

# **TECHNICAL**

# **SPECIFICATION**

## GENERAL TECHNICAL SPECIFICATIONS

### 1.0 General :

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

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

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

### 2.0. Measurement of lead for Materials :

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

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

### 3.0 Surface Regularity of sub grade and Pavement courses :

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

PERMITTED TOLERANCES OF SUB REGULARITY FOR PAVEMENT COURSE.

| Sr. | Type of construction                                  | Longitudinal Profile with 3 meter straight edge. |  |    |    |    | Cross Profile   |
|-----|---|--|--|----|----|----|---|
|     |   | Maximum permissible undulation in mm             | Maximum number of undulation permitted in any 300 m. length exceeding in |    |    |    | Maximum permissible variation from specified profile camber 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 stabilized sub base.             | 23   | -  | 30 | -  | -  | 12  |
| 3   | Water Bound Macadam with nominal size metal (20-50)mm | 18   | -  | -  | 30 | -  | 8   |
| 4   | Semi Dense carpet @                                   | 15   | -  | -  | -  | 20 | 6   |

#### Notes:

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

#### Rectification:

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

- (i) **Sub grade;** Where the surface in high, it shall be trimmed and suitably compacted. Where the same in low, the deficiency shall be corrected by adding frees material. The degree of compaction and the type of material to be used shall confirm to the specified requirements.
- (ii) **Granular/Sub Base:** Same as at (i) above except that the degree of compaction and the type of material to be used shall conform to the specified requirements.
- (iii) **Lime/Cement stabilized soil sub-Base:** For lime/ cement treated materials where the surface is high, the

same shall be suitably trimmed while taking care that the material below is not disturbed due to this operation. However where the surface is low, the same shall be corrected as described here in below. For cement treated material, when the time elapsed between detection of irregularity and the time of mixing of the material, is less than 2 hours, the surface shall be scarified to a depth of 50mm, supplemented with freshly mixed material as necessary and recomposed to the relevant specification. When this time is more than 2 hour, 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 meters wide. This also applies to lime treated material except that the time criterion shall be 3 hours instead of 2 hours.

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

#### **4.0 Quality Control Test During Construction. :**

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

#### **5.0 Tests of Earthwork for Embankment Construction :**

##### **5.1 Borrow Materials:**

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

##### **5.2 Compaction Control :**

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

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

- (1) Cement IS : 269 (Abuja and Tata make only)
- (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 under:**

## **DETAIL SPECIFICATION**

### **(Schedule-B)**

#### **Item No:1**

**Clearing and grubbing road land including uprooting rank vegetation grass bushes, shrubs, sapling and trees girth up to 300 mm removal of stumps of trees cut earlier and disposal of unserviceable materials (A) By manual means in area of light jungle.**

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 woods 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.

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.

In jungle clearing, all trees, not specifically marked for preservation, bamboos, jungle wood and brush wood shall be cut down, their roots rubbed up. All wood and material made available as directed by the Engineer-in-charge.

All holes or hollows, whether originally or produced by digging up roots shall be carefully filled up with earth.

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.

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.

The land width shall be cleared i.e. cutting of tress of any diameter, grass, vegetation etc. as per the instruction of the Engineer-in-charge. The wood obtained if any by clearing of 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 instruction laid by him.

Mode of Measurement and payment:

Measurement will be done in Hector of the actual area laid

#### **Item No:2**

**Providing and laying compacted W.B.M. 150mm thick of machine crushed B.T.metal of size 45mm to 63mm with using 20% stone screenings as filler grit and stone dust including spreading, wateriang & consolidation by vibratory roller etc. complete.**

