90 percent passing 150 micron sieve and not less than 70 percent passing 75 micron sieve. The filler shall be cement, stone dust, hydrated lime, fly ash and other non – plastic mineral matter approved by the Engineer in charge.

**2.5 Aggregate gradation** : The mineral aggregates, including mineral filler, shall be so graded or combined as to conform to gradings set forth in table below :

**Table : Aggregate gradation For Asphaltic Concrete**

Sieve Designation.	% by the weight passing the sieve	Sieve Designation.	% by weight passing the Sieve.
20mm	100	600 micron	18 – 29
12.5mm	80 – 100	300 micron	13 – 23
10mm	70 – 90	150 micron	8 – 16
4.75 mm	50 – 70	75 micron	4 - 10

**2.6 Proportioning of materials** : The binder content for premixing shall be 5.5 percent by weight of the total mix.

The quantities of aggregates shall be sufficient to yield the specified thickness after compaction. The contractor shall get the job – mix formula for the mix approved by the Engineer – in – charge before starting the work.

**2.7 Variation in Proportioning of material** : The Contractor shall have the responsibility of ensuring proper proportioning of materials in accordance with the approved job mix formula and producing a uniform mix. A variation in binder content of  $\pm 0.3$  percent by weight of total mix shall, however, be permissible in individual specimen taken for quality control tests vide MOST Specification Section 900.

## 3. CONSTRUCTION OPERATIONS

**3.1 Weather and seasonal limitation** : Asphaltic Concrete shall not be laid during rainy weather or when the base course is damp or wet.

**3.2 Preparation of base** : The base on which asphaltic concrete is to be laid shall be prepared shaped and conditioned to the specified, lines grade and cross section in accordance with MOST Specification Clause 601 as directed by the Engineer in charge. The surface shall be thoroughly swept and scraped clean and free of dust and foreign matter.

**3.3 Tack coat : Application of binder** : Binder shall be heated to the temperature appropriate to the grade of bitumen used and approved by the Engineer in charge and sprayed on the base at the rate specified hereafter. The rate of spread in terms of straight run bitumen shall be 5 kg per 10 square metre area for an existing bitumen treated surface and 10 kg per 10 square metre area for an untreated water bound macadam surface. The binder shall be applied uniformly with the aid of sprayers. The tack coat shall be applied just ahead of the oncoming bituminous construction.

**3.4 Preparation of the mix** : Hot mix plant of adequate capacity and capable of producing a proper and uniform quality shall be used for preparing the mix. The plant should be continuous type having a co-ordinated set of essential units such as dryer for heating the aggregates, device for feeding by weight or volume the required quantities of aggregates, a binder heating and control unit for metering out the correct quantity of heated binder together with a paddle mixer for intimately mixing of the binder and aggregates. For details regarding Hot mix plant the Annexure 'A' may be referred.

The temperature of binder at the time of mixing shall be in the range of 150° C - 177° C and aggregates in the range of 150° C - 163° C provided also that at no time shall the difference in temperature of the aggregates and the binder exceed 14° C.

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

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

**3.5 Spreading :** The mix, transported from the hot mix plant to the site, shall be spread by means of self propelled mechanical paver with suitable screens capable of spreading, tamping and finishing the mix, true to specified grade, line and cross sections. The temperature of mix at the time of laying shall be in the range of 121° C- 163° C.

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

**3.6 Rolling :** Immediately after the spreading of mix, it shall be thoroughly compacted by rolling with a set of rollers moving at a speed not exceeding 5 km per hour. The initial or break-down rolling shall be with 8-12 tonne three wheeled rollers and the surface finished by final rolling with 8-10 tonne tandem rollers, or suitable pneumatic rollers.

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

#### **4. OPENING TO TRAFFIC**

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

#### **5. SURFACE FINISH AND QUALITY CONTROL OF WORK**

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

#### **6. ARRANGEMENT FOR TRAFFIC**

The provision of MOST Specification Clause 112 shall apply as regards the flow to traffic during construction.

#### **7. MEASUREMENT 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 weigh bridge of suitable capacity, for the purpose of weighing of dumpers at suitable place, at his cost as directed. Weight of "empty dumper and weight of loaded dumper will be recorded in bound and numbered register on plant side.

Department will be free to get some loaded dumpers test checked at other, weigh bridge. Weigh bridge will be periodically got calibrated and verified from weight and measure authorities.

For the purpose of application at tack coat if the theoretical area as per sanctioned estimate for basis of tonne differs with the actual area of work done in the field, then the reduction in or addition to payment shall have to be effected to the contractor on proportionate basis depending upon the area, reduced or exceeded respectively.

Weight of mix materials will be done in presence of Responsible person, not less than the rank of supervisor of Department Deputy Executive Engineer or Assistant Engineer or Addl. Assistant Engineer if so authorised. Record of each dumper will be maintained separately in bound and numbered register which will be maintained by the departmental representatives and signed by the contractor, proper gate pass system shall be established for the vehicles coming to the plant site and but going from the plant site. The location of the kilometer, hectometer in which individual dumper are unloaded will be recorded\* carefully.

#### **8. RATE**

The Contract unit rate for semi-dense carpet shall be payment in full for carrying out the required operations including full compensation for all components listed in MOST Specification Clause 503.8.

**ITEM-21 Providing and laying bituminous 37.5 mm thick lean bound macadam in one or two layers considering 0.66 cum. per M.T. mix materials with machine crushed stone aggregate and asphalt for tack coat @ the rate of 10 Kg /10 sq. mt. (on metaled surface) / 5 kg per 10 sq. mt. (on existing B. T. surface) using 30 kg. of bitumen per asphalt including mixing the aggregate, heating the asphalt including mixing by continuous batching of hot mix plant and spreading the same by paver finisher and consolidation with power roller including providing atl equipments by the contractor and flushing sand at the rate of 0,30 cu.m /100 sq. mt.**

### 1. DESCRIPTION

The work shall consist of construction in one layers each 37.5 mm thick LBM 'on previously prepared base, to the requirements of these specifications.

### 2. MATERIALS

2.1 **Binder** : The binder shall be straight run bitumen of 60/70 or 80/100 grade satisfying the requirement of IS.73. The actual grade of the binder to be used shall be decided by the Engineer-in-charge and it shall have to be brought by the contractor to the site of work at his own cost.

2.2 **Coarse aggregates** : The coarse aggregate shall consist of crushed stone or crushed gravel. These shall be clean, durable, of cubical shape, free disintegrated pieces, organic or other deleterious matter and adherent coatings. The aggregates shall preferably be hydrophobic and of low porosity and shall satisfy the physical requirements set forth in Table given in Item No. 18 Para 2.

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

2.4 **Filler** : The filler, where required, shall be an inert material the whole of which passes 600 micron sieve at least 90 percent passing 150 micron sieve and not less than 70 percent passing 75 micron sieve. The filler shall be cement, stone dust, hydrated lime, fly ash and other non-plastic mineral matter approved by the Engineer-in-charge.

2.5 **Aggregate gradation** : The mineral aggregates, including mineral filler, shall be so graded or combined as to conform to gradings set forth in tables below :

**Table : Aggregate gradation For LBM**

Sieve Size	%by weight passing the Sieve		Sieve Size	%by weight passing the Sieve	
	37.5	75 m.m.		37.5	75 m.m
40mm	-	100			
25mm	100	75-100	4.75 mm	15-35	15-35
20.0 mm	70-100	60-95	2.36mm	5-20	5-20
10.0mm	35 -60	30-55	0.75 mm	0-5	0-5

The above gradation is tentative. To achive Correct quantity the contractor shall get the job mix farmula for the mix approved by Engineer-in-charge before starting the work.

2.6 **Proportioning of materials** : The binder content for premixing shall be 3.0 percent by weight of the total mix. The quantities of aggregates shall be sufficient to yield the specified thickness after compaction The contractor shall get the job-mix formula for lthe mix approved by the Engineer-in-charge before starting the work Variation in Proportioning of material : The Contractor shall have the responsibility of ensuring proper proportioning of materials in accordance with the approved job mix formula and producing a uniform mix. A variation in binder content of  $\pm 0.3$  percent by weight of total mix shall, however, be permissible in Individual specimen taken for quality control tests vide MOST Specification Section 900.

### 3. CONSTRUCTION OPERATIONS

3.1 **Weather and seasonal limitation** : Lean bound Macadam shah not be laid during rainy weather or when the base course is damp or wet.

3.2 **Preparation of base** : The base on which LBM is to be laid shall be prepared shaped and conditioned to the specified, lines, grade and cross section in accordance with MOST Specification Clause 601 as directed by the Engineer-in-charge. The surface shall be thoroughly swept and scraped clean and tree of dust and foreign matter

3.3 **Tack coat** : Application of binder : Binder shall be heated to the temperature appropriate to the grade of bitumen used and approved by the Engineer-in-charge and sprayed on the base at the rate specified hereafter. The rate of spread in terms of straight run bitumen shall be 5 kg per 10 square metre area for an existing bitumen treated surface and 10 kg per 10 square metre area for an untreated water bound macadam surface. The binder shall be applied uniformly with the aid of sprayers. At specified temperature, so as to provide uniformly rate and unbroken spread bitumen. The tack coat shall be applied just ahead of the oncoming bituminous construction.

3.4 **Preparation of the mix** : Hot mix plant of adequate capacity and capable of producing a proper and

uniform quality shall be used for preparing the mix. The plant should be continuous type having a co-ordinated set of essential units such as dryer for heating the aggregates, device-for feeding by weight or volume the required quantities of aggregates, a binder heating and control unit for metering out the correct quantity of heated binder together with a paddle mixer for intimately mixing of the binder and aggregates. For details regarding Hot mix plant the Annexure 'A' may be referred.

The temperature of binder at the time of mixing shall be in the range of 150 C - 177° C and aggregates in the range of 150 C - 163° C provided also that at no time shall the difference in temperature of the aggregates and the binder exceed 14 C.

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

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

**3.5 Spreading :** The mix, transported from the hot mix plant to the site, shall be spread by means of self propelled mechanical paver with suitable screens capable of spreading, tamping and finishing the mix, true to specified grade, line and cross sections. The temperature of mix at the time of laying, shall be in the range of 121 C-163°C.

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

**3.6 Rolling :** Immediately after the spreading of mix, it shall be thoroughly compacted by rolling with a set of rollers moving at a speed not exceeding 5 km per hour. The initial or break down rolling shall be with 8-12 tonne three wheeled rollers and the surface finished by final rolling with 8-10 tonne tandem rollers, or suitable pneumatic rollers.

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

#### **4. OPENING TO TRAFFIC**

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

#### **5. SURFACE FINISH AND QUALITY CONTROL OF WORK**

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

#### **6. ARRANGEMENT FOR TRAFFIC**

The provision of MOST Specification Clause 105 shall apply as regards the flow to traffic during construction.

#### **7. MEASUREMENT 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 weigh bridge of suitable capacity for the purpose of weighing of dumpers at suitable place at his cost as directed; Weight of empty dumper and weight of loaded dumper will be recorded in bound and numbered register on plant side.

Department will be free to get some loaded dumper test checked at other weigh 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 the field, then the reduction in or addition to payment shall have to be effected to the contractor on proportionate basis depending upon the area reduced or exceeded respectively.

Weight of mix materials will be done in presence of responsible person, not less than the rank of supervisor of Department Deputy Executive Engineer or Assistant Engineer or Addl. Assistant Engineer if so authorised. Record of each dumper will be maintained separately in bound and numbered register which will be maintained by the departmental representatives and, signed by the contractor. Proper gate pass system shall be established for the vehicles coming to the plant Site and out going from the plant site. The location of the kilometer, hectometer in which individual dumper are unloaded will be recorded carefully.

7.2 In case of LBM, DBM and asphaltic concrete of thickness 50 mm and above, initial levels before commencement of the work and final levels after completion of the work will be taken as indicated below for working out the average thickness of pavement laid, also the actual area of work done will be measured and the quantity of the work actually done shall be computed in Cu. M. basis. The article tonnage of the mix shall then be worked out based on the designed density, for broad cross check on the actual tonnage of total mix used in the works.

Surface levels before and after laying the pavement course shall be taken as below:

Cross profiles will be taken at least at every ten meters longitudinally as shown below :

(a) For single Lane : Levels at 15 Cms & 75 from both the edges and centre point.

(Levels at 5 points)

(b) For double Lane: Levels at 15 Cms & 75 cms : 175 Cms. 275 Cms. from both the edges and the centre point. (Levels at 9 Points)

(c) Widening single to double lane : Levels at 15 Cms. from both the edges and the centre Carriage way (Up to 2 meters widening) point (levels at 3 Points)

However, in special cases if necessary, the cross profiles may be taken at closer length upto 3 meters.

## 8. RATE

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

## ITEM 22 DBM 50MM THICK.

### 1. DESCRIPTION

The work shall consist of construction in a single course of 50 mm thick DBM on previously prepared base, to the requirements of these specifications.

### 2. MATERIALS

**2.1 Binder** : The binder shall be straight run bitumen of 60/70 or 80/100 grade satisfying the requirement of IS.73. The actual grade of the binder to be used shall be decided by the Engineer-in-charge.

**2.2 Coarse aggregates** : The coarse aggregate shall consist of crushed stone or crushed gravel. These shall be clean, durable, of cubical shape, free disintegrated pieces, organic or other deleterious matter and adherent coatings. The aggregates shall preferably be hydrophobic and of low porosity and shall satisfy the physical requirements set forth in Table given in Item No. 18 Para 2.

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

**2.4 Filler** : The filler, where required, shall be an inert material the whole of which passes 600 micron sieve at least 90 percent passing 150 micron sieve and not less than 70 percent passing 75 micron sieve. The filler shall be cement, stone dust, hydrated lime, fly ash and other non-plastic mineral matter approved by the Engineer-in-charge.

**2.5 Aggregate gradation** : The mineral aggregates, including mineral filler, shall be so graded or combined as to conform to gradings set forth in tables below :

**Table : Aggregate gradation For LBM**

Sieve Size	%by weight passing the Sieve	Sieve Size	%by weight passing the Sieve
25mm	100	10mm	35-60
20mm	70 – 100	4.75mm	15-35
12.5mm	55 – 80	2.60mm	5-20
		0.75mm	0-5

**2.6. Proportioning of materials** : The binder content for premixing shall be 3.0 percent by weight of the total mix.

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

The contractor shall get the job-mix formula for the mix approved by the Engineer-in-charge before starting the work.

**2.7. Variation in Proportioning of material** : The Contractor shall have the responsibility of ensuring proper proportioning of materials in accordance with the approved job mix formula and producing a uniform mix. A variation in binder content of  $\pm 0.3$  percent by weight of total mix shall, however, be permissible in Individual specimen taken for quality control tests vide MOST Specification Section 900.

### **3. CONSTRUCTION OPERATIONS**

**3.1 Weather and seasonal limitation :** DBM shall not be laid during rainy weather or when the base course is damp or wet.

**3.2 Preparation of base :** The base on which DBM is to be laid shall be prepared shaped and conditioned to the specified, lines, grade and cross section in accordance with MOST Specification Clause 601 as directed by the Engineer-in-charge. The surface shall be thoroughly swept and scraped clean and free of dust and foreign matter.

**3.3 Tack coat :** Application of binder : Binder shall be heated to the temperature appropriate to the grade of bitumen used and approved by the Engineer-in-charge and sprayed on the base at the rate specified hereafter. The rate of spread in terms of straight run bitumen shall be 5 kg per 10 square metre area for an existing bitumen treated surface and 10 kg per 10 square metre area for an untreated water bound macadam surface. The binder shall be applied uniformly with the aid of sprayers. At specified temperature, so as to provide uniformly rate and unbroken spread bitumen. The tack coat shall be applied just ahead of the oncoming bituminous construction.

**3.4 Preparation of the mix :** Hot mix plant of adequate capacity and capable of producing a proper and uniform quality shall be used for preparing the mix. The plant should be continuous type having a co-ordinated set of essential units such as dryer for heating the aggregates, device for feeding by weight or volume the required quantities of aggregates, a binder heating and control unit for metering out the correct quantity of heated binder together with a paddle mixer for intimately mixing of the binder and aggregates. For details regarding Hot mix plant the Annexure 'A' may be referred.

The temperature of binder at the time of mixing shall be in the range of 150° C - 177° C and aggregates in the range of 150° C - 163° C provided also that at no time shall the difference in temperature of the aggregates and the binder exceed 14° C.

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

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

**3.5 Spreading :** The mix, transported from the hot mix plant to the site, shall be spread by means of self propelled mechanical paver with suitable screens capable of spreading, tamping and finishing the mix, true to specified grade, line and cross sections. The temperature of mix at the time of laying, shall be in the range of 121° C-163° C.

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

**3.6 Rolling :** Immediately after the spreading of mix, it shall be thoroughly compacted by rolling with a set of rollers moving at a speed not exceeding 5 km per hour. The initial or break down rolling shall be with 8-12 tonne three wheeled rollers and the surface finished by final rolling with 8-10 tonne tandem rollers, or suitable pneumatic rollers.

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

### **4. OPENING TO TRAFFIC**

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

### **5. SURFACE FINISH AND QUALITY CONTROL OF WORK**

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

### **6. ARRANGEMENT FOR TRAFFIC**

The provision of MOST Specification Clause 105 shall apply as regards the flow to traffic during construction.

### **7. MEASUREMENT 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 weigh bridge of suitable capacity for the purpose of weightment of dumpers at suitable place at his cost as directed; Weight of empty dumper and weight of loaded dumper will be recorded in bound and numbered register on plant side.

Department will be free to get some loaded dumper test checked at other weigh 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 the field, then the reduction in or addition to payment shall have to be effected to the contractor on proportionate basis depending upon the area reduced or exceeded respectively.

Weight of mix materials will be done in presence of responsible person, not less than the rank of supervisor of Department Deputy Executive Engineer or Assistant Engineer or Addl. Assistant Engineer if so authorised. Record of each dumper will be maintained separately in bound and numbered register which will be maintained by the departmental representatives and, signed by the contractor. Proper gate pass system shall be established for the vehicles coming to the plant Site and out going from the plant site. The location of the kilometer, hectometer in which individual dumper are unloaded will be recorded carefully.

7.2 In case of LBM, DBM and asphaltic concrete of thickness 50 mm and above, initial levels before commencement of the work and final levels after completion of the work will be taken as indicated below for working out the average thickness of pavement laid, also the actual area of work done will be measured and the quantity of the work actually done shall be computed in Cu. M. basis. The article tonnage of the mix shall then be worked out based on the designed density, for broad cross check on the actual tonnage of total mix used in the works.

Surface levels before and after laying the pavement course shall be taken as below:

Cross profiles will be taken at least at every ten meters longitudinally as shown below :

- (a) For single Lane : Levels at 15 Cms & 75 from both the edges and centre point.  
(Levels at 5 points)
- (b) For double Lane: Levels at 15 Cms & 75 cms : 175 Cms. 275 Cms. from both the edges and the centre point. (Levels at 9 Points)
- (c) Widening single to double lane : Levels at 15 Cms. from both the edges and the centre Carriage way  
(Up to 2 meters widening) point (levels at 3 Points)

However, in special cases if necessary, the cross profiles may be taken at closer length upto 3 meters.

## 8. RATE

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

**ITEM-23 Providing and laying seal coat with 0.18 cum stone chips i.e. 0.2727 M. T. per 10 sq. nit. using 42.50 kgs of bitumen per M.T. (4.25% by weight) for mixing the aggregates, heating the asphalt including mixing by continuous batching of hot mix plant and spreading the same by paver finisher and consolidation with power roller including providing all equipments by the contractor and flushing sand at the rate of 0.30 cu. m /100 sq. mt.**

### 1 DESCRIPTION

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

### 2. MATERIALS

2.1 **Binder:** The binder shall be straight run bitumen of 60/70 or 80/100 grade satisfying the requirement of IS:73. The actual grade of the binder to be used shall be decided by the Engineer-in-charge and it shall have to be brought by contractor to the site at his own cost unless otherwise specified in schedule 'A'.

2.2 **Coarse aggregates:** The coarse aggregate shall consist of crushed stone or crushed gravel. These shall be clean, durable, of cubical shape, free disintegrated pieces, organic or other deleterious matter and adherent coatings. The aggregates shall preferably be hydrophobic and of low porosity and shall satisfy the physical requirements set forth in Table given in Item No. 18 Para 2. Except that the upper limit for water absorption value shall be one percent.

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

2-4 **Filter:** The filler, where required, shall be an inert material the whole of which passes 600 micron sieve at least 90 percent passing 150 micron sieve and not less than 70 percent passing 75 micron sieve. The filler shall be cement, stone dust, hydrated lime, fly ash and other non-plastic mineral matter approved by the Engineer-in-charge.

2.5 **Aggregate gradation :** The mineral aggregates, including mineral filler, shall be so graded or combined as to conform to gradings set forth in tables below:

**Table : Aggregate gradation Pre-Mix Seal Coat**

Sieve Designation	Percentage by wt passing through Sieve	
	For type 'A'	For Type 'g.'
12.5 mm		100 70-
10 mm	100	100 20-
4.75 mm	40-85	40
2.35	5-20	5-20
75micron	0-4	0-4

**2.6 Proportioning of materials :** The binder content for premixing shall be 42.50 kg per M.T. (4.25% by weight) for mixing aggregate.

The quantities of aggregates shall be sufficient to yield the specified thickness after compaction. The contractor, shall get the job-mix formula for the mix approved by the Engineer-in-charge before starting the work.

**2.7 Variation in Proportioning of material :** The Contractor shall have the responsibility of ensuring proper proportioning of materials in accordance with the approved job mix formula and producing a uniform mix. A variation in binder content of  $\pm 0.3$  percent by weight of total mix shall, however, be permissible in individual specimen taken for quality control tests vide MOST Specification Section 900.

### 3. CONSTRUCTION OPERATIONS

**3.1 Weather and seasonal limitation :** Premix seal coat shall not be laid during rainy weather or when the base course is damp or wet.

**3.2 Preparation of base :** The base on which premix seal coat is to be laid shall be prepared shaped and conditioned to the specified, lines, grade and cross section in accordance with MOST Specification Clause 601 as directed by the Engineer-in-charge. The surface shall be thoroughly swept" and scraped clean and free of dust and foreign matter.

**3.3 Tack coat :** Application of binder : Binder shall be heated to the temperature appropriate to the grade of bitumen used and approved by the Engineer-in-charge and sprayed on the base at the rate specified hereafter. The rate of spread in terms of straight run bitumen shall be 5 kg per 10 square metre area for an existing bitumen treated surface and 10 kg per 10 square metre area for an untreated water bound macadam surface. The binder shall be applied uniformly with the aid of sprayers. The tack coat shall be applied just ahead of the oncoming bituminous construction.

**3.4 Preparation of the mix :** Hot mix plant of adequate capacity and capable of producing a proper and uniform quality shall be used for preparing the mix. The plant should be continuous type having a co-ordinated set of essential units such as dryer for heating the aggregates, device for feeding by weight or volume the required quantities of aggregates, a binder heating and control unit for metering out the correct quantity of heated binder together with a paddle mixer for intimately mixing of the binder and aggregates. For details regarding Hot mix plant the Annexure 'A' may be referred.

The temperature of-binder at the time of mixing shall be in the range of 150° C - 177° C and aggregates in the range of 150° C -163° C provided also that at no time shall the difference in temperature of the aggregates and the binder exceed 14° C.

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

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

**3.5 Spreading :** The mix, transported from the hot mix. plant to the site, shall be spread by means of self propelled mechanical paver with suitable screens capable of spreading, tamping and finishing the mix, true to specified grade, line and cross sections. The temperature of mix at the time of laying shall be in the range of 121° C -163°C.

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

**3.6 Rolling :** Immediately after the spreading of mix, it shall be thoroughly compacted by rolling with a set of rollers moving at a speed not exceeding 5 km per hour. The initial or break-down rolling shall be with 8-12 tonne three wheeled rollers and the surface finished by final rolling with 8-10 tonne tandem rollers, or suitable pneumatic rollers. Rolling temperature shall not be-less than 100 °C in any case the rolling shall be completed the temperature of mix falls about 80 ° C.



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

#### **4. OPENING TO TRAFFIC**

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

#### **5. SURFACE FINISH AND QUALITY CONTROL OF WORK**

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

#### **6. ARRANGEMENT FOR TRAFFIC**

The provision of MOST Specification Clause 105 shall apply as regards the flow to traffic during construction.

#### **7. MEASUREMENT 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 weigh bridge of suitable capacity for the purpose of weighing of dumpers at suitable place at his cost as directed. Weight of empty dumper and weight of loaded dumper will be recorded in bound and numbered register on plant side.

Department will be free to get some loaded dumper test checked at other weigh 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 the field, then the reduction in or addition to payment shall have to be effected to the contractor on proportionate basis depending upon the area reduced or exceeded respectively.

Weigh of mix materials will be done in presence of responsible person, not less than the rank of supervisor of Department, Deputy Executive Engineer or Assistant Engineer or Addl. Assistant Engineer if so authorised. Record of each dumper will be maintained separately in bound and numbered register which will be maintained by the departmental representatives and signed by the contractor. Proper gate pass system shall be established for the vehicles coming to the plant site and out going from the plant site. The location of the kilometer, hectometer in which individual dumper are unloaded will be recorded carefully.

#### **8. RATE**

The Contract unit rate for seal coat shall be for payment for carrying out the required operations including full compensation for all components listed in MOST Specification Clause 503.7

#### **ITEM - 24 Special Conditions for Bituminous surface work with use of Hot Mix Plant paver Finisher.**

1. The Hot Mix Plant and accessories to be used for the work shall be in conformity with the specifications prescribed vide Govt. of India, Ministry of Transport Circular No. RQ/RMP/1613784 dt.1-1-87. The plant shall be equipped with all units and accessories as per latest I.S. 3066/1965, as amended from time to time. The Contractor will have to modify their plants suitably within a period of six months from the date of issue of latest I.S. Specification or Codes.

2. The work of laying aggregate mixed with bitumen shall start on site of work only after 8.00 hours in the morning and continue upto 17.00 hours in winter season and upto 18.30 hours in summer. No work shall be done except during the period mentioned above and also on Sundays and National holidays viz. 26th January, 15th August & 2nd October.

3. Quantity of bituminous aggregate mix to be laid shall be restricted to 250 tonnes per day for 30/4'0 capacity plant and may be more\* or less depending upon the rated capacity of the plant.

4. The work of laying asphalt mix shall start latest within 60 days from the date of issue of work order except when work is closed for few days due to breakdown of machinery and during such period the contractor has not shifted paver plant to any other paver work not carried out by the same plant and will be completed as per time limit. Reasons for delay in starting of work after 60 days shall result into sufficient cause for levying compensation for disproportionate progress. However, the period from 15th June to 15th October monsoon shall not be counted for the purpose of disproportionate progress and consequent cause for levy of compensation. The contractors shall commence the work of laying pavement on or before the last date of the period mentioned above failing which he shall pay for every day that he shall delay the commencement of the work as above in accordance with clause-2 of the contract.

કોન્ટ્રાક્ટર ૬૦ દિવસની અંદર કામ શરૂ કર્યા પછી થોડુંક કામ કરીને નીચ દર્શાવેલ સંજોગો સિવાય કામ અધુરા મુકશે તો જે દિવસથી કામ અધરૂં મુકે તે દિવસથી કામ શરૂ કરે ત્યાં સુધી રૂ. ૫૦૦/- લેખે વળતર વસુલ કરવામાં આવશે.

- (૧) મશીનરી બ્રેકડાઉન થયેલ હોય અને તેટલા જ જુજ સમય પુરતું કામ બંધ રહેલ હોય.
- (૨) મશીનરી બ્રેકડાઉન સમય દરમિયાન પેવર પ્લાન્ટ પણ ત્યાંથી ખસેડવામાં આવેલ ન હોય અથવા જે પ્લાન્ટ પેવરથી અન્ય જગ્યાએ કામગીરી કરવામાં આવી ન હોય.

5. The Contractor shall invariably get the job mix formula for the mix approved by the Engineer-in-charge before starting the work.

6. These special conditions shall be applicable to the specifications of all the items included in this contractor where work is to be carried out with Hot Mix Plant and paver finisher.

7. No asphalt work shall be executed in monsoon as per condition 4 of same Item 24. However in critical circumstances asphalt work may be executed during monsoon with permission of Superintending Engineer who may give permission after ascertaining the proportion of moisture in existing surface & atmosphere (R & B D. G R. dated 24-10-94 & No. S.S.R.-102004 (23)-C dated 23-6-2004).

#### **SCHEDULE OF WORK TO BE EXECUTED SHALL BE AS UNDER**

Time Limit:-

Sr.No.	Period	Description of items to be executed
1	Month.....Month	1. Collection of Materials on site
2	From Month 2 to 4 Month	2. Erection of Plant Machinery as required
3	From Month....to....Month	3. Laying of asphaltting work carpet & Seal coat & Flushing of sand over surface, side with filling with earth as required-and directed

#### **ITEM-25 Dismantling [Road and bridge items]**

1. The work shall consist of removing, as herein after set forth, existing, culverts, bridges, pavement, kerbs and other structures like guards-rails, fences, utility poles, manholes, catch basins, inlets, etc Which are in place but interfere with the new construction or are not suitable to remain in place and of salvaging and disposing of the resulting materials and back filling the resulting trenches and pits.

2. Existing culverts, bridge, pavements and other structures which are within the highway and which are designated to be removed, shall be removed upto the limits and extent specified in the drawings or as indicated by the Engineer-in-charge.

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

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

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

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

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

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

9. Steel structures shall unless otherwise provided be 'carefully dismantled in such a manner as to avoid damage to members thereof/If specified-in the drawing or directed-by the Engineer-in-charge that structure is to be removed in a condition suitable for re-erection all-members shall be match marked by the contractor with white lead paint before dismantling. End pins, nuts, loose, plates, etc. shall be painted with a mixture of white lead and tallow and loose parts shall be securely wired to adjacent members or packed in boxes.

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

11. In removing pavements, kerbs, gutters, and other structure, like guards rails, fences, manholes, catch, basins, inlets etc. where portions of the existing construction are to be left in the finished work, the same, shall be

removed to an existing joint or cut and chipped to a true line with a face perpendicular to the surface of the existing structure. Sufficient removal shall be made to provide for proper grades and connections with the new work as directed by the Engineer-in-charge.

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

13. Where directed by the Engineer-in-charge holes and depressions caused by, dismantling operations shall be back filled with excavated or other approved materials and thoroughly compacted in line with surrounding area.

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

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

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

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

18. All the products of dismantling operations which in the opinion of the Engineer-in-charge cannot be used or auctioned shall be disposed as directed, within 100 metres.

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

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

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

**ITEM-26 Excavation for foundation up to 1.5 m depth including sorting out and stacking of useful material and disposing stuff 50 metre lead. (A) in loose or soft soil (B) in dense or hard soil.**

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

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

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

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

5. Where waters is met with in excavation due to stream-flow, seepage springs, rain or other reasons, the contractor shall take adequate measures such as bailing, pumping, constructing diversion channels drainage channels, and other necessary work to keep the foundation trenches dry when so required and to protect green

concrete/masonry against damage by erosion or sudden rising of water level. The method to be accepted in this regard and other details thereof shall be left to the choice of (the contractor but subject to approval of the Engineer-in charge, Approval of the Engineer-in-charge shall, however, not relieve the contractor of the responsibility for the adequacy of dewatering and protection arrangements and for the quality and safety of the work.

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

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

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

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

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

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

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

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

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

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

#### **ITEM - 27 -DO- in hard murrum**

1.0 Para 1 to 13 of the item of excavation for foundation in all sorts of soil shall apply.

14. Excavation shall be in hard soil such as stiff heavy clay, hard shale or compact murrum requiring grouting tool or pick or both and shovel. Closely applied and gravel and rubble stone having maximum diameter in any one direction between 75 and 300 mm and soft conglomerate. The classification of excavation shall be decided by the Engineer in-charge and his decision shall be final and binding on the Contractor

#### **ITEM - 28 - DO - in hard rock**

1. Para 1 to 13 of the item of excavation for foundation in all sorts of soil shall apply.

14. Excavation shall be in soft rock such as limestone, sand stone, laterite, hard conglomerate or other softer disintegrated rock which may be quarried or split with crow bars, boulders which do not requiring and any rock which in dry state may be hard, requiring blasting but which when wet becomes soft and manageable by means other than blasting. The classification of excavation shall be decided by the Engineer-in-charge and his decision shall be final and binding on the Contractor.

**ITEM-29 - DO - in hard rock**

1. Para 1 to 13 of the item of excavation for foundation in all sorts of soil shall apply.

14. Excavation shall be in any rock or boulders for which the use of mechanical plant for blasting is required. The classification of excavation shall be decided by the Engineer-in-charge and his decision shall be final and binding on the Contractor. Merely the use of explosives in excavation will not be considered as a reason for higher classification unless blasting is clearly necessary in the opinion of the Engineer-in-charge.

15. In the opinion of the Engineer-in-charge where blasting is prohibited for any reason, excavation shall be carried out by chiselling, wedging or any other agreed method.

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

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

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

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

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

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

(d) A notice that smoking is strictly prohibited.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**ITEM 30 Providing and laying uncoursed rubble masonry with hard stone of approved quality in foundations and plinth in cement mortar 1:6 (1 cement: 6 course sand) including levelling up etc. complete.**

1. Stone shall be hard, sound, free from cracks, decay and weathering and shall be freshly quarried from an approved quarry. Stone with round surface shall not be used. The stones when immersed in water for 24 hours shall not absorb water by more than 5 percent of their dry weight when tested in accordance with IS : 1124. The length of stone shall not exceed three times its height and the breadth on base shall not be greater than three fourths of the thickness of wall nor less than 15 cm.

2. Cement and sand shall be mixed in proportion as specified in the item. Cement and sand shall be proportioned by volume after making due allowance for bulking. The required quantity of water shall then be added and the mortar mixed to produce workable consistency.