- The stone metal shall be obtained from quarries approved by the Executive Engineer prior to collection. The metal shall be of approved quality with all leads and lift. The 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 belonged or flaky materials shall be rejected. No round or oblong pebbles or angular chips large or smaller then specified size should be allowed. The size of metal shall be 40mm to 63mm and shall be hand broken. All unsound weathered or disintegrated stone obtained from the upper surface layer or other layers of bounders shall be rejected.
- The samples of metal collected from approved quarries shall be got tested at Government recognized laboratory as may be directed to the contractor. The test result shall conform to the standard requirements laid down for metal to be used for W.B.M work.
- The physical requirements for standard size B.T. metal shall conform to the test result indicated in the Table below:

| Type of Construction | Test                       | Test Method          | Requirement     |
|----------------------|----------------------------|----------------------|-----------------|
| Base (a) OR          | Los Angeles Abrasion Value | I.S. 2386 Part IV    | 50 percent Max. |
| Sub Base             | Aggregate impact Value     | I.S. 2386 Part IV or | 40 percent Max. |
|                      | Flakiness index            | I.S. 2386 Part I     | 15 percent Max. |

- 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 thought the sieve |
|---------|--------------------------------|-------------------|--|
| 1.      | 40mm to 63mm<br>& 25mm to 40mm | 80 mm             | 100-100  |
|         |                                | 63 mm             | 90-100   |
|         |                                | 50 mm             | 35-70  |
|         |                                | 40 mm             | 00-15  |
|         |                                | 20 mm             | 00-05  |

The size of metal for W.B.M shall be 20mm to 50mm wherein tolerance limit for oversize shall be up to 10% and that for lower size should be up to 10%.

- Whenever any doubt exists as to where the above requirements are satisfied, whole or any part of the collection of metal shall be got screened 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 2m X 1.5m X 0.5m size which shall be supplied by the Department if available on rent otherwise 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 an hectometer is not conforming with the cubical content of the standard pharas (2 X 1.5 X 0.5m) 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 stacks in particular Hectometer found to be less than the standard measurements viz. 1.5 centimeters the entire collection in the Hectometer shall be paid on the basis of the quantity so found. Regular stacks shall be done by the Engineer-in-Charge. Collection of metal shall be completed in two hectometer wise as per the final

requirement and measurement shall be recorded two hectometer-wise. If the quantity of metal as per the final requirement is not collected in any two consecutive. H. M and std. boxes are not filled in completely in two hectometers, measurements shall not be recorded and payments shall not be done.

- For roadwork complete stacking of metal as per requirement shall be carried out in 2km length before spreading. Other Deputy Engineer as per rules shall be crosschecked the metal stacks 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.
- The payment shall be on cubic meter basis without deduction of voids. The contractor shall maintain all Departments. 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 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.

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 thought the sieve |
|---------|--------------------------------|-------------------|--|
| 1.      | 40mm to 63mm<br>& 25mm to 40mm | 80 mm             | 100-100  |
|         |                                | 63 mm             | 90-100   |
|         |                                | 50 mm             | 35-70  |
|         |                                | 40 mm             | 00-15  |
|         |                                | 20 mm             | 00-05  |

The size of metal for W.B.M shall be 40mm. To 63mm. where in tolerance limit for oversize shall be 10percent and that for lower size should be up to 15 percent and below 25mm it shall be up to 5 percent

Standard for acceptance at reduced rate and rejection shall be as under:

- Retained on 63mm square mesh sieve: Not more than 30%
- Retained on 75mm square mesh sieve:

Nothing will be retained & 100% metal shall pass through the sieve. For the oversize metal, payment at reduce Rate should be made as under:

- 90% of accepted tender rates for the metal retained between 10% and 20% on square mesh sieve of 63mm gauge.
- 75% of accepted tender rates for the metal retained between 20% and 30% on square mesh sieve of 63mm gauge.

If more than 30% of metal is retained on specified sieve, (i.e. 63mm square size) the stack shall be rejected. Also if any stone aggregate retained on 75mm sieve, the stack shall be rejected.

The quantity 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 Cu. m. 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 of 1.23 Cu. m. shall be paid for at 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]

Supplying of murrum/binding material.