3. The mixing shall be done intimately. The operation shall be carried out on a clean water tight platform, and cement and sand shall be first mixed dry in the required proportion to obtain a uniform colour and then the mortar shall be mixed for at least two minutes after addition of "water. In case of cement mortar, that has stiffened because of evaporation of water the same shall be retempered by adding water as frequently as needed to restore the requisite consistency, but this retempering shall be permitted only, within thirty minutes from the time of addition of water at the time of initial mixing.

4. The dressing of stone shall conform to the general requirements of dressing of stone covered in IS : 1129. Stones shall be sufficiently wetted before laying to prevent absorption of water from mortar. The bed which is to receive the stone shall be cleaned, wetted and covered with a layer of fresh mortar. All stones shall be laid lull in mortar both in bed and in vertical joints and settled carefully in place with a wooden mallet immediately on placement so that it is solidly bedded in mortar before the same has set. Clean chips and spalls shall be edges into the mortar joints and beds wherever necessary to avoid truck beds or joints of mortar. Whenever foundation masonry is laid directly on rock, the face space of the first course shall be dressed to fit into the rock snugly when pressed down in the mortar bedding over the rock. No dry or hollow space shall be left anywhere in the masonry and each stone shall have all the embedded faces completely covered with mortar. Vertical joints, shall be staggered as far as possible. Sufficient transverse bond shall be provided by the use of bond stones extending from the front to the back of the masonry. In case of thick walls bond stones shall overlap each other in their arrangement. Bed shaped bond stones or headers shall not be used.

5. At all angular junctions, stones at each alternate course shall be well bonded into the respective course of the adjacent wall. All connected masonry in structure shall be carried up at one uniform level throughout as far as possible, but when breaks are unavoidable, the masonry shall be raked in sufficient long steps to facilitate joining of new work with old. The stepping of taking shall not be more than 45 degree with horizontal wing walls. Abutments and piers etc. shall be carved up truly plumb or with the specified batter. Face work and hearting shall be brought up evenly. The top of each course, however, shall not be levelled up by use of flat chips.

6. Stone shall be hammer dressed on the face, the sides and beds to enable it to come in proximity with the neighboring stone. The bushing on the face shall not be more than 4 cm on exposed face chips and spalls of stone may be used where necessary to avoid thick mortar beds or joints and it shall also be ensured that no hollow spaces are left anywhere in the masonry. The chips shall not be used below hearting stone to bring these up to the level of face stone. Use of chips shall be restricted to filling of interstices between the adjacent stones in hearting and they shall not exceed 20 percent of the quantity of stone masonry.

7. The hearting or interior filling of wall face shall consist of rubble stones not less than 15 cm. in any direction, carefully laid, hammered down with a wooden mallet into position and solidly bedded in the mortar. The hearting should be laid nearly level with facing and backing. Through bond stone shall be provided in masonry up to 60 cm. thickness and in case of masonry above 60 cm. thickness a set of two or more than bond stones overlapping each other at least by 15 cm shall be provided in a line from face to back. In case of highly absorbent types of stone (Porous lime stone and sand stones etc.) the bond stone shall extend only about two third into the wall, as through stone in such cases may give rise to penetration of dampness and therefore for all thickness of such masonry a set of two or more bond stones, overlapped each other by at least 15 cm shall be approved. One bond stone or a set of bond stones shall be provided for every 0.50 square metres of the masonry surface, bond stones shall be stacked separately and marked to distinguish from other stones. Masonry work shall be started after sufficient number of bond stones are collected on site as directed by the Engineer-in-charge.

8. The quoins shall be laid header and stretcher alternately. Every stone shall be tilted to the adjacent stone so as to form neat and close joint. Face stone shall extend and bond well in the back. These shall be arranged to break joints, as much as possible and to avoid long vertical lines of joints.

9. The face joints shall not be more than 20 mm thick, but shall be sufficiently thick to prevent stone to stone contact and shall be completely filled with mortar.

10. Green work shall be protected from rain by suitable covering. Masonry work in cement or composite mortar shall be kept constantly wet on all faces for a minimum period of seven days. The top of the masonry work shall be left flooded with water at the close of the day. During hot weather all finished or partly completed work shall be covered for wetted in such manner as will prevent rapid drying. The racking of joints where necessary shall be done at the end of day's work when mortar is green.

11. The scaffolding shall be sound and strong to withstand all loads likely to come upon it. The holes which provide resting space for horizontal members shall not be left in masonry under one metre in width or immediately near the skew backs of arches. The holes left in the masonry work for supporting the scaffolding shall be filled and made good.

12. When fresh masonry is to be placed against existing surface of structures, these shall be cleaned of all loose material, roughened and wetted as directed by the Engineer-in-charge so as to effect a good bond with the new work.

13. Stone masonry shall be measured cubic meters

14. The contract unit for stone masonry work shall include the cost of all labour, materials, tools and plant. Scaffolding and other expenses incidental to the satisfactory completion of the work as described herein above.

**ITEM-31 Providing and laying coursed rubble masonry hard stone of approved quality for super structure -and plinth in cement mortar 1:5 (1 cement :5 course sand) etc. complete.**

1. Para 1 to 14 of item of U.C.R. masonry shall apply.

15. Masonry shall be laid with course, where there is variation in the height of course. Large courses shall be placed at lower levels with height of courses decreasing gradually towards the top.

16. In case of abutment and wing walls, weep holes shall be provided in the masonry to drain moisture from the backfilling. Weep holes shall be 8 cm wide, 15 cm high or circular of 15 cm. diameter and shall extend through the full width of the masonry with slopes of about 12 vertical to 20 horizontal towards the draining face. The spacing of weep holes shall be generally 1 metre in either direction with the lowest one at about 1.5 cm. above the low water level or ground level whichever is higher or as directed by the Engineer-in-charge.

**ITEM-32 Providing and laying Brick work using common burnt clay building bricks having crushing strength not less than 35 kg/sq.m. in foundation and plinth in cement mortar 1:5 (1 cement: 5 fine sand)**

1. Burnt clay bricks shall conform to the requirements of IS: 1017, except that the minimum compressive strength when tested flat shall not be less than 35 Kg/square cm. and that the size may be according to local practice with a tolerance of 5 percent.

2. Cement and sand shall be mixed in proportions as specified in the item. Cement and sand shall be proportioned by volume after making due allowance for bulking. The required quantity of water shall then be added and the mortar mixed to produce workable consistency.

3. The mixing shall be done intimately. The operation shall be carried out on a clean, wet, tight platform, and cement and sand shall be first mixed dry in the required proportion to obtain uniform colour and then the mortar shall be mixed for at least two minutes after addition of water. In case of cement mortar, that has suffered because of evaporation of water, the same shall be re-tempered by adding water as frequently as needed to restore the requisite consistency but this retempering shall be permitted only within thirty minutes from the time of addition of water at the time of initial mixing.

4. Bricks shall be soaked in water for a minimum period of one hour before use. When bricks are soaked they shall be removed from the tanks sufficiently in advance so that at the time of laying they are skin-dry. Such soaked bricks shall be stacked on a clean place where they are not spoiled by dirt, earth etc.

5. All brick work shall be laid in English bond, even and true to line, plumb level and all joints accurately kept. The bricks used on the face shall be selected whole ones of uniform size and with true rectangular face.

5.1 Bricks shall be laid frogs up, if any, on a full bed of mortar. When laying bricks shall be slightly pressed so that the mortar gets into all the surface pores of bricks to ensure proper adhesion. All joints shall be properly flushed and packed with mortar so that no hollow spaces are left.

5.2 Before laying bricks in foundations, a layer of not less than 12 mm. of mortar shall be spread to make the surface on which the work will be laid even.

5.3 The brick work shall be built in uniform layer, corners and other advanced work shall be racked back. Brick work shall be done true to, plumb or in specified manner. No part of it, during construction, shall rise more than one metre above the general construction level to avoid unequal settlement and improper jointing.

5.4 Toothing may be done where future extension is contemplated but shall be used as an alternative to raking back.

5.5 The thickness of joints shall not exceed 12 mm.

6. When fresh masonry is to be placed against existing surface of structures, these shall be cleaned of all loose material, roughened and wetted as-directed by the Engineer-in-charge so as to effect a good bond with the new work.

7. Green work shall be protected from rain by suitable covering. Masonry work in cement or composite mortar shall be kept constantly moist on all faces for a minimum period of seven days. The top of the masonry work shall be left flooded with water at the close of the day.

7.1 During hot weather, all finished or partly completed work shall be covered or wetted in such manner as will, prevent rapid drying of the brick work.

8. The scaffolding shall be sound and strong to withstand all loads to come upon it. The holes which provide resting space for horizontal members shall not be left in masonry under one metre in width or immediately near the skew backs or arches. The holes left in the masonry work for supporting the scaffolding shall be filled and made good.

9. In case of abutment and wing wall, weep holes as shown on the drawing or directed by the Engineer-in-charge shall be provided in the masonry to drain moisture from the backfilling. Weep holes shall



be 8 cm wide 15 cm. high or circular 15 cm. diameter and shall extend through the full width of the masonry with slope of about 1 vertical to 20 horizontal high or circular of 15 cm towards the draining face. The spacing of weep holes shall be generally 1 m. in either direction with the lowest one at about 15 cm. above the low water level or ground level whichever is higher or as directed by the Engineer-in-charge.

10. All brick work shall be measured in cubic metres.

11. The contract unit for brick work shall include the cost of all labour, materials tools and plant, scaffolding and other expenses incidental to the satisfactory completion of the work as described herein above and provision of weep holes.

**ITEM-33 Supplying and fixing reinforced concrete heavy duty non-pressure pipes with collars for culverts carrying heavy traffic as per Indian Railway Standard specifications including setting the pipes in C.M. 1:2 watering and laying (to level or slope) of class NP3 of following internal diameters, (i) 300 mm dia. (ii) 450 mm dia. (iii) 600 mm dia. (iv) 750 mm dia (v) 900 mm dia. (vi) 1050 mm dia. (vii) 1200 mm dia.**

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

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

NP3, NP2, NP1 pipes are used for R. C. C. Pipes, where testing of pipes will not be feasible the contractors will have to produce a certificate from the manufacturers on company's letter head the given hereinafter form.

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

#### **FORM OF CERTIFICATE FOR NP3, NP2, NP1 PIPES**

We \_\_\_\_\_ manufacturer of R.C.C. pipes produce B.C.C. pipes as per the requirement of IS: 458 and also carry out the required test at our place. We have acquired equipments for carrying out test and are prepared to carryout test at our factory sites.

We have experience of manufacturing of pipes of \_\_\_\_\_ years  
The pipes supplied by us to M/s. \_\_\_\_\_ satisfy the requirement of IS : 458

Date: \_\_\_\_\_

Place : \_\_\_\_\_ Manufacturer's Sign \_\_\_\_\_

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

4. The pipes shall be jointed either by collar joint or by flush joint. In the former case, the collars shall be of R.C.C., 150 to 200 mm wide and having the same strength as the pipes to be jointed. Caulking, space shall be between 13 and 20 mm according to the diameter of the pipes., Caulking material shall be slightly wet mix of cement and sand in the ratio of 1:2 rammed with Caulking irons. Before caulking the collar shall be so placed that its centre coincides with that of pipe and an even annular space is left between the collar and the pipes. Flush joint may be shaped to form a self centering joint with a joining space 13 cm wide. The joining space shall be filled with cement mortar. 1 cement to 2 sand, mixed sufficiently dry to remain in position when forced with a trowel or rammer. Care shall be taken to fill all voids and excess mortar shall be removed. All joints shall be made with care so that their interior surface is smooth and consistent with the interior surface of the pipes. After finishing, the joint shall be kept covered and damp for at least four days.

5. R. C. C. pipe shall be measured along their centre between their inlet and outlet ends in linear metres.

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

**ITEM-34 Supplying and fixing reinforced concrete heavy duty non-pressure pipes with collars for culverts including setting and jointing the pipes in C. M. 1:2 watering and laying (to level or slope) of I.S. class of NP2 of following internal diameter, (i) 300 mm dia. (ii) 450 mm dia. (iii) 600 mm dia. (iv) 750 mm dia (v) 900 mm dia. (vi) 1050 mm dia (vii) 1200 mm dia.**

1. The work shall be carried out as per item of NP3 pipes except that the pipes will be of NP2 class instead of NP3 class conforming to requirements of IS : 458 and of the dia as specified in this item.

**ITEM-35 Supplying and fixing NP1 class R.C.C. pipes**

1. The work shall be carried out as per item of NP3 pipes except that the pipes will be ordinary irrigation pipes of NP 1 class instead of NP 3 class conforming to requirements of IS'458 and of the dia. as specified in this item. Please see Item No 53 for detailed information.

**ITEM-36 Filling around the pipes with murrum including dressing, tampering etc. complete.**

1. Area around pipes shall be filled with murrum, chhara or other gritty material immediately after the pipes have been laid and the joining material has hardened. The material shall be clean, free from boulders large roots, excessive amount of sods or other vegetable matter, and lumps and shall be approved by the Engineer-in-charge. Filling upto 0.3 metre above the top of the pipe shall be carefully done and the soil thoroughly rammed, tampered or vibrated in layers of not exceeding 150 mm: particular care being taken to thoroughly consolidate the materials under the haunches of the pipe. Filling shall be carried out simultaneously on both sides of the pipes in such a manner that unequal pressures do not occur. In case of high embankments, after filling upto the top pin the above said manner a loose fill of a depth equal to external diameter of the pipe shall be placed over the pipe before further layers are added and compacted. Materials shall be filled in pharas 3m. x 1,5m x 0.5m size and shall be measured in cubic metres. Unit rate includes cost of materials and spreading including labour and tools needed for the above operations.

**ITEM-37 Providing and laying ordinary (unreinforced) concrete 1:2:4 (1 cement :2 coarse sand :4 crushed stone aggregate 20 mm nominal size) & curing complete including cost of form work (without reinforcement)**

1. In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportions of cement, fine aggregates and coarse aggregates are specified by volume as given in table below for different four grads 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 to the specified 28 days works cube compressive strength of that mix on 150 mm cubes, expressed in kg./cm.
3. The ordinary concrete mix shall generally be specified by volume. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg. of cement as 0.035 cubic metre in volume. While measuring aggregate by volume, shaking, ramming or hammering shall not be done, proportioning of sand be as per its dry volume. In case it is damp allowance lor bulking shall be made as per IS:2386 (Part III).
4. In gradients required for ordinary concrete cotaining one 50 kg bag of cement for different proportions ofmix shall be as given in Table below.

TABLE

Grade of Concrete	Mix by Volume	Total quantity of dry aggregate by volume per 50 kg cement to be taken as sum of individual volume of fine % coarse aggregate maximum (1 cubic metre = 1000 Litres)	Proportion of fine aggregate to Coarse aggregate	Quantity of water per 50 kg of cement maximum
1.	2.	3.	4.	5.
Ordinary M200	1:3:6	300	Generally 1:2 for	34
Ordinary M1 50	1:2:4	220	fine aggregate to	32
Ordinary M200	1:1.5:3	160	coarse aggregate by	30
Ordinary M250	1:1:2	100	volume but to a upper limit of 1:1.5 and Limit of 1 :3	27

**Note :** The proportions of the aggregates shall be adjusted from upper limit to lower limit progressively as the grading of the final aggregate becomes finer and the maximum size of coarse aggregate becomes larger.

**Example :** For an average grading of fine aggregate (that is Zone II of IS:383-1963) the proportions shall be 1:1 1/

2. 1:2 and 1:3 for maximum size of aggregates 10 mm, 20 mm and 40 mm respectively.

Note : *K* mix leaner than *M* 100 (1:3:6) may be used for non structural part, if provided in the contract. In such cases grading of aggregates shall be by volume. Other requirements for mixing, placing and curing shall be the same.

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

- |  |       |
|--|-------|
| (i) Plain C.C.   | 63 mm |
| (ii) Soild type piers, abutments and wing walls, and their per caps. (Coarse aggregate of size upto 40 mm shall be machine crushed,) | 40 mm |
| (iii) C.C. Wearing Coat M-150<br>(Coarse aggregate of size upto 40 mm shall be machine crushed.)                                     | 20mm  |

6. Fine aggregate shall be clean, hard coarse sand. It shall be free from dust and such other substanes. The sand shall 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 work.

8. Cement shall be stored above the ground level in perfectly dry and watertight sheds and 'shall be stocked not more than eight, bags high. Wherever bulk storage containers are used, their capacity should be sufficient to cater to the requirements at site and should be cleaned atleast once every 3 to 4 months. Cement more than 3 to 4 months old shall invariably be tested to ascertain that it satifies the acceptability requirements. The aggregates shall be stored in such a way as to prevent admixture of foreign materials. Different sizes of fine or coarse aggregate shall be stored in separate stock piles sufficiently removed from each other to prevent intermixing the materials at edges of the pipes.