- Materials for the purpose shall be of approved quality. Any material, 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 collected from quarries approved by the Executive Engineer. The material shall be granular and gritty.
- The Executive Engineer prior to collection on site shall be approved the material. It shall be free from all rubbish, dust and any organic materials as well as clod 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 use bind age 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 construction. Testing charges shall be borne by the contractor.
- River or nala or sea sand required for the work shall be clear, sound, property, 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 Meter basis.

- Stacking shall be done by filling in the standard steel boxes of 2m X 1.5 X 0.5m size, which shall be supplied by the Authority 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 stacks of murrum in a hectometer 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 hectometer is found to be less than the standard measurements viz., 1.5 centimeters. The entire collection in the hectometer shall be paid on the basis of the quantity so found. The Contractor in a fairly level ground shall do regular stacks. Stacking of the murrum shall be done in a manner as directed by the Engineer-in-charge.

- For road work completed stacking of murrum as per requirement shall be carried out in 2-kilometre length before spreading. The collection shall always, be commenced at one end of the K.M and be carried continuously towards the other end unless the Engineer-in-charge shall direct otherwise.
- 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 authority. 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 leads and lifts and filling the boxes including all labour, tools, equipment and other incidental expense.

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

The payment shall be made on cubic meter basis.

Spreading of stone aggregate:

- 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 stack in balance for making good unevenness or depressions during rolling works. To ensure that the material is spread to the required thickness, the road surface shall be marked out into 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 medaled and shall be enough to prevent the loose metal from spreading during consolidation as well as to retain water used for consolidation. Payment for bunds will be made in the respective item.
- 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 cambers by using camber boards shall be in use at site. The surface shall be checked at every 50 ft. by means of template while the correctness of the camber in between shall be tested by string and corrected as required. Between the straight lengths and the curves in camber of road to super elevation shall be made very gradually as may be directed by the Engineer-in-charge.
- The spreading of metal shall precede only 200-meter (max.) advance of the rolling operations the collection and spreading of the metal shall not be carried out in one and the same kilometer.

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

The payment shall be made on cubic meter basis.

Spreading blind age:

Spreading of materials 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 medaled surface then the spreading shall be uniform and as its has to act as binding surface, it shall be used for filling the interstices for metal and forming a smooth running surface as far as possible. Murrum blind age shall be specified, as blind age shall be speared evenly with a twisting motion of the baskets. No more murrum shall be used then specified as blind age. The rate is for gross measurements and no deductions of voids shall be made. The murrum is to be speared over earthen embankment as a sub base or for side shoulders or as blindange; 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 operation except consolidation.

The payment shall be made on cubic meter basis.

### **Item No:3**

**Providing, laying, spreading and compacting graded machine crushed black stone aggregates to Wet Mix Macadam (WMM) in layers including premixing the material with water to OMC in mechanically mix (Pug-mill) carriage of mix material by tipper to site, laying.**

Scope

This work shall consist of laying and compacting clean, crushed, graded aggregate and granular material, premixed with water, to a dense mass on a prepared sub grade/sub-base/base or existing pavement as the case may be in accordance with the requirements of these Specifications. The material shall be laid in one or more layers as necessary to lines, grades and cross-sections shown on the approved drawings or as directed by the Engineer.

The thickness of a single compacted Wet Mix Macadam layer shall not be less than 75 mm. When vibrating or other approved types of compacting equipment arc, used, the compacted depth of a single layer of the sub-base course may be increased to 200 mm upon approval of the Engineer.

Materials, Aggregates

Physical requirements:

Coarse aggregates shall be crushed stone. If crushed gravel/shingle is used, not less than 90 per cent by weight of the gravel/shingle pieces retained on 4.75 mm sieve shall have at least two fractured faces. The aggregates shall conform to the physical requirements set forth in Table 400-10 below.

TABLE 400-10. PHYSICAL REQUIRMENTS OF COARSE AGGREGATES  
FOR WET MIX MACADAM FOR SUB-BASE/BASE COURSES

|   | Test  | Test Method                 | Requirements        |
|---|---|-----------------------------|---------------------|
| 1 | * Los Angeles Abrasion value Or                   | IS:2386 (Part-4)            | 40 per cent (Max)   |
|   | * Aggregate Impact value                          | IS:2386 (Part-4) or IS:5640 | 30 per cent (Max)   |
| 2 | Combined Flakiness and Elongation Indices (Total) | IS:2386 (Part-1)            | 30 per cent (Max)** |

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

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

If the water absorption value of the coarse aggregate is greater than 2 per cent, the soundness test shall be carried out on the material delivered to site as per IS:2386 (Part-5).

Grading requirements:-

The aggregates shall conform to the grading given in Table 400-11.

TABLE 400-11.

GRADING REQUIREMENTS OF AGGREGATES FOR

WET MIX MACADAM

| IS Sieve Designation | Per cent by weight passing the IS sieve |
|----------------------|---|
| 53.00 mm             | 100                                     |
| 45.00 mm             | 95-100                                  |
| 26.50 mm             | --                                      |
| 22.10 mm             | 60-80                                   |
| 11.20 mm             | 40-60                                   |
| 4.75 mm              | 25-40                                   |
| 2.36 mm              | 15-30                                   |
| 600.00 micron        | 8-22                                    |
| 75.00 micron         | 0-8                                     |

Materials finer than 425 micron shall have Plasticity Index (PI) not exceeding 6.

The final gradation approved within these limits shall be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa.

Construction Operations

Preparation of base: Clause 404.3.1 shall be apply.

Provision of lateral confinement of aggregates:

While constructing wet mix macadam, arrangement shall be made for the lateral confinement of wet mix. This shall be done by laying materials in adjoining shoulders along with that of wet mix macadam layer and following the sequence of operations described in Clause.

Preparation of mix:

Wet Mix Macadam shall be prepared in an approved mixing plant of suitable capacity having provision for controlled, addition of water and forced/positive mixing arrangement like pugmill or pan type mixer of concrete batching plant. For small quantity of wet mix work, the Engineer may permit the mixing to be done in concrete mixers.

Optimum moisture for mixing shall be determined in accordance with IS:2720 (Part-8) after replacing the aggregate fraction retained on 22.4 mm sieve with material of 4.75 mm to 22.4 mm size. While adding water, due allowance should be made for evaporation losses. However, at the time of compaction, water in the wet mix should not vary from the optimum value by more than agreed limits. The mixed material should be uniformly wet and no segregation should be permitted.

Spreading of mix:

Immediately after mixing, the aggregates shall be spread uniformly and evenly upon the prepared subgrade/sub- base/bass in required quantities. In no case should these be dumped in heaps directly on the area where these are to be laid nor shall their hauling over a partly completed stretch be permitted.

The mix may be spread either by a paver finisher or motor grader. For portions where mechanical means cannot be used, manual means as approved by the Engineer.

shall be used. The motor grader, shall be capable of spreading the material uniformly all over the surface. Its blade shall have hydraulic control suitable for initial adjustments and maintaining the same so as to achieve the specified slope and grade.

The paver finisher shall be self-propelled, having the following features:

- (i) Loading hoppers and suitable distribution mechanism
- (ii) The screed shall have tamping and vibrating arrangement for initial compaction to the layer as it is spread without rutting or otherwise marring the surface profile.
- (iii) The paver shall be equipped with necessary control mechanism so as to ensure that the finished surface is free from surface blemishes.

The surface of the aggregate shall be carefully checked with templates and all high or low spots remedied by removing or adding aggregate may be required. The layer may be tested by depth blocks during construction. No segregation of larger and fine panicles should be allowed. The aggregates as spread should be of uniform gradation with no pockets of fine materials.

#### Compaction:

After the mix has been laid to the required thickness, grade and crossfall/camber the same shall be uniformly compacted, to the full depth with suitable roller. If the thickness of single compacted layer does not exceed 100 mm, a smooth wheel roller of 80 to 100 kN weight may be used. For a compacted single layer upto 200 mm, the compaction shall be done with the help of vibratory roller of minimum static weight of 80 to 100 kN or equivalent capacity roller. The speed of the roller shall not exceed 5 km/h.