9. The water for mixing shall be potable water to the 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 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 an uniform colour of the entire mass is obtained and each individual particles of the coarse aggregate shows complete coating of mortar containing its proportionate amout 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 ingrediets 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. Then shall be mixed thoroughly by turning over to mass turned over till a mix of required consistency is obtained. In hand mixing quantity of cement shall be increased by 10 percent 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 by the Engineer-in-charge the first batch of concrete from the mixer shall contain only two third of normal quantity of course aggregate. Mixing plants shall be thoroughly cleaned before chnging 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 place. All form work and reinforcement contained in it shall be cleaned and made free from standing water, dust snow or ice immediately before placing of conrete. No concrete shall be placed in any part of the structure until the approval of the Engineer-in-charge has been obtained.

If concreting is not started with 24 hours of the approval being given, it shall have to be obtained again from the Engineer-in-charge. Concreting then shall proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly designed 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 by the Engineer-in-charge, concrete shall be disposed in horizontal layer to a compacted depth of not more than 0.45 metre when internal vibrators are used and not exceeding 0.30 metre in all other cases.

15. Unless otherwise agreed to by the Engineer-in-charge, concrete shall not be dropped into place from a height exceeding 2 metres. When trucking or chutes are used they shall be kept clean and used in such 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 cleaned with a 13mm.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 new surface with wire or bristle brushed. Care being taken to avoid dislodgement of particulars of coarse aggregate. The surface shall then be thoroughly wetted, all free water removed and then coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 150 mm. in thickness, and shall be well rammed against old work particular attention being given to corner 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 vibrator cannot be used sufficient vibrators in serviceable condition shall be kept at site so that spare equipments 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, vibrations due to traffic, rapid temperature changes, fast drying put 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. It shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonry work over the foundation concrete may be started after 48 hours of its laying but the curing of concrete shall be continued for a minimum period of 14 days.

18. Form work shall include all temporary or permanent forms required for forming the concrete, together with all temporary construction required for their support. Forms for concrete shall be constructed of metal or timber suitably lined and be of substantial and rigid construction true to shape and dimensions shown on the drawings. Where metal forms are used, all bolts and rivets shall be counter sunk and well ground to provided a smooth, plain surface. Where timber is used it shall be well seasoned, free from loose knots, projecting nails, splits or other defects that may mark the cement surface of concrete. For exposed concrete faces, timber for shuttering shall be wrought on all faces in contact with concrete.

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

20. The inside surface of forms 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 of prestressing tendons and anchorage. Different release agents shall not be used in form work of concrete which will be visible in the finished works.

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

22. The Engineer-in-charge shall be informed in advance by the contractor of his intention to strike any formwork. While fixing the time for removal of formworks, due consideration shall be given to local conditions, character of the structure, the weather and other conditions that influence the setting of concrete the removal of the load supporting or soffit forms may commence when concrete has attained strength and of the materials used in the ix. Where field operations are controlled by the strength test of concrete, the removal of the load supporting or soffit forms may commence when concrete has attained strength equal to at least twice the stress to which the concrete will be subject 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 form work shall be removed without causing any damage to the concrete. Centering shall be gradually and uniformly lowered in such a manner as to avoid any shock or vibrations. Supports shall be removed 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 mortars. No permanently embedded metal part shall have less than 25mm. cover to the finished concrete surface. Where it is intended to reuse the formwork it shall be cleaned and made good to the satisfaction of the Engineer-in-charge.

23. Immediately after the removal of forms, all exposed bars or bolts passing through the Cement Concrete member and used for shuttering or any other purpose shall be cut inside the Cement Concrete member to a depth of at least 25 mm. below the surface of the concrete and the resulting holes filled by cement mortar. All fins cause 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 a consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surface which have been pointed shall be kept moist for a period of 24 hours. If rock, pockets/honeycombs, in the opinion of the Engineer-in-charge are of such an extent and character as to affect structure materially or to endanger the life of the strength of the steel reinforcement, he may declare the concrete defective and require the removal and replacement of the portions of the structure affected. Joint shall be filled up with bitumen as directed by Engineer-in-charge in case of C.C. wearing surface.

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

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

**Item No. 37 A : Providing & laying C.C.1:4:8 (1=Cement, 4=coarse sand, 8=grade agg 40 m.m. nominal size) and curing comp of form work.**

**Item No. 37 B : Providing & laying C.C.1:5:10 (1=Cement, 4=coarse sand, 8=grade agg 40 m.m. nominal size) and curing comp. incl. cost of form work.**

Materials : Specification for all the ingredients to be used shall be as per the details given in the central specifications for materials attached.

**PROPORTION** : The concrete shall consist for the part of cement, sand and metal as per (40 to 63 m.m. size) the above description of items.

**MIXING** : Mixing of the materials shall be done as for specified volumetric proportion as a possible after water is added, so that every place of agg, is uniformly coated by cement plaster. The concrete must be used immediately after it is prepared and in any case shall be used after the cement has attained final set. Generally concrete prepared before more than half an hour shall not be permitted to be used.

**LAYING** : Consolidation shall be rapidly carried out sufficient labour being employed to permit of ramming or spreading etc. being comp. within as short items as possible causing the mortar to cream up in no case shall ramming be prolonged after the cement has been to take its initial sets.

**CURING** : As soon as the concrete has set sufficiently i.e. after about an hour of laying the surface must be protected from rapid curing out by being covered with at sand wet sunny or where possible curing shall be done by forming the shall be allowed pools of water by means of sand polices. The curing shall be continued or at least 10 (ten) days broadly two or three weeks and where possible for longer period. The rate includes all necessary equipments, labour etc. Payment shall be made on cubic measurement of cement concrete. The entire work shall be carried out as per the specification for the PWD Hand book Vol. I Page No. 166 to the satisfaction of the Engineer-in-charge.

**ITEM-38 Providing and laying ordinary (reinforced) concrete 1:2:4 (1 cement :2 coarse sand :4 crushed stone aggregate 20 mm nominal size) & curing complete (excluding cost of reinforcement)**

1. Para 1 to 25 of ordinary concrete [without reinforcement] shall apply.

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

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

Maximum nominal size of the concrete aggregate shall be 20 mm. and shall machine crushed.

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

26. 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.

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

30. R.C.C. work shall have exposed concrete surface. Centering design and its erection shall be approved by the Deputy 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 as suitable platforms shall be provided so that steel reinforcement in positions is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, kapachi or metal pieces shall not be used for this purpose. Concreting of important structural members shall always be done in the presence and under the supervision of department person not below the rank of Junior Engineer/ Supervisor/Overseer. After removal of form work and shuttering, the Executive Engineer shall inspect the work and satisfy by random checks that concrete of good quality. Plastering shall not be allowed to the exposed face of concrete.

32. 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.

**ITEM-39 Providing steel reinforcement.**

- (a) Providing & placing in position mild steel bar reinforcement including cutting, bending, hooking & tying complete as per details.
- (b) High yield strength deformed bars reinforcement.

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

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

3. Reinforcing steel shall conform accurately to the dimensions given in bar bending schedules shown on relevant drawings. Bars shall be bent cold to the specified shape and dimensions or as directed by the Engineer-in-charge using a proper bar bender, operated by hand or power to attain proper radius of bends. Bars shall not be bent or straightened in a manner that will injure the material. Bars bent during transporting or handling

shall be straightened before use on work; they shall not be invariably be provided. The radius of the bend shall not less than twice the diameter of the round bar and length of the straight part of the bar-beyond the end of the curve shall be at least four times the diameter of the round bar. In the case of bars which are not round and in the case of deformed bars, the diameter shall be taken as the diameter of a circle having an equivalent effective area. The work shall be suitably encased to prevent any splitting of the concrete.

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

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

6. As far as possible, bars of full length shall be used. In case this is not possible, overlapping of bars shall be done as directed by the engineer-in-charge. When practicable, overlapping bars shall not touch each other, but be kept apart by 25 mm or 1.25 times the maximum size of the coarse aggregate which ever is greater, by concrete between them. Where not feasible, overlapping bars shall be bound with annealed steel wire, not less than 1 mm. thickness twisted right. The overlaps shall be staggered for different bars and located at points, along the span where neither shear nor bending movement is maximum.

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

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

9. Wastage shall be permitted upto 5 per cent maximum. Useful pieces of steel, as may be decided by the Engineer-in-charge shall be taken back by the Government at issue rate and at P.W.D. Store from where the steel was supplied. All the expenses of loading, carting, unloading and returning the waste will be borne by the contractor.

10. Reinforcement shall be measured in length separately for different diameters as actually used in the work. From the length so measured the weight of reinforcement shall be calculated in tones on the same basis of IS: 1732 even though steel is supplied to the contractor by the Department on actual weighment Lengths shall include hooks at ends. Wastage and annealed steel wire for binding shall not be measured and cost of these items shall be deemed to be included in the rates for reinforcement.

11. Rate for reinforcement shall include cost of all steel, its carting from P.W.D. Store to work site, its bending, placing binding and fixing in position as shown on the drawings and as directed by the Engineer in charge It shall also include cost of all devices for keeping reinforcement in approved position, cost of joining as per approved methods, and all wastage, & spacer bars, & also returning the useful wastage of the Department.

**ITEM – 40      Providing Cement pointing on uncoursed / coursed stone / brick wall masonry with cement mortar 1:3 ( 1 cement : 3 sand) (A) Flush pointing (B) Ruled Pointing.**

1. For surface which is to be subsequently jointed, the joints shall be squarely raked out to a depth of 15 mm while the mortar is still green. The raked joints shall be well brushed to removed dust and loose particles and the surface shall be thoroughly washed with water, cleaned and wetted.
2. Cement and sand shall be mixed in proportions as specified in the item. Cement and sand shall be proportioned by volume after making due allowance for bulking. The required quantity of water shall then be added and the mortar mixed to produce workable consistency.
3. The mixing shall be done intimately by hand – mixing. The operation shall be carried out on a clean watertight platform and cement and sand shall be first mixed dry in the required proportion to obtain a uniform colour and then the mortar shall be mixed for at least two minutes after addition of water. In case of cement mortar, that has stiffened because of evaporation of water, the same shall be re-tempered by adding water as frequently as needed to restore the requisite consistency but this re-tempering shall be permitted only with thirty minutes from the time of addition of water at the time of initial mixing.
4. For pointing, the mortar shall be filled and pressed into the raked out joints before giving the required finish. The pointing shall then be finished to proper type given on the drawings. If type of pointing after the mortar has been filled and pressed into the joints and finished off level with the edge of the bricks, it shall while still green be ruled along the centre with a half round tool of such width as may be specified by the Engineer – in – charge. The superfluous mortar shall then be cut off from the edges of the lines and the surface of masonry shall also be cleaned of all mortar.
5. Curing shall be started as soon as the mortar used for finished has hardened sufficiently not to be damaged when watered. It shall be kept wet for a period of at least 7 days. During this period it shall be suitably protected from all damage.
6. Stage scaffolding shall be approved for the work. This shall be independent of the structure.
7. The work of pointing shall be measured in square metres of the surface treated.
8. The rate for pointing shall include erecting the removal of scaffolding all labour, materials and equipment incidental to complete the pointing, raking out joints, wetting filling with mortar, trowelling, point and watering.

**ITEM – 41      Providing and laying 22.50 cms thick rubble stone pitching including preparing surface, lying 15 cms thick murrum layer over prepared surface and arranging rubbles on it by hand packing and in level & lined surface in slope camber including filling the interstices between adjacent stone by spalls of proper size & wedged for tight packing as directed etc. complete without cement pointing.**

1. The work shall consist of covering the slopes of guide banks, training works and road embankment with stone or boulders, over a layer of murrum bedding.
2. Stone subject to marked deterioration by water or weather will not be accepted. The stone shall be sound, hard, durable and fairly regular in shape and its thickness in any one direction shall not be less than the thickness of pitching as specified in the item and thickness of the stone at any place shall not be less by 15% of the thickness specified. The largest stones procurable shall be supplied on site. The sizes of spalls shall be minimum 25mm and shall be suitable to fill the voids in the pitching. Thickness of the pitching shall be as specified in the pitching item. ( G.C.No.SSR/2080 IB 547/28/C, dated 6<sup>th</sup> March, 1982)
3. Before laying the pitching, the sides of banks shall be trimmed to the required slope and profiles put up by means of line and pegs at intervals of 3 metres to ensure regular straight work and uniform slope throughout. Depressions shall be filled and thoroughly compacted.
4. Murrum for bedding shall be laid over the prepared base and suitably compacted to a thickness 150mm. Quality of murrum will be as per its relevant specifications.
5. The stone pitching shall commence in a trench below the toe of the slope. Stone shall be placed by derrick or by hand to the required length, thickness and depth conforming to the drawing. Stones shall be set normal to the slope and placed so that the largest dimensions is perpendicular to the face of the slope, unless such dimensions are greater than the specified thickness of pitching. The largest stones shall be placed in the bottom courses and for use as headers for subsequent course. When full depth of pitching can be formed with a single stone, the stones shall be laid breaking joints and all interstices between adjacent stones shall be filled in with spalls of the proper size and wedged in with hammers to ensure tight packing. Pitching shall be done in panles of 3.0 M x 3.0 M with a 30 CM wide and 8 Cm. deeper band all around.



6. Payment shall be made on Square Meter basis of the-finished work. If directed by the Engineer-in-charge, for measurement the materials may have to be stacked at site before laying and nothing extra will be paid to the Contractor for this stacking. Preparation of base for laying bedding shall be deemed indicated to the work.

7. The rate shall include the cost of preparing the base, putting to the profiles, providing, laying and compacting the murrum bedding and stone pitching of dry rubble as per embankment slopes to specified thickness, lines, curves, slopes levels and all labour and materials as well as tools and plant required of the work.

**ITEM-42 Providing 12 mm thick premoulded asphalt filler joints as per drawings.**

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

2. When preformed filler is to be provided, the filler shall be placed in correct position before concrete is placed against the filler. The filler material shall form part of the joint and while concreting the slab. Care shall be taken to prevent the former form being displaced, After the work is completed, the exposed face of the joint shall be cleaned of all loose materials sticking to it.

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

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

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

**ITEM-43 Providing parapet of controlled cement concrete M 150 as per detailed drawing with necessary reinforcement including shuttering laying, vibrating & finishing to line level complete precast consistency.**

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

2. The portion of the railing or parapet which is to be casting in place shall be constructed in accordance with the relevant specification for reinforced cement concrete. Forms shall either be of single width boards or shall be lined with suitable materials duly approved by the Engineer-in-charge. Form joints in plane surfaces will not be permitted. All mouldings, panels in the finished work shall be constructed according to the details shown on the drawings. All corners in the finished work shall be true, sharp and clean cut and shall be free from cracks, spall or other defects.

3. Railing shall be measured in running metres.

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

**ITEM-44 Providing 15 mm thick cement plaster in single coat on brick/Concrete wall for interior plastering up to floor two level finished even and smooth in (i) Cement mortar 1:3 (1 cement :3 sand) (ii) Cement mortar 1:4 (1 cement :4 sand) (iii) Cement mortar 1:6 (1 cement :6 sand)**

1. For a surface which is to be subsequently plastered the joints shall be squarely raked out to a depth of 15 mm, while the mortar is still green. The raked joints shall be well brushed to remove dust and loose particles and the surface shall be thoroughly washed with water, cleaned and wetted.

2. Cement and sand shall be mixed in proportion as specified in the item, Cement and sand shall be proportioned by volume after making due allowance for bulking. The required quantity of water shall then be added and the mortar mixed to produce workable consistency.

3. The mixing shall be done intimately by hand mixing. The operation shall be carried out on a clean watertight platform, and cement and sand shall be first mixed dry in the required proportion to obtain a uniform colour and then the mortar shall be mixed thoroughly after addition of water. In case of cement mortar that has stiffened because of evaporation of water, the same shall be retamped by adding water as frequently as needed to restore the requisite consistency but this retamping shall be permitted only within thirty minutes from the time of addition of initial mixing.

4. Plastering shall be started from top & worked down All pit/holes shall be properly filled in advance

of the plastering as the scaffolding is being taken down. Wooden screeds 75 mm wide and of the thickness of the plaster shall be fixed vertically 2.5 metres to 4 metres apart to act as gauges and guides in applying the plaster. The mortar shall be laid on the wall between the screeds using the plaster float and pressing the mortar to the racked joints are properly filled.

The plaster shall then be finished off with a wooden straight edge reaching across the screeds. The straight edge shall be worked on the screeds with a small upward and side way motion 50 mm or 75 mm at a time. Finally, the surface shall be finished off with a plaster's wooden float. Metal floats shall not be used.

5. When recommencing plastering beyond the work suspended earlier the edge of the old plaster shall be scrapped, cleaned and wetted before plaster is applied to the adjacent areas. No portion of the surface shall be left out initially or be patched by later on. The plaster shall be finished to a true and plumb surface and to the proper degree of smoothness as required by the Engineer-in-charge. The average thickness of plaster shall not be less than the thickness specified in the item with a tolerance of 3 mm thickness which appear in the surface and all portions, which sound hollow when tapped, or are found to be otherwise defective, shall be cut out in rectangular shape and re-done as directed by the Engineer-in-charge.

6. Curing shall be started as soon as the mortar used for finished has hardened sufficiently not to be damaged when watered. It shall be kept wet for a period of atleast 7 days. During this period, it shall be suitably protected from all damages.