In portions having unidirectional cross fall/superelevation, rolling shall commence from the lower edge and progress gradually towards the upper edge. Thereafter, roller should progress parallel to the centre line of the road, uniformly overlapping each preceding track by at least one-third width until the entire surface has been rolled. Alternate trips of the roller shall be terminated in stops at least 1 m away from any preceding stop.

In portions in camber, rolling should begin at the edge with the roller running forward and backward until the edges have been firmly compacted. The roller shall then progress gradually towards the centre parallel to the centre line of the road uniformly overlapping each of the preceding track by at least one-third width until the entire surface has been rolled.

Any displacement occurring as a result of reversing of the direction of a roller or from any other cause shall be corrected at once as specified and/or removed and made good.

Along forms, kerbs, walls or other places not accessible to the roller, the mixture shall be thoroughly compacted with mechanical tampers or a plate compactor. Skin patching of an area without scarifying the surface to permit proper bonding of the added material shall not be permitted.

Rolling should not be done when the sub grade is soft or yielding or when it causes a wave-like motion in the sub-base/base course or sub grade. If irregularities develop during rolling which exceed 12 mm when tested with a 3 meter straight edge, the surface should be loosened and premixed material added or removed as required before rolling again so as to achieve a uniform surface conforming to the desired grade and crossfall. In no case should the use of unmixed material be permitted to make up the depressions.

Rolling shall be continued till the density achieved is at least 98 per cent of the maximum dry density for the material as determined by the method outlined in IS: 2720 (Part-8)

After completion, the surface of any finished layer shall be well-closed, free from movement under compaction equipment or any compaction planes, ridges, cracks and loose material. All loose, segregated or otherwise defective areas shall be made good to the full thickness of the layer and recompacted.

#### Setting and drying:

After final compaction of wet mix macadam course, the road shall be allowed to dry for 24 hours.

#### Opening to Traffic:-

Preferably no vehicular traffic of any kind should be allowed on the finished wet mix macadam surface till it has dried and the wearing course laid.

#### Surface Finish and Quality Control of Work

##### Surface evenness:

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

##### Quality control:

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

##### Rectification of Surface Irregularity

Where the surface irregularity of the wet mix macadam course exceeds the permissible tolerances or where the course is otherwise defective due to subgrade soil getting mixed with the aggregates, the full thickness of the layer shall be scarified over the affected area, reshaped with added premixed material or removed and replaced with fresh premixed material as applicable and recompacted in accordance with Clause 406.3. The area treated in the aforesaid manner shall not be less than 5 m long and 2 m wide. In no case shall depressions be filled up with unmixed and ungraded material or fines.

##### Arrangement for Traffic

During the period of construction, arrangement of traffic shall be done as per Clause 12

##### Measurements for Payment

Wet mix macadam shall be measured as finished work in position in cubic metres.

##### Rates

The Contract unit rate for wet mix macadam shall be payment in full for carrying out the required operations including full compensation for all components listed in Clause 401.8.

The payment shall be made on cmt basis of work done.

#### Item No:4

**Scarifying graveled macadam or bitumen macadam surface 6 cm to 10 cm. depth including stacking useful materials on road side and disposing off remaining stuff.**

The layer of the existing layer medalling shall be 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 deduction for avoid shall be made from the gross measurements. Where any doubt exist as to whether the quantity of stacks metal in any hectometre is not conforming with 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 is found to be less than the standard measurement 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 metal shall be done in a manner as directed by the Engineer-in-charge.

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 chain age measured.

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 material are fully stacked and completed kilometre wise.

The rate includes the cost of scarifying macadam, depositing, conveyance with all lead and lift, filling the boxes including all labour, tools, equipment and all other incidental expenses.