7. Stage scaffolding shall be provided for the work. This shall be independent of the structure.

8. The work of plastering shall be measured in sq. metre of the surface treated.

9. The rate of plastering shall include the cost of all labour, materials tools and plant scaffolding and all incidental expenses as described herein above.

**ITEM-45 Box cutting of the road surface to proper, slope and camber for making a base for road work including removing the excavated stuff and depositing the road side as directed upto 50 M. lead etc. comp.**

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

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

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

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

5. The payment shall be made on Cmt. basis.

**ITEM - 46 Providing open graded carpet with Premix H.M.P. & P.P.:**

1. The work shall consist of construction in a single course of 20. 25 mm thick open graded carpet on a previously prepared base. Single course shall also include additional material @ 20% to remove unevenness of the existing surface.

Para 1 to 4 of item of semidense carpet (Item - 18) shall apply.

5. Proportioning of materials. The material shall be proportioned as quantities given below.

- |   |     |
|---|-----|
| (a) Stone chipping 12 mm size and retained on 10 mm sieve.                      | 67% |
| (b) Stone chipping 10mm size passing 12.5 mm sieve and retained on 6.3 mm sieve | 33% |

Para 6 to 11 of item of semidense carpet (Item - 18) shall apply.

12. Open graded carpet shall not be laid during rainy weather or when the base course is damp or wet.

13. The base on which open graded carpet is to be laid shall be thoroughly swept and scrapped clean and free of dust and foreign matter.

14. The work shall consist of application of single coat of bituminous material to an existing road surface preparatory to bituminous construction. The temperature of bitumen at the time of application shall be in the range of 160 degree centigrade to 175 degree centigrade

15. Binder shall be heated to the temperature appropriate to the grade of bitumen used and approved by the Engineer-in-charge and sprayed at the rate specified below. The rate of spread of straight run bitumen for tack coat shall be 5/10 Kg / 10 Sq. metre are for an existing B.T./W.B.M. surface. The binder shall be applied uniformly. The tack coat shall be applied, just ahead of the coming bituminous constructions.

16. The binder content for premixing shall be 3.50/3.28 percent by weight of the total mix unless otherwise specified.

The quantities of aggregate shall be sufficient to yield the specified thickness after compaction. Para 17 to 35 of item of semi dense carpet (Item No. 18) shall apply.

36. The contract unit rate of open-graded carpet shall be paid in full for carrying out the required operations including full compensation for :

- 1 . Making arrangement of control and safety of traffic.
2. Preparation of base
3. Providing all materials to be incorporated in the works with all lead and lift.
4. All labours, tools, equipments and incidental to complete the works to the specification.

**TTEM-47 Providing & laying bituminous mix seal coat surfacing considering 0.66 cmt / 1 M.T. with m/c stone chipping as per gradation and asphalt of 4.25% by wt. of mixing by heating asphalt & mixing by continuous batching of hot mix plant and spreading by paver finisher consolidation by power roller & providing & operating plant machineries with cost of fuel, oil, lubricants etc, with sand / dust flushing at 0.30 cmt /100 smt.**

1. The work shall consist of constructing in a single course of mix seal surfacing as course on a previously prepared base of carpet single course shall also include additional thickness. If any. to remove unevenness of the existing surface.

Para 3 to 4 of item No. 18 shall apply.

5. The aggregates shall be so graded or combined as to confirm to the grading as under.

Sieve Designation	Percent by weight passing Sieve for type 'A' Mix seal surfacing.
20mm	100
7.75mm	40 –85
7.36mm	5 – 10
75 micron	0 - 4

Para 6 to 11 of item of Semi-Dense carper (Item No. 18) shall apply.

12. Mix seal surfacing shall not be laid during rainy weather or when the base course is damp or wet.

13. The base on which mix seal surfacing is to be laid shall be thoroughly cleaned and free of dust and foreign matter.

14. The work shall consist of application of mix seal surfacing of single coat of bitumninous mateial to an existing carpet surface preparatory to. bituminous construction. The temperature of bitumen at the time of application shall be in the range of 160 degree centigrade to 175 degree centigrade.

16. Tack coast for mix seal surfacing shall be applied as the work of laying mix seal surfacing is being preceded by a bituminous open graded carpet.

17. The binder content for pre mixing shall be 4% by weight of the total unless otherwise specified in item of schedule B of the work. Quantity of aggregate shall be sufficient to yield the specified thickness after compaction.

Para 18 to 35 of the item of Semi-dense carpet) (item 18) shall apply.

36. The contract unit rate for mix seal surfacing shall be paid in full for carrying out the required operation including full compaction for:

- 1 . Making arrangement of control and safety of traffic.
2. Preparation of base.
3. Providing all materials to be incorporated in the works with all lead and lift.
4. All labours, tools, equipments and incidental to complete the works to the specification.

**1TEM-48(A) Providing and laying 20 mm. thick (completed asphalt carpet using asphalt for tack coat at the rate of 5-10 kg./10 sq. mt. using crushed stone aggregates as per the gradation and bitumen at the rate of 3.26% by wt. of total mix for binder using hot mix plant and laid by paver finisher including consolidation by Power road roller providing and operating plant, machineries and equipment, cost of fuel oil, lubricant and charges, including flushing sand @ 0.30 cmt/100 sq. mt. at directed etc. complete.**

The specification of this item, shall be the same as per item No. 18 except for aggregate gradation and weather and seasonal limitation which shall be as below and the binder shall be as specified.

## **2. Table Aggregate gradation for Asphalt carpet.**

Sieve Size	% by weight passing the Sieve
20mm	100
12.5mm	70-100
10.0mm	20-40
4.75 mm	0-5
2-36 mm	

**3.1 Weather and seasonal limitation :** Carpet shall not be laid during rainy weather or when base course is damp or wet.

**ITEM-48(B) Providing and laying 25 mm. thick (completed asphalt carpet using asphalt for tack coat at the rate of 5-10 kg./10 sq. mt. using crushed stone aggregates as per the gradation and bitumen at the rate of 3.28% by wt. of total mix for binder using hot mix plant and laid by paver finisher including consolidation by Power road roller providing and operating plant, machineries and equipment, cost of fuel oil. lubricant and charges, including flushing sand & 0.30 cmt/100 sq. mt. at directed etc. complete.**

The specification of this item, shall be the same as per item No. 18 except for aggregate gradation and weather and seasonal limitation which shall be as below and the binder shall be as specified.

## **2. Table Aggregate gradation for Asphalt carpet.**

Sieve Size	% by weight passing the Sieve.
20mm	100
12.5mm	70-100
10.0mm	20-40
4 75 mm	0-5
2.36mm	

**3.1 Weather and seasonal limitation :** Carpet shall not be laid during rainy weather or when base course is damp or wet.

**ITEM-49 (1) Surface dressing one coat with paving bitumen using 18 kg. bitumen per 10.0 Sq.m. with 0.15 cum of Stone chipping 12 mm. nominal size per 10.0 sq.m of road surface excluding rolling and consolidation (stone chipping and bitumen shall be paid separately). (2) Surface dressing in two coats with bitumen using 18 Kg. per 10sqm. with 0.15 sqm of stone chipping 12mm nominal size per 10sqm. for first size 11kg. of bitumen with 0.10 cum of stone chipping 10mm nominal size per 10 sqm. of road surface for second coat excluding consolidation etc. complete, (stone chipping and bitumen shall be paid separately)**

### **1 . DESCRIPTION**

This work shall consist of the application of one coat of surface dressing, consisting of a layer of bituminous binder sprayed on a base prepared previously followed by a cover of stone chipping properly rolled to form a wearing course to the requirements of these specifications.

### **2. MATERIALS**

**2.1 Stone chipping :** The machine crushed B.T. stone chipping shall consist of fairly cubical fragments of clean, hard, tough and durable rock of uniform quality throughout. These shall be obtained by crushing B T. stone. The chipping shall be free of elongated or flaky pieces, soft or disintegrated stone, salt, alkali, vegetable matter, dust and adherent coatings.

**2.2 Binder :** The binder shall be straight run bitumen of 80/100 or 60/70 penetration and satisfying the requirement of I.S. 73 or other type of bitumen as may be approved by the Department

Necessary storage arrangements i.e. provision of tanks etc for bulk asphalt shall be done by the contractor without any extra charges.

In the case of bitumen is to be supplied by Department in bulk at the rate and place shown in Schedule "A" for bulk asphalt, contractor shall have to make adequate arrangement for stacking bulk asphalt at plant site, according to requirement. If the asphalt is supplied as bulk on plant site, the rate of conveyance for lead difference from store to plant site shall be recovered at S.O.R. for Qty of asphalt supplied

**2.3 Keeping Records :** The Department shall keep a day account of the supply and use of the asphalt in separate bound register having numbered pages in the proforma prescribed by the Department. Day to day signature of the responsible contractor or his representative as may be directed by Engineer-in-charge shall be obtained in this register. The register shall be maintained by the Department and shall be produced with each bill.

**TABLE . Physical requirements of aggregates**

Sr. No.	Test	Test Method	Requirement
1	Los Angeles Abrasion Value*	IS : 2386 (Part IV)	40% Maximum
2	Aggregate Impact Value*	-do-	30% Maximum
3	Flakiness Index	IS : 2386 (Part I)	30% Maximum
4	Stripping Value	IS : 6241	25% Maximum
5	Soundness		
	(i) Loss with Sodium Sulphate 5 cycles		12%
	(ii) Loss with Magnesium		18%
6	Water Absorption	IS ; 2386 (Part III)	1% Maximum

\* Aggregate may satisfy requirements of either of the two tests.

Note : If crushed slag is used. Clause 404.2 3 shall apply.

Requirements of stone chipping and binder content for surface dressing for 10 sq.mt.

Sr. No.	Type of Construction	Nominal Size of stone chipping	Specifications percent passing through Sieve and retained on Sieve	Quantity of materials	Binder content
1	Single coat surface dressing of first coating of two coat surface coating	12mm	Passing 20 mm Sieve & Retained on 10 mm Sieve	0.15 CM	18 Kg.
2	Second Coat of two coat surface dressing	10mm	Passing 12 mm Sieve & retained on 4.5mm sieve	0.10 CM	11 Kg.

### 3. CONSTRUCTION OPERATION

**3.1 Weather & seasonal limitations** ; The surface dressing work shall be carried on only when the atmospheric temperature in shade is above 15° C. No bituminous materials shall normally be applied when the surface of cover material is damp. when the weather is foggy or rainy or during dust storms.

**3.2 Preparation of base** : The base on which surface dressing is to be laid shall be prepared, shaped and conditional to the specified lines, grade and cross section as directed by the Engineer-in-charge.

The surface shall be thoroughly swept and scraped cleans of dust and any other extraneous matter before the spraying of binder. As necessary the cleaning shall be Hone first with hard brushed, then with softer brushes and finally by blowing with sacks or gunny bags

**3.3 Application of binder** : Binders shall be heated to 163° C to 177° C. and sprayed on the dry surface in uniform manner with the help of self-propelled mechanical sprayers having, self-heating arrangement and bitumen pressure pump and spray nozzle bar capable of spraying bitumen uniformly at specified rate as given in above table. Excessive deposits of binder caused by stopping or starting of the sprayer or Through leakage or any other reasons shall be suitably corrected before the stone chipping are spread.

**3.4 Application of stone chippings** : The cover material i.e. machine crushed B T chips of 11.2 mm nominal size shall be stacked on road side by filling standard boxes of 2.0 m x 1.50 m x 0.50 m the measurement shall be recorded in the measurement book after collection in two kilometer length is complete. The material shall be cross checked by another D .E. E. as per rules. There after, the spreading shall be allowed. The permission of Engineer-in-charge shall be obtained before spreading.

Immediately after the application of binder, stone chippings in a dry and clean, state shall be spread uniformly on the surface, preferably by means of mechanical gritter. otherwise, manually so as to cover the surface completely. If necessary, the surface shall be broomed to ensure uniform spread of chippings.

**3.5 Rolling** : Immediately alter the application of the cover material, the entire surface shall be rolled with a 8-10 tones three wheeled roller. Rolling shall commence at the edges and progress towards the center except in supper elevated portions, where it shall proceed from the inner edge to the other. Each pass of the roller shall uniformly be not less than one third, of the track made in the preceding pass. While rolling is in progress additional chippings shall be spread by hand in whatever quantities required to make up irregularities. Rolling shall continue until aggregate particles are firmly bedded in the binder and present a uniform closed surface.

**3.6 Application of second coat of surface dressing** : Where surface dressing in two coats is specified the second coat shall be applied immediately after laying the first coat. The operation shall be the same as describe in para 8.3.3 to 8.3.5.

#### 4. OPENING TO TRAFFIC

Traffic shall not be permitted to run on any newly surface dressed area until the following day. In circumstances, however, the Engineer-in-charge may open the road to traffic immediately after rolling, but in such cases its speed shall be limited to 16 k.m. per hour till the following day.

#### 5. SURFACE FINISH AND QUALITY CONTROL OF WORK

The surface finish of construction shall conform to requirements of M.O.S.T. No. 902 Specification. Control on the quality of materials and works shall be exercised by the Engineer-in-charge in accordance with section 900.

#### 6. ARRANGEMENTS FOR TRAFFIC

During the period of construction flow of traffic shall be maintained as per clause-112.

#### 7. MEASUREMENTS FOR PAYMENT

Surface dressing shall be measured as finished work in square metres.

#### 8. RATE

The contract unit rate for surface dressing shall be payment in full for carrying out the required operations including full compensation for all components listed in item No. 1 para 2.8

**ITEM 50 Providing & laying with built up spray grout (B.S.G.) base course in one layer with asphalt for tack coat at rate of 5kg/10sq.mt and then bitumen at the rate of 15kg/10sq.mt. with 0.50 CMT aggregate per 10 SMT of road surface for first layer and then spraying over it key aggregate at the rate of 0.13 cmt per. 10 smt. including rolling and consolidation.**

##### 1. Description:

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

##### 2. Materials:

2.1 **Binder** : The binder shall be straight run bitumen of a suitable grade, 60/70 or 80/100 as directed by the Engineer-in-charge, satisfying the requirements of IS-73 or approved cutback.

2.2 **Aggregates** : The aggregates shall, durable, of fairly cubical shape and free of disintegrated pieces, organic or other deleterious matter and adherent coatings. The aggregates shall preferably be hydrophobic and of low porosity.

The aggregates shall satisfy the physical requirements set forth in Annexure-B except that the upper limit for Los Angeles Abrasion Value and Aggregate impact Value shall be 50 and 40 respectively. The coarse and key aggregates for built-up spray grout shall conform to the gradings given below.

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

Sieve Designation	Percent by weight passing the Sieve	
	Coarse Aggregate	Key Aggregate
50.0 mm	100	-
25.0 mm	35-70	—
20.0 mm	—	100.0
12.5mm	0-15	35-70
4.75 mm	—	0-15
2.36 mm	0-5	0-5

##### 3. Construction Operations

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

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

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

3.4 **Spreading and rolling coarse aggregates** : Immediately after the application of tack coat the coarse aggregates in a dry and clean form shall be spread uniformly, and evenly at the rate of 0.5 cum per 10 Sq. m. area. The surface of the layer shall be carefully checked with templates and all high and low spots remedied by removing or adding as may be required.

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

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

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

**3.5 Application of binder - First spray :** The binder shall be heated to the temperature appropriate to grade of bitumen approved by the Engineer-in-charge and sprayed on aggregate layer at the rate of 15 kg/ 10 m<sup>2</sup> (In terms of straight-run bitumen) in a uniform manner with the help of mechanical sprayers. Excessive deposits of caused by stopping or starting of the sprayers or through leakage or any other reason shall be corrected promptly.

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

**3.7 Application of binder - second spray :** The second aggregate layer shall then be given a binder spray at the rate of 15 kg/10 m<sup>2</sup> (in terms, of straight-run bitumen) to 3.5 above.

**3.8 Application of key aggregate :** immediately after second application of the binder key aggregate in a clean and dry state shall be spread uniformly at the rate of 0.13 m<sup>3</sup> / 10m<sup>2</sup> so as to cover the surface completely. If necessary, the surface shall be broomed to ensure uniform application of the key aggregates. The entire surface shall then be rolled with a 8-10 tonne smooth wheeled roller. While rolling is in progress, additional key aggregates where required shall be spread by hand. Rolling shall continue until the entire course is thoroughly compacted and the key aggregates are firmly in position.

**4. Surface Finish and Quality Control :** The surface finish of construction shall conform to the requirements of 902 of M.O.S.T.

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

6. **Arrangements for Traffic :** During period of construction, arrangements of traffic shall be done as per para 112 of M.O.S.T. Specification.

7. **Measurements for Payment :** Built-up spray grout shall be measured as finished work in square meters.

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

(1) Providing all materials to be used in the work including royalty charges, fees, rent where necessary with all lead & lift.

(2) All labour, tools, plants, equipments and incidental to complete the work to the specification.

(3) Providing and maintaining diversion and controlling traffic.

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

#### **ITEM-51 Providing & Laying L.C.C. from working foundation & plinth.**

**(A) Providing and laying C.C. 1:5:10 (1 cement : 5 coarse sand : 10 graded stone aggregates, of 40 mm. nominal size) & curing etc. complete excluding cost of form work in foundation & plinth.**

**Material :** The specifications for graded stone shall be as per details given in the General Specification for materials attached,

**Proportions :** The concrete shall consist of one part of Cement, Five parts of Sand and Ten parts of Metal (40 to 63 mm size)

**Mixing :** Mixing of the materials shall be as thorough as possible after water is added so that every pieces of aggregate is uniformly coated by cement. The concrete must be used immediately after it is prepared and in no case shall it be used after the cement has achieved final set. Generally concrete which has been standing for more than half an hour shall not be permitted to be used.

**Laying :** The concrete must be laid gently (not dumped from height) as not to permit the segregation of the concrete.

**Consolidation :** Consolidation shall be strictly earned out. Sufficient labour shall be employed to permit ramming, rodding, spreading etc. being complete within as short time as possible causing the mortar come up. In no cases shall ramming be permitted after the cement has begun to take initial set.

**Curing** : As soon as the concrete has set sufficiently i.e. about an hour of laying the surface must be protected from rapid drying out by being covered with sand quarry dust or where possible the curing shall be done by forming pond. The watering shall be continued for at later 10 (Ten) days usually two to three weeks and where possible for longer period.

The rate includes all necessary equipment etc. complete.. Payment shall be made on cubic measurement of concrete.

The entire work shall be carried out as per the specification for PWD Hand Book Vol. 1 to the satisfaction of the Engineer-in-charge.

**(B) Providing & laying L.C.C. 1:5:10 (1 cement : 5 coarse sand : 10 graded brick bats of 40 to 50 mm. nominal size) & curing complete excluding cost of form work in foundation and plinth.**

The specification shall be same as per item No 51 (A) except that coarse aggregate shall be brick bats of 40 mm to 50 mm nominal size instead of graded metal.

**(C) Providing & laying L.C.C. 1:5:10 (1 cement : 5 coarse sand : 10 graded stone aggregate of 40 to 63 mm. nominal size) including curing etc. complete excluding cost of form an work in the foundation and plinth.**

The specification shall be same as per Hem No. 51 (A).

#### **ITEM-52 Whitewashing :**

**White washing with lime on wall surface two coat to give an even shade including thoroughly brooming the surface to remove all dirt, and mortar drops and other foreign matter.**

1. **General:** Lime shall be hydraulic lime of approved quality

The slaked lime, if stored, shall be kept in a weather proof and damp roof shed with impervious floor and sides to protect it against rain, moisture, weather and extraneous materials mixing with it. All lime that has been damaged to any ways shall be rejected and all rejected materials shall be removed from site of work

2. **Workmanship** : The fat lime shall be slaked at site and shall be mixed and stirred with about five liters of water and 1 Kg of unslaked lime to make a thin cream. This shall be allowed to stand for a period of 24 hours and then shall be added to each cubic meter of lime cream. Small quantity of ultra marine blue shall also be added to the last two coat of while wash solution and the whole solution shall be stirred thoroughly before use.

3. **Preparation of surface** : The surface shall be thoroughly cleaned of all dust mortar dropping and other foreign matter before white wash is to be applied. Oil or grease spots shall be removed by suitable chemicals and smooth, surface shall be rubbed with wire brush

All unsound portion of the surface plaster shall be removed to full depth of plaster in rectangular patches and plastered again after raking the masonry joints properly.

4. **Application of white wash** : On the surface so prepared the white wash shall be applied with brush. The first stroke of the brush shall be from top to downwards and another from bottom to upwards over the first stroke and similarly one stroke from the right and another from the left over the first stroke before it dries.

Each coat shall be allowed to dry before next coat is applied number of coats as specified in item shall be applied.

5. **Mode of Measurement & Payment** : All work shall be measured in the decimal system i.e. in sq meters. Deduction for pipe openings shall be made fully both sides of openings. The rates shall includes the cost of all materials, labour, scaffolding protective etc. involved in all the operations described. The rate shall be for a unit of one sq. meter.

#### **ITEM-53 Providing and fixing 4" (100 mm) dia. G.I. water spouts 2'6" long in CM necessary iron grating as per design etc. complete (10 CM dia pipe)**

The galvanized water spouts of the size 10 cm dia and the Galvanize iron gritting shall be of the approved quality and type, and shad be first got approved from the Engineer-in-charge before actual use.. The G.I. pipe shall be of sufficient length projecting. Out beyond the concrete surface for sufficient discharge. Iron grating shall be fixed rigidly into the concrete. The galvanized pipe iron as well as gratings shall be painted with two coats of anticorrosive paint.

The measurement shall be recorded and paid on the basis of each Mo. of pipe fixed in position

#### **ITEM-54 Providing and fixing 30 cm x 22 cm x 2.5 cm thick year plate of marble stone set in cm 1:4 including finishing and engraving letters etc complete.**

Providing and fixing 30 cms x 22 cms x 2.5 cms No and year plate of marble and of standard lettering with leads or paint including finishing etc. complete.

Marble plate shall be white and of approved quality and shall be 25 mm thick and of standard size as



directed by the Engineer – in – charge of the work.

Lettering shall be done by U-shape engraving and shall be filled with black paint of approved quality, Lettering shall be done as directed by the Engineer – in – charge. The marble plate shall be fixed in neat cement at a place as directed by the Engineer – in – charge. Cement shall conform to relevant I.S. Specification.

Measurement shall be per number of marble plate fixed.

Unit rate includes cost of all material, labour etc. for complete work.

**ITEM – 55      Numbering the C.D. works with approved paint including all materials for painting etc. complete.**

Numbering the C.D. works shall be carried out as per relevant I.R.C. specification. Oil paint of approved quality and make shall be used for the purpose. Numbering shall be very neat and clean Arrow shall be marked on the Head wall in the correct direction of flow of water. Payment shall be made on the number basis. Unit rate include the cost of all materials, labours for painting & lettering as directed by Engineer – in – charge.

**ITEM – 56      Providing and fixing junction Board of R.C.C. precast as per standard design of I.R.S. including fixing in C.C. block of 1:4:8 with necessary excavation enamel painting, lettering figures etc. complete.**

1.      These boards should be fixed at a distance of 120 metre from the centre line of the crossing and they should be located on the left hand side of the road in the direction of the traffic and facing the traffic.

2.      The board will be located in such a way that the edge of the board towards the centre of the road will be at a distance of 4.57 metres from the centre of a National Highway and 3.66 meters from the centre of State Highway or Major District Road.

3.      The bottom of the board should be 1 metre above the road surface and the board shall be at right angle to the centre line of the road facing the direction of traffic.

4.      The board shall be of the size of 107 cm in length and 91 cm in height for “T” and “Y” junctions shall be 145 C.M. in length and 91 C.M. in height for cross roads.

5.      The board shall be painted by two coarse, the Board and posts shall be R.C.C. as shown in the type design.

6.      The post shall be fixed in concrete and the projection of this above the road level shall be 45 cm x 45 cm and height of 24 cms above the road level and the top to be finished in plaster from the height of 15cm.

7.      The size of letter and figures shall be 8 cm for English and 10 C.M. for devnagri and Gujarati scripts.

8.      The post shall be painted in black and white reflective strips 23 cm in height.

9.      The board shall be painted in white with border 2 C.M. wide.

10.      On this board tablets shall be painted in yellow with black and the tablets shall have 5 cm clear distance from the board.

11.      Each such tablet shall be 61 cm in length and 33 cm in height, arrow lines indicating the direction of the road at the junctions shall be painted in black and shall have a thickness of ..... C.M. for National Highway and 4 C.M. on a State Highway and a ..... C.M. for a Major district road.

12.      All letters and figures shall be painted in black.

13.      The work shall be carried out as per design as per the instructions of the Engineer – in – charges. The measurements shall be recorded and paid on number basis for board fixed in position.

**ITEM – 56 A      Providing & fixing Board of M.S. Plate with two angles iron post and fixing in C.C. Concrete 1:4:8.**

The size of the board shall be 110 cm in length & 60 cm in height. It shall be prepared from M.S. plate of 6 mm thickness. The angle iron post shall be of size 75 mm x 75 mm and 6mm thick. The length of iron post shall be 2.1 metres. The post shall be fixed to the board by welding. The welding shall be true and strong and neat in appearance.

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

The post shall be painted with two coats of paint, alternatively in black & white strips 23 cms in height after applying one coat of anticorrosive paint. The paint shall be of approved quality. The board shall be painted with colour, as directed by Engineer – in – charge. The information as per instruction of engineer-in-charge shall be written on board with letters & signs in accordance with IRC The information may be one or more of the three script. viz. Hindi, English & Gujarati.

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

The measurement for payment shall be for number of board fixed in position & complete in all respect.

The unit rate includes cost of material, labour, tools, welding, concreting, painting, lettering etc.

**ITEM – 57 Providing & fixing Boundary stone as per I.R.C. type design including painting, carving, lettering etc. complete.**

**(i) Fixing earth / Fixing in C.C. 1:5:10.**

1. Boundary stone shall be of the size 20 x 15 x 75 cms true to all the faces.
2. Boundary stones shall be neatly finished shall be chisel dressed on all the sides and at top.
3. Boundary stones shall be fixed at the border line of acquired length so that the land width is properly demarcated. The width between boundary stones shall be fixed at a distance of 330 feet ( 100 mt) a part in the direction of length of the road.
4. The letter B.B. of ( Border) as directed by the Engineer in charge shall be carved on the face of the boundary stone & letter shall be painted with black Japan.
5. The measurement shall be recorded per No. of boundary stone fixed in position and paid accordingly.

**ITEM – 58 Clearing the site before commencement and after completion of the work :**

1. Before starting the work, the site shown on plans shall be cleared of all obstructions, loose stones and materials, rubbish of all kinds as well as all trees and brush wooden except those marked for preservation, the roots being entirely grubbed up. No trees are to be cut down before obtaining the instruction from Engineer – in – charge.
2. The stuff obtained from clearance shall be stacked in such a place and in such a manner as ordered by the Engineer – in – charge and the ground shall be left in a perfectly clean condition.
3. In jungle clearing, all trees, not specifically marked for preservation, bamboos, jungle wood & brush wood shall be cut down, their roots rubbed up. All wood and material available as directed by the Engineer – in – charge.
4. All holes or hollows, whether originally or produced by digging up roots shall be carefully filled up with earth, well rammed and leveled up neatly as directed.
5. After completion of the work, but before its acceptance, the site shall be cleared of all scaffolding, surplus materials and rubbish etc. as per contract. No extra payment shall be made for site.
6. The rate for this item of work shall be for the complete job and shall be paid at the lump sum rate tendered for the work on completion of the entire work.

**ITEM – 59 Supplying and fixing rough kota stone 60 to 80 mm size including fixing in line & level etc. complete.**

The stone to be used shall be approved quality kota stone. It shall be sound, hard, durable and fairly regular in shape and its thickness of the stone at any place shall not be less b 15% of the thickness specified.

The stone shall be laid in line and level with camber as directed & set properly in sand. The whole work shall be generally carried out to the entire satisfaction of Engineer in charge of the work.

The rate shall include the cost of all materials and labour involved in all the operations described above. The kota stone flooring shall be measured in square metre correct to two places of decimal. Length and breadth shall be measured correct to be centimeter & between the finished faces of skirting or Dado and no deduction shall be made extra paid for any opening in floor of a unit of one sq.m.

**ITEM – 60 Providing & laying kota stone for kerbing on both sides of stone paving including fixing kota stone kerbing in 0.30 Mtrs. depth ( Kerbing stone of 60 to 80 mm thick size) etc. complete.**

The stone shall be of approved quality kota stone. Specifications for the materials & laying as per item No.59 above. The rate shall per unit of one Rmt.

**ITEM – 61 Supplying and stacking hard murrum on site of work etc. as directed.**

1. Hard murrum should be of approved quality. Any material which is found interior shall be rejected and contractor shall remove such rejected material from the site at his own cost. The material of Hard murrum shall be collected from quarries approved by the Executive Engineer.

2. The materials shall be got approved by the Executive Engineer prior to collection on site and shall be free from all, rubbish, dust and any organic materials as well as clods of black cotton soil. Material shall not be allowed to be collected from within the road boundary. The materials to be used shall be got tested prior to its use in road construction.

For road work complete stacking of materials as per requirement shall be carried out in 2 Km. length before spreading. The materials stacks shall be got cross checked by other Deputy Executive Engineer as per rules before spreading. The collection shall always commence at one end of K.M and be carried continuously towards the other end.

The materials shall be stacked by filling standard boxes of size 2m x 1.5m x 0.5m on a fairly level ground. It shall be stacked on road land beyond the top of the bank and on a level ground. The rate includes supplying the hard murrum with all lead and lift on road site and stacking the same in regular pharas of the required dimensions. Materials shall be collected in required quantity only at required site of work.

The payment shall be made on cubic metre basis.

**ITEM-62 White stone Bela masonry in C.M. 1:5 including curing etc. complete.**

The stone shall be fine dressed chisel draft one incl. the drafts on all beds and joints.

The stone shall be laid in regular course. The height of the course shall be as approved by the Executive Engineer. All the course shall be of same height unless otherwise ordered but no course will be thicker than any course below it. No stone shall be less in breadth than in height and less in length than twice the width.

The stone shall break the joints in each course and to be carried out in cement mortar 1:6 and thickness of the joints shall not be more than 10 mm. The side joints and beds of all stone shall be vertical and horizontal respectively and all stones shall be rough, true and square.

The work shall be measured and paid for cubic measurements of the work carried out as per approved drawing or as directed by the Engineer-in-charge.

**ITEM-63 40 mm. thick asphalt carpet:**

1. This work shall consist of laying an open graded carpet of 40 mm thickness in a single course and seal coat (excluding cost of asphalt) composed of suitable small sized aggregates premixed with a bituminous binder on a previously prepared basis.

2. The materials shall be proportioned as per quantities given within the following table.

Quantities of materials required for 10 Smt. of road surface for 4 cm. thick open graded premix carpet with seal coat.

**Aggregate for carpet:**

(A)	Stone chipping-20 mm size	0.27 Cum.
(B)	Stone Chipping-12 mm size	0.24 Cum.
(C)	Stone Chipping-10 mm size	0.06 Cum.

**Aggregate for Seal Coat :**

Stone Chipping-6mm size	0.09 Cum.
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**Binder for premixing (Quantities in item of strengthened bitumen)**

1. For Carpet

(A)	For 0.27 Cum. of 20mm size stone chipping at 48 kg./Cum.	12.96 kgs
(B)	For 0.24 Cum. of 12 mm size stone chipping at 52 kg./Cum	12.48 kgs
(C)	For 0.06 cum of 10mm size stone chipping at 56 kg/Cum	3.36 kgs

**Seal Coat :**

For 0.09 Cum. of 6 mm size grit at 80 kg./Cum	7.20 kgs
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**36.00 kgs**

3. Carpet shall not be laid during rainy weather or when the base course is damp or wet or when the atmospheric temperature in shade is 16° degree centigrade or below.

4. The underlying base on which the bituminous carpet is to be laid shall be prepared, shaped and conditioned to the specified line, grade and cross-section as directed by the Engineer-in-charge. The surface shall be well wire cleaned with brushes. Sweeping with brooms and finally dusting with sacks as necessary.

5. **Tack coat :** This work shall consist of application of a single coat of bituminous material to an existing road surface preparatory to another bituminous construction. The temperature of bitumen at the time of application shall be in the range of 160.0 deg, centigrade.

6. Binder shall be heated to the temperature appropriate to the grade of bitumen used and approved by the Engineer-in-charge at the rate specified below. The rate of spread in terms of straight run bitumen shall be 9.75 Kgs per 10 square meter area for a surface untreated water bound macadam surface. The binder shall be applied uniformly. The tack coat shall be applied just ahead of the oncoming bituminous construction. For the purpose of calculating consumption wastage of bitumen will not be permitted beyond 2.5% Excess consumption over 2.5% will be charge at penal rate.

7. Mixers of approved type shall be employed for mixing the aggregates with the bituminous binder. The binder shall be heated to the temperature approved by the Engineer-in-charge, avoiding local overheating and ensuring a continuous supply. The aggregates shall be dried before they are placed in the mixer. After about 15 seconds of dry mixing the heated binder shall be distributed over the aggregates at the rate specified. Kerosene to an extent of 4% to 6% of asphalt shall be provided the contractor according to the requirement at the contractor cost. The mixing of binder with chipping shall be continued until the chippings are thoroughly coated with the binder. The mixing of binder with chipping shall be continued until the chippings are thoroughly coated with the binder. The mix shall be immediately transported from the mixer to the point of using suitable vehicles or wheel barrows. The vehicle employed for transport shall be clean and be covered over in transit if so directed.

8. The premixed materials shall be spread on the road surface with rakes to the required thickness and camber or distributed evenly with the help of a drag spreader, without any undue loss of time. The camber shall be checked by means of camber boards and inequalities evented out. As soon as sufficient length of bituminous material has been laid, rolling shall commence (rolling shall be done departmentally) when the roller has passed over the whole area once any. Stops or depressions which become apparent shall be corrected by removing or adding premixed materials. The contractor shall provide necessary labour for keeping the roller wheels damp during rolling so as prevent the premix from adhering to the wheels and being packed up. The edges both longitudinal and transverse of the carpet laid and compacted earlier shall be cut to their full depth so as to expose fresh surface which shall be painted with thin surface coat of appropriate binder before the new mix is placed against.

9. Seal coat: for. preparation of premix and spreading etc. para 7 & 8 above shall apply. The coat shall be applied immediately after the laying of bituminous course of carpet. Before application of seal coat materials surface shall be cleaned free of any dust of other Extraneous matter.

10. Coarse sand or stone dust flush in as the rate of 0.03 Cmt/10 Smt. Shall be done on asphalt surface at the contractor's own cost.

11. Traffic may be allowed stood after final rolling when the premixed material had cooled down to surrounding temperature.

12. Control on quality of works shall be exercised by the Engineer-in-charge by carrying out the following tests as shown against each.

Sr.No.	Type of Const. Material.	Test	Frequency
1	Tack Coat	(i) Binder temperature for application (ii) Rate of spread of binder of aggregate	At regular close intervals Two test per day
	Open graded premix carpet with seal coat	(i) Temperature of binder at application (ii) Binder Content (videAs/TM:D2172) (iii) Rate of spread of mixed material	At regular close intervals Two test per day for work of every 3 Km length in one lane Regular control through checks on material and layer thickness.

13. Para 13 to 17 as regards arrangements for traffic para 29 to 33 of semidense carpet shall apply.

18. Open graded carpet and seal coat shall be measured in cubic metres on the basis of stone chips actually used.

19. The contract unit rate for open .grade carpet and seal coat (excluding cost of asphalt, stone chips and rolling) shall be payment in full for carrying out the required operation including full compensation for

- (1) Preparation of base.
- (2) Providing all materials like fuel, lubricants, kerosene and coarse sand or stone dust for flushing with all lead and lifts.
- (3) All labours, tools equipment and incidentals.
- (4) Making arrangements for control and safety of traffic.

**ITEM-64 Providing 75 mm thick premix asphalt macadam using 611.00 Kg. Asphalt 10.80 CU.MT. chips for IOOSq.M.**

1. This work shall consist of laying an open graded carpet of 7.5 cm. thickness in a single course and seal coat (excluding cost of asphalt stone chips) composed of suitable small aggregated premixed with a bituminous binder on a previously prepared base.

2. The materials shall be proportioned as per quantities given in the table.

Quantities of materials required for 100 smt. of road surface for 7.5 cm thick open graded premixed cement.

<b>Aggregate for carpet</b>		
(A) Stone Chipping	40 to 50mm size	4..80 Cum.
(B) Stone Chipping	25 to 40mm size	3.60 Cum.
(C) Stone Chipping	12 to 20mm size	2.40 Cum.
<b>Total...</b>		<b>10.80 Cum.</b>

Asphalt 611.00 Kg per 100 SM.

3. Carpet shall be laid during rainy weather or when the base course damp or whether or when the atmospheric temperature in shade is 160 Centigrade or below.

<b>Asphalt Requirement</b>			
Size of Chips	Quantity of Chips	Rate of Asphalt	Total Qty. of Asphalt.
1. Tack coat	-	73.40 Kg/Cum.	73.40
2. 50 to 40mm	4.80	48.00 Kg/Cum.	230.40
3. 40 to 20mm	3.60	58.80 Kg/Cum.	172.80
4. 20 to 10mm	2.40	56.00 Kg/Cum.	134.40
			<b>611.00 Kg.</b>

i.e. 0.611 tonnes per 100 sq. metres.

4. The under laying base on which the bituminous carpet is to laid shall be prepared , shaped and conditioned to the specified line , grade and cross section as directed by the Engineer-in –charge . The surface shall be well cleaned with brushes. Swipping with brooms and final dusting with sacks as necessary .

5 **Tack coat :** This work shall consist of application of a single coat of bituminous material to an existing road surface preparatory to another bituminous construction . The temperature of bitumen at the time of application shall be in range of 160.0 deg. Centigrade to 175.0 deg. Centigrade.

6 Binder shall be heated to the appropriate temperature grade of bitumen used and approved by the Engineer-in-charge at the rate of specified below. The rate of spread in terms of straight run bitumen shall be 611 kgs. per 100 sq. Mt . area. The binder shall be applied uniformly . Wastage of bitumen will not be permitted beyond 2.5 %

7 Mixers of approved type shall be employed for mixing the aggregate with the bitumens binder. The binders shall be heated to the temperature approved by the Engineer-in-charge avoiding local overheating and ensuring a continuous supply .The aggregates shall be dried before they are placed in the mixture. After is seconds of dry mixing the aggregates at the rate specified. Kerosene to an extent of 4 % to 6% of asphalt shall be provided by the contractor or all to the requirement at the contractors cost.

8 The premixed materials shall be spread on the road surface with rates to the required thickness and camber and distributed evenly with the help of a drag spread , without any induce loss of time. The camber shall be checked by means of camber boards and inequalities evented out . As soon as sufficient length of bituminous material has been laid rolling has pass over the wheels clean during so as to prevent the premix from adhering to the wheels and being packed up. The edge along and of carpet laid and compacted earlier shall be cut to their depth so as to expose fresh surface which will be cut to their full depth so as to expose fresh surface which shall be pointed with a thin surface coat of appropriate binder before the new mix is placed against.

Control on quality of the work shall be exercised by the Engineer – in – charge by carrying out the following tests at the frequencies shown against each.

Sr No.	Type of Const. Material.	Test.	Frequency.
1.	Tack coat for application	(i) Binder temperature (ii) Rate of spread of binder.	At regular close intervals Two test per day.
2	Open graded premix carpet with seal coat.	(i) Temperature of binder at application. (ii) Binder Content (vide As/TM:D2172) (iii) Rate of spread of mixed material.	At regular close intervals. Two test per day for work of every 3 Km length in one line. Regular control through checks On materials and layer thickness.

13. Para 13 to 17 as regards arrangements for traffic para 29 to 33 of semi dense carpet shall apply.

18. Open graded carpet and seal coat shall be measured in cubic metres on the basis of stone chips actually used.

19. The contract unit rate for open grade carpet and seal coat (excluding cost of asphalt, stone chips and rolling) shall be payment in full for carrying out the required operation including full compensation for

(1) Preparation of base.

(2) Providing all materials like fuel, lubricants, kerosene and coarse sand or stone dust for flushing with all lead and lifts.

(3) All labours, tools, equipment and incidentals.

(4) Making arrangements for control and safety of traffic.

**TEM-65 Earthwork in cutting including preparing the slope and camber and stacking or utilising the cutting stuff in bank as directed up to 200 mt. from the end of cutting with all lead and lift (I) Hard Murrum**

(1) Para 1 to 8 of Item "Earth work in cutting in all sort of soil" shall apply except that the work shall be carried out in hard murrum.

(9) Earth work in cutting shall be made in hard soil such as stiff heavy clay, hard shale or compact murrum, requiring grafting tool or pick or both and shovel, closely applied and gravel and rubble stone having maximum diameter direction between 75 and 300 mm and soft conglomerate. The classification of cutting shall be decided by the Engineer-in-charge and his decision shall be binding on the contractor. Mode of measurement shall be measured after removal of over burden by tucking cross section at suitable intervals in the original position before the work starts and after its completion areas. Payment shall be made in CMT basis. The rate shall include the cost of labour tools to complete the Job.

**ITEM-66 U.C.R. Masonry for super structure in C.M.:**

Para\* 1 to 14 item No. 30 of the roads specification booklet shall apply for the work of this item.

**ITEM-67 Earthwork in cutting including preparing the slope and camber and stacking or utilising the cutting stuff in bank as directed up to 200 mt. from the end of cutting with all lead and lift (I) Soft Roack (not requiring blasting)**

(1) Para 1 to 8 of Item "Earth work in cutting in all sort of soil" shall apply except that the work shall be carried out in soft rock.

(9) Earth work in cutting shall be in soft rock such as lime stone, sand stone, limestone, hard conglomerate or other soft rock which may be quarried or split with crow bars, boulders which do not require blasting and any rock which dry state may be hard, requiring blasting but which when wet becomes soft and manageable by means other than blasting. The classification shall be decided by the Engineer-in-charge and his decision shall be final and binding on the contractor.

(10) Mode of measurement shall be measured after removal of over burden by taking cross sections at suitable intervals in the original position, the work starts and after its completion and computing the volumes in cubic meter by method of average and areas, payment shall be made on CMT basis. The rate shall include the cost of labour, tools to complete the job, Name of the works :

**ITEM-68 Supplying and Stacking Rubble on site of work etc. as directed.**

The stone shall be hard, sound free from cracks decay and weathering and shall be freshly quarried from and approved quarry stone. with round surface shall be used. The stone when immersed in water for 24 hours shall not absorb water by more than 5 percent of their dry weight when tested in accordance with I.S. fl 124. The length of stone shall not exceed three times its height and the breadth on base shall not be greater than three fourth of the thickness of wall. The rubble shall be stacked on fairly levelled ground.

Stacking shall be done as per the instruction; given by Engineer-in-charge. 15% deductions for voids shall be made from the gross measurement. The payment shall be made on cubic meter basis.

**ITEM-69 Carting and stacking of scarcity hand broken metal on site with all lead including filling the boxes.**

The stone metal shall be obtained from stacking of security metal which is broken in previously scarcity period carting shall be done as per instruction of Engineer-in-charge.

Stacking shall be done by filling the standard steel boxes of 2mm x 1.5 m x 0.5 m size which shall be supplied by the Department, if available, on rent otherwise contractor shall make his own arrangement and no

deduction for voids shall be made from the gross measurements. Where any doubt exists as to whether the quantity of stacks of metal in any hectometer is not confirming with the cubical content of the standard para (2m x 1.5m x 0.5 m) shall be got corrected by the contractor, if so order by the Engineer-in-charge, for which extra payment shall be claimed by the contractor. If the quantity of metal in any stack in particular Hectometer is found to be less than the standard measurement viz 1.5 cm, the entire collection the Hectometre shall be paid on the basis of the quantity so found. Regular stacks shall be done by the contractor on a fairly level ground. Stacking of the metal shall be done in a manner as directed by the Engineer-in-charge. The standard size box measurement for aggregate will be recorded as final and no subsequent change will be permitted.

The payment shall be made on cubic meter basis without deduction for voids. The contractor shall maintain all stacks in regular and proper size till the whole materials are collected, measured and finally accepted by the Department. The rate includes conveyance to the site with all lead and lift and filling the boxes including all labour, tools, equipment and other incidental expenses.

**ITEM-70 Providing and laying 50 mm thick compacted bituminous macadam with tack coat at 5 kg/10 sq. mt. using stone aggregate as per M.O.S.T. gradation specification and asphalt mixing at the rate of 4% (40 kg/H.T.) using hot mix plant and spreading the same with paver finished including consolidation with power rollers including fuel, labour charges, equipments etc. complete.**

## 1. DESCRIPTION

The work shall consist of construction, in a single course, of 50 mm/75 mm thickness of compacted crushed aggregates premixed with bituminous binder, laid immediately after mixing, on a base prepared previously in accordance with the requirement of these specification and in conformity with lines, grades and cross sections shown on the drawings or as directed by the Engineer-in-charge.

## 2. MATERIALS

**2.1 Binder :** The binder shall be straight run bitumen of a suitable grade as directed by the Engineer-in-charge complying with IS : 73

**2.2 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 of disintegrated pieces, organic and other deleterious matters and adherent coatings. The aggregates shall preferably be hydrophobic and of low porosity.

The aggregates shall satisfy the physical requirements set forth in Table hereafter.

**Table-1 PHYSICAL REQUIREMENTS OF AGGREGATES FOR BITUMINOUS MACADAM**

SR.NO.	Test	Test Method	Requirement
1	Los Angeles Abrasion Value'	IS : 2386 (part IV)	35% Maximum
2	Aggregate Impact Value*	-do-	30% Maximum
3	Flakiness Index	IS : 2386 (Part 1)	30% Maximum
4	Stripping Value	TS:6241	25% Maximum
5	Water Absorption	IS: 2386 (Part III)	2% Maximum

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

The aggregate for bituminous macadam for different thicknesses shall conform to the Grading A or B given in Tables 2 and 3. The actual grading to be used shall be specified in the contract).

**TABLE 2 AGGREGATES GRADING FOR 75 mm COMPACTED THICKNESS OF BITUMINOUS MACADAM**

Sieve Designation	Percentage by wt. passing through Sieve	
	For type 'A'	For Type 'B'
63mm	100	-
50mm	90-100	-
40 mm	35-65	100
25mm	20-40	70-100
20mm	—	50-80
12.5mm	5-20	-
4.75 mm	—	10-30
236mm	—	5-20
75 micron	0-5	0-4

**TABLE 3 AGGREGATES GRADING FOR 50 MM  
COMPACTED THICKNESS OF BITUMINOUS MACADAM**

Sieve Designation	Percentage by wt pasting through Sieve	
	For type 'A'	For Type 'B'
50 mm	100	—
40mm	90-100	—
25 mm	50-80	100
20mm	-	70-100
12.5mm	10-30	—
10mm	-	35-60
4.75 mm	—	15-35
2.36mm	—	5-20
75 micron	0-5	0-4

**2.3 Proportioning of materials :** The binder content for pre mixing shall be 35 and 4.0 percent by weight of the total mix for aggregate grading A and B respectively, except when otherwise directed by the Engineer-in-charge.

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

**2.4 Variation in proportioning of material :** The Contractor shall have the responsibility for ensuring proper proportioning of materials and producing a uniform mix. A variation in "binder content of  $\pm 0.3$  percent by weight of total mix shall, however, be permissible for individual specimens taken for quality control tests vide Section 900 V

### **3. CONSTRUCTION OPERATION**

**3.1 Weather and seasonal limitation :** Bituminous macadam shall not be laid during rainy weather or when the base course is damp or wet.

**3.2 Preparation of the base :** The base on which bituminous macadam is to be laid shall be prepared. shaped and conditioned to the specified lines, grades and cross sections in accordance with Clause 501', as directed by the Engineer-in-charge. The surface shall be thoroughly swept and scraped clean and free from dust and foreign matter.

**3.3 Tack coat :** A tack coat as per Clause 503' shall be applied over the base except when the laying of bituminous macadam is being preceded by a bituminous leveling course.

**3.4 Preparation and transport of mix :** Hot mix plant of adequate capacity shall be used for preparing the mix.

The temperature of binder at the time of mixing shall be in the range of  $150^{\circ}\text{C}$  to  $165^{\circ}\text{C}$ , Provided that the difference in temperature between the binder and aggregate at no time exceeds  $25^{\circ}\text{C}$ .

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

The mixture shall be transported from the mixing plant to the point of use in suitable vehicles. The vehicles employed (or transport shall be dean and be covered over tn transit if so directed by the Engineer-in-charge.

**3.5 Spreading :** The mix shall be spread immediately after mixing by means of self propelled mechanical paver with suitable screeds capable of spreading, tamping and finishing the mix true to the specified lines, grade and cross sections. However, in restricted and in narrow widths, where the available plants cannot operate in the opinion of the Engineer-in-charge, he may permit manual laying of the mix.

The temperature of the mix at the time of laying shall be in the range of  $110^{\circ}$  to  $135^{\circ}\text{C}$ . In multi layer construction the longitudinal joint in one layer shall offset that in the layer below by about 150 mm. However, the joint in the most layer shall be at the center line of the pavement.

Longitudinal joint and edges shall be constructed true to the delineating line parallel to the centre line of the road. All joints shall be cut vertical to the full thickness of the previously laid mix and the surface painted with hot bitumen-placing fresh material.

**3.6 Rolling :** After the spreading of mix. rolling shall be done by 8 to 10 tonne power rollers or other approved plant. Rolling should start as soon as possible after the material has been spread. Rolling should be done with care to keep from unduly roughening the pavement surface.

Rolling of the longitudinal joints shall be done immediately behing the paving operation. After this the rolling shall commence at the edge and progress towards the centre longitudinally except that on super elevated 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, as soon as it is possible to roll the mixture without cracking the surface or having the mix pick up on the roller wheels. The second or intermediate rolling shall follow the break down rolling as lossely as possible 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.

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 fresh material. The rolling shall then be continued till the entire surface has been rolled to compaction, there is no crushing of aggregates and all roller marks have been eliminated. Each pass of the 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 be used for the purpose.

Rolling operation shall be completed in every respect the temperature of the mix falls below 80° C. Rollers shall not stand on newly laid material while there is a risk that it will be deformed thereby. The edges along and transverse of the bituminous macadam 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 appropriate binder before the new mix is placed against it.

#### **4. SURFACE FINISH AND QUALITY CONTROL OF WORK**

The surface finish of construction shall conform to the requirements of Clause 90,1.

Control on the quality of materials of materials and works shall be exercised by the Engineer-in-charge in accordance with Clause 902\*.

5. The bituminous macadam shall be provided with final 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 511 before allowing any traffic over it.

#### **6. ARRANGEMENTS OF TRAFFIC**

The provision of Clause 105 shall apply as regards the flow of traffic during construction.

#### **7. MEASUREMENTS FOR PAYMENT**

Bituminous macadam shall be measured as finished work in cubic metres.

#### **8. RATE**

The contract unit rate for bituminous macadam shall be payment in full for carrying out the required operations including full compensation for:

(i) making arrangements for traffic to clause 105 except for initial treatment to shoulders and construction of diversions.

(ii) preparation of base except for laying of levelling course but including filling of potholes;

(iii) providing all materials to be incorporated in the work, including all royalties, fees, rents where necessary and all leads and lifts.

(iv) all labour, tools, equipments and incidentals to complete the work to the specifications, and

(v) carrying out the work in par widths where directed.

#### **ITEM-71 Providing and laying C.C. 1:5:10 (1 Cement: 5 Coarse sand : 10 graded stone aggregate of 40 mm nominal size) and curing etc. complete excluding cost of form work in foundation & plinth**

##### **1.0 Material**

##### **1. Water**

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

1.2 If required by the Engineer-in-charge it shall be tested by comparison with distilled water.

Compression shall be by means of standard cement tests for soundness, time of setting and mortar strength as specified in I.S. 269-1976. Any indication on unsoundness, change in time of setting by 30 minutes or more of decrease or more than 10 percentage of mortar prepared with water sample when compared with the results obtained with mortar prepared with distilled water shall be sufficient cause for rejection of water under test.

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

mortar surfaces.

1.4 Hard and bitter water shall not be used for curing

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

## 2.0 SAND

2.1 Sand shall be natural sand, clean well graded, hard strong durable and gritty particles free from immures amounts of dust, clay kanker modules, soft or flaky particles shall alkali salts, organic matter, learn mica or other deleterious substance and shall be got approved from the Engineer-in-charge. The sand shall not contain more than 8 percent of slit as determined by field test. If necessary the sand.

### 2.2 Course Sand

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

4.75 mm	100
2.36 mm	90 to 100
1.18mm	70 to 100
600 MC	30to 100
300 MC	85 to 70
150 MC	00 to 50

### Fine Sand

2.3 The fineness module shall not exceed 1.0 the sieve analysis of fine sand be as unde

% by wt. passing	
1. S. Sieve Designation	% by wt. passing
4 75 mm	100
2.36 mm	100
1.18mm	75 to 100
600 MC	40 to 85
300 MC	05 to 50 '
150 MC	00 to 10

## 3.0 Cement

3.1 Cement shall be ordinary portland slab cement as per I.S. 1975 pr portlar alag cement as per I.S 455 1976

## 4.0 Stone coarse Aggregate for Nominal Mix Concrete :

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

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

IS Sieve Designation	Percentage passing for single sized aggregate of nominal size		
	40mm	20. mm	16 mm
80 mm	-	-	-
63 mm	100	-	-
40 mm	85-100	100	-
20mm	0-20	85-100	100
16 mm	-	-	85-100

IS Sieve . Designation	Percentage passing for single sized aggregate of nominal size		
	40 mm	20 mm	16mm
12.5 mm	-	-	-
10mm	0.5	0.20	0.30
4.75 mm	—	0.5	0.5
2.35 mm	-	-	—

Note : This percentage may be varied some what by the Engineer-in-charge when consiidered necessary containing better density and strength of concrte.

4.3 The grading test shall be taken in the beginning and at the change of source of material. Theis necessary that indicates in I.S. 383-1970 and I.S. 456-1978 shall have to be carried pit to ensure the acceptability. Aggregate shall be stored separately and handled in such a member as to prevent the intermixing diff. aggregate if

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the aggregate are covered with dust. they shall be washed with water to make them clean.

## **2.00 Workmanship :-**

### **2.1 General :-**

2.1.1 Before starting concreting the bed of foundation trenches shall be cleared of all loose materials level watered and rammed as directed.

### **2.2 Proportion of Mix :**

2.2.1 The proportion of cement sand and coarse aggregate shall be one part of cement 5 parts of sand and 10 parts of bricks bats aggregate and shall be measured by volume

### **2.3 Mixing -**

2.3.1 The concrete shall be mixed in a mechanical mixer at the site of hand mixing may however be allowed for collar quantity work if approved by the Engineer-in-charge when hand mixing is permitted by Engineer-in-charge in case of break down of machineries and in the interest of work it shall be carried out on water tight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency. However in such cases 10% more cement extra case. One mixing in mechanical mixer shall be done period of 1.5 to 2 minutes and the quantity of water shall be just sufficient to provide a dense concrete of required workability for the purpose.

### **2.4 Transporting and Placing the Concrete :-**

2.4.1 The concrete shall be handled from the place of mixing to the final position in not more than 15 minutes by the method as directed and shall be placed into its final position completed and finished within 30 minutes of mixing with water i.e. before the setting commences.

2.4.2 The concrete shall be laid in layer of 15 cms to 20 cms.

### **2.5 Compacting**

2.5.1 The concrete shall be rammed with heavy iron rammer and rapidly to get the required compaction and to allow all the interstices to be filled with mortar.

### **2.6 Curing :-**

2.6.1 After final set the concrete shall be kept continuously wet if required by ponding for a period of not less than 7 days the date of placement

### **2.7 Mode of Measurements and Payments :**

2.7.1 The concrete shall be measured for its length, Breadth and depth limiting dimensions to those specified on plan or as directed.

2.7.2 The rate shall be for a unit of one cubic metre.

## **ITEM-72 Supplying and stacking unscreened gravel on site of work etc. as directed.**

The unscreened gravel shall be obtained from quarries approved by Executive Engineer prior to collection. The material shall be of approved quality with all lead and lift. The material shall be clear and free from organic material, silt, clay etc. and shall be got approved from Engineer-in-charge

Wherever any doubt exists as to whether the above requirements are satisfied in work or any part of the collection, it shall be rectified by the contractor at his own cost, if so ordered by Engineer-in-charge.

Stacking shall be done by filling in the standard steel boxes of 2 mt. X 1.5 mt. x 0.5 mt. size which shall be supplied by the department if available on rent otherwise contractor shall make his own arrangements. No deduction for voids shall be made from the gross measurement... its. Where any doubt exists as to whether the quantity of stacks of material in any hectometer is not confirming with the cubical content of the standard pharas (2 mt. x 1.5 mt. x 0.5 mt.) shall be got corrected by the contractor if so ordered by the Engineer-in-charge for which no extra payment shall be claimed by the contractor. If the quantity of material in any stack in a particular Hectometer is found to be less than the standard measurements viz. 1.5 cmt. the entire collection in the Hectometer shall be paid on the basis of the quantity so found. Regular stacks shall be done by the contractor on fairly level ground Stacking of material shall done in a manner as directed by the Engineer-in-charge.

For road work complete stacking of material as per requirements shall be carried out in 2 k.m. length before spreading. The material stacks shall be measured and recorded and got cross checked by the other Deputy Executive Engineer as per rules before spreading. The collection shall always commence at one end of the k m. and be carried out continuously towards the other end unless the Engineer-in-charge direct otherwise.

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

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

**ITEM-73 Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20 cm. in depth consolidating each deposited layer by ramming and watering.**

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

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

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

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

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

**ITEM-74 Providing and fixing junction board of M.S. Plate and angle as per standard I.R.C. design including fixing in C.C. 1:4:8 with necessary excavation, painting, lettering, figuring and lettering on board etc. complete.**

1.0 The boards shall be fixed at a distance of 120 mtr. from the centre line of the crossing and they should be located on the left hand side of the road in the direction of the traffic and facing the traffic.

2.0 The board will be located in such a way that the edges of the board towards the centre line of the road will be at a distance of 4.57 mt. from the centre of a N.H. and 3.56 mtr. from the centre of a S.H. or M.D R or as directed by the Engineer-in-charge

3.0 The bottom of the board shall be 1 m above the road surface and the board shall be at right angles of the centre line of the road facing the direction of the traffic.

4.0 The size for the junction board M.S plate and angles shall be as per standard confirming to I.R.C type design.

5.0 The board shall be fixed in concrete and the projection of this above the road level shall be 4 cms x 45 cms. and a height of 24 cms. above the road level and the top is to be finished tapering from to the height of 15 cms.

6.0 The board shall be supported by the angle iron parts of M.S. angle as shown in the standard type design.

7.0 The size of letters and figures shall be 8 cm. for English and 10 cms for Devanagari and Gujarati scripts.

8.0 The post shall be painted in black and white alternative strips of 23 cms. in height. 9.0 The board shall be painted in white with blackboard 2 cm. wide.

10.0 On this board tablets shall be painted in yellow with a black border and the tablets shall have 5 cms. clear distance from the board.

11.0 Each such tablets shall be 61 cms in length and 33 cms. in height arrow lines indicating the direction of the road at a junction shall be painted in black and shall have a thickness of 5 cms for N.H. and 4 cms of S.H and 2.5cms for M.D.R.

12.0 All letters and figures shall be painted in black.

13.0 The work shall be carried out as per design and as per the instructions of the Engineer-in-charge.

**ITEM-75 Scarifying gravelled macadam of bitumen macadam surface 6 cm to 10 cm. depth including stacking useful materials on road side and depositing or remaining stuff.**

1.0 The layer of the existing layer metalling shall L-U excavated and shall be screened on site of work. Stacking of 75% of metal obtained from screening shall be done by filling in the standard steel boxes of 2 m x 1.5 m x 0.5 mt. size which shall be supplied by department if available on rent, otherwise contractor shall make his own arrangements. No deductions for voids shall be made from the gross measurements. Where any doubt exist as to whether the quantity of stacks of metal in any hectometer is not confirming with cubical content of the standard pharas { 2m x 1.5 m x 0.5 m) shall be got corrected by the contractor if so ordered by the Engineer-in-charge for which no extra payment shall be claimed by the contractor. If the quantity of metal in any stack in a particular hectometer is found to be less then the standard measurements viz. 1.5 cmt. the entire collection in the hectometre shall be paid on the basis of the quantity so found. Regular stacks shall be done by the contractor on a fair level ground. Stacking of the metal shall be done in a manner as directed by the Engineer-in-charge.

2.0 The remaining material except 75% of metal obtained from screening process shall be used in embankment with all lead and lift. It shall be directly deposited at the required location in specified layers. No handling or conveyance charges shall be paid if the materials is temporarily deposited else where and subsequently convey to site of deposition. The sequence of operations should be arranged properly. Material not required for any use whatsoever may be disposed off by the contractor at his own cost in manner approved by the Engineer-in-charge. The material utilised in the embankment will be deducted from the net quantity of earthwork in embankment arrived at within the chainage measured.

3.0 The payment shall be made on sq. mt. basis, the contractor shall maintain all stacks in regular and proper size till the whole materials shall not be measured and finally accepted by the department. The spreading of materials shall not be allowed till the materials are fully stacked and completed kilometer wise.

4.0 The rate includes the cost of scarifying macadam, screening, depositing, conveyance with all lead and lift, filling the boxes including all labour, tools, equipments and all other incidental expenses.

**ITEM-76 Extra for dewatering in foundation etc. as directed.**

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

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

3.0 The measurements shall be paid on Cubic Meter basis for each class of materials encountered.

4.0 The rate includes the cost of dewatering including pumping.

**ITEM-77 Supplying and stacking of rubble including rubble dumping as and where required as directed.**

1.0 Stone shall be hard, sound, free from cracks, decay and weathering and shall be freshly quarried from an approved quarry. Stone with round surface shall not be used. The length of stone shall not exceed three times its height and the breadth on base shall not be greater than three fourth of the thickness of wall nor less than 15 cm. The rubble shall be stacked in chhattas manner on fairly levelled ground as and where directed as per the instruction of the Engineer-in-charge. 16% for voids shall be deducted from gross measured quantity. The rate includes all labours, materials, tools and equipments, dumping the rubble and all other incidental expenses incurred. The payment shall be made on cmt. basis

**ITEM-78 Jungle cutting for road side clearance on road site as directed.**

The land width shall be cleared i.e. cutting of trees of any diameter, grass, vegetation etc. as per the instruction of the Engineer-in-charge, The wood obtained if any by clearing off the jungle shall be the property of department and the same shall be casted and stacked to the place and hand over the same to the Deputy Executive Engineer as per the instructions laid by him.

**CONTRACTOR'S SIGNATURE**

**EXECUTIVE ENGINEER**

### SCHEDULE FOR TESTING OF MATERIALS

For ensuring quality control and workmanship. Various tests prescribed below for materials shall be taken at periodical intervals as stipulated below.

The materials shall be a got tested at Government recognised Laboratory, (R & B) or field Laboratory of GERI (R & B) for which 1% of the estimated amount put to Tender shall be recovered from the contractor from the R. A. bills and final bills at the testing charges shall be paid to the GERI by the Government. However if the charges increase over 1% no exceeds recovery shall be made from the contractor as per resolution of B & C Department dated 10th May. 1985 Vide TNC/1085 (4) s.

Item No as per schedule 'B'	Brief Description of Materials to be tested	Qty. of Material	Prescription of test which shall be carried out	Frequency @ which test shall be carried out	Total No. of Test to be taken
1	25 to 90 H. B Metal 40 to 63 H. B. Metal 40 to 50 M. C.Metal 20 to 50 M.C. Metal Kapachi		- Gradation Test - Impact value - Flakiness Index	(1 to 100 Cmt - 1 Test 100 to 500Cmt-3 Test 500 to 1500Cmt-5 Test 1500 to 5000 Cmt - 7 Test)	
2	Grit		- Stripping Value	— As Above —	
3	Murum		- P.I- Value	One test per / 50 cmt	
4	Sand Quarry Spaul CBR-1test per work		- Silt Content – Gradation	One test per work One test per 200 cmt.	
5	Asphalt		1 Penetration Test as per I.S.1203  2 Ductility Test 3 Specification Gravily Test 4 Softening point Test 5 Viscosity Test	No. of Tanker Test 1 to 10 1 11 to 20 2 21 to 50 3 51 to 100 4 Remaining every 50 tank. 1 As per I.S. 1208 As per I.S. 1202 As per I.S. 1204 As per I.S. 1206	
6.	Tack coat		- Binder temperature for application. - Rate of spread of binder	Irregular close in intervals Two tests per day.	
7.	Carpet & seal coat mix		- grading - temperature of binder in boiler, aggregates in the dryer and mix at the time of laying and rolling (Binder content vide 45 IMD 2172)  - Rate of Spreaded mix materials	One Test on individual constituents and mixed aggregates from the dryer for each 100 tonnes of mix subject to minimum of Two tests per plant per day. One Test for each 100 tons of mix subjects to mini, of Two per day plant Regular control through checks on layer thickness.	
8	Bricks		- Water absorption Efflorence -Size -Compressive Strength	1 test per 50,000 Bricks	

Item No. As per Schedule 'B'	Brief Description of Materials to be tested	Qty of Materials	Prescription of test which shall be carried out.	Frequency @ which test shall be carried out	Total No. of Test to be taken														
9.	Cement		- Consistency - Setting time - Compressive Strength - Fineness - Chemical analysis - Soundness	Upto 50 T    1 test    (As per 100 T        2 tests    GERt 200 T        3 tests    Manual 300 T        4 tests    2002) 500 T        5 tests 800 T        6 tests 1300T        7 tests and 8 test for larger consingment															
10.	Steel		- Tensile Strength - Yield Stress - Elongation -Size	1 test / 40 tonnes / per category															
11.	C.C. cube 1:2:4		- Compressive Strength {I.S. 516 - 1959)	<table><tr><th>Qty. C.C.M<sup>3</sup></th><th>No. of test</th></tr><tr><td>1 to 5</td><td>- 1 no.</td></tr><tr><td>6 to 15</td><td>- 2 no.</td></tr><tr><td>16 to 30</td><td>- 3 no.</td></tr><tr><td>31 to 50</td><td>- 4 no.</td></tr><tr><td>51 &amp; above</td><td>-4+1</td></tr><tr><td colspan="2">(For each additional 50 M<sup>3</sup> or part thereof).</td></tr></table>	Qty. C.C.M <sup>3</sup>	No. of test	1 to 5	- 1 no.	6 to 15	- 2 no.	16 to 30	- 3 no.	31 to 50	- 4 no.	51 & above	-4+1	(For each additional 50 M <sup>3</sup> or part thereof).		
Qty. C.C.M <sup>3</sup>	No. of test																		
1 to 5	- 1 no.																		
6 to 15	- 2 no.																		
16 to 30	- 3 no.																		
31 to 50	- 4 no.																		
51 & above	-4+1																		
(For each additional 50 M <sup>3</sup> or part thereof).																			

The number of tests will be as per Manual of Quality Control or latest Govt. G.R. / Circulars will be final.

The contractor shall have to pay 1% of the estimate cost put to tender towards all testing of materials & the same shall be deducted from their bills for the works. The testing of various materials shall be carried out in GER1 and result received shall be binding to all i.e. the contractor and Govt.

Testing charges of GERI shall be borne by Govt. No refund be made nor extra charges over 1% shall be recoverable from the contractor

SIGNATURE OF CONTRACTOR	Dy. Executive Engineer	EXECUTIVE ENGINEER
	R. & B. Sub Division.	R. & B. Division.
	Khedbrahma	Himatnagar.