**Item No:5**

**Providing and laying bituminous 50.00mm thick Bitumen macadam with asphalt 60/70 for tack coat @ 2.5 kg./10 Smt. in one or two layers considering 0.66 cum. per M.T. mix materials with machine crused stone aggregates and Asphalt grade VG-30 {60/70} for mixing @ 34.00 Kg./M.T. i.e. 3.4% by total weight of the mix and including heating the aggregates and asphalt by continuous batching of drum mix plant and spreading the same by paver finisher and consolidation with vibratory roller 80 to 100 KN static weight including providing all materials, equipment's, tools and plant, oil, kerosene, firewood, labour charges etc. comp. using contractor's own machineries, drum mix plant and paver finisher etc. complete.**

1. DESCRIPTION: This work shall consist of construction in a single course of 20/25mm thick premixed asphalt carpet.

2. MATERIALS:

2.1 Binder: The binder shall be straight run bitumen 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 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 Annexure-B except that flakiness index shall be 30 & water absorption 1.

2.3 Aggregate gradation: The mineral aggregates, shall be so graded or combined as to conform to gradients set forth in table below

Table Aggregate gradation.

| Sieve Size | % By weight passing the sieve |                    |
|------------|-------------------------------|--------------------|
|            | For 25mm thickness            | For 25mm thickness |
| 20.0 mm    | 100                           | 100                |
| 12.5 mm    | 70-100                        | 100                |
| 10.0 mm    | 20-40                         | 70-100             |
| 4.75 mm    | 0-5                           | 20-40              |
| 2.36 mm    | -                             | 0-5                |

2.4 Proportion of materials:

The binder content for premixing shall be 3.28 percent by weight of the total mix. The quantities of aggregate shall be sufficient to yield the specified thickness after compaction. 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 specimens taken of quality control test vide M O. S. T. Specification Section 900.

3. CONSTRUCTION OPERATIONS:

3.1 Weather and seasonal limitation: The surface dressing work shall be carried on only when the atmospheric temperature in shade is above 15°C No. Bituminous 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 carpet to be laid shall be prepared, shaped and conditioned to the specified, lines, grade and cross section in accordance as directed by the Engineer-in-charge.

The surface shall be thoroughly swept and scraped clean and free of dust and foreign matter before the spraying of binder. If necessary the cleaning shall be done first with hard brushes, and finally by blowing with sacks or gunny bags.

3.3 Application of binder: Binder shall be heated to 163°C to 177°C and sprayed on the dry surface in a 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 of binder caused by stopping or starting of the sprayer or thought leakage or any other reasons shall be suitably corrected before the stone chippings 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 stocked on road side by filling standard boxes of 2.0 m X 1.50 m X 0.50m the measurement shall be recorded in the measurement book after collection in two kilometre length is complete. The material shall be crosschecked by another D.E.E. as per rules. Thereafter, 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 grittier, otherwise, manually so as to cover the surface completely. If necessary, the surface shall be boomed to ensure uniform spread of chippings.

3.5 Rolling: Immediately after the application of the cover material, the entire surface shall be rolled with an 8-10 tones three-wheeled roller. Rolling shall commence at the edges and progress towards the centre except in super elevated portions, where it shall proceed from the inner edge to the other. Each pass of the roller shall overlap 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 making 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 construction operation shall be the same as described as per IS.

4. Opening to traffic: Traffic shall not be permitted to run on any newly surface dressed until the following day. In circumstances, however, the Engineer-in-charge may open to the road to traffic immediately after rolling, but in such cases its speed shall be limited to 16 Km per hour till the following day.

5. Surface and finish and Quality Control of work: The surface 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 of Traffic: During the Period of construction flow of traffic shall be maintained as per clause-112.

7. Measurement for Payment: Surface dressing shall be measured as finished work in MT/square meters.

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.

Rate per MT of work complete.

#### **Item No:6**

**Providing and laying Builtup spray grout base 37.50 mm thick (Average) layer with Asphalt 60/70 for tack coat at the rate of 2.5 kg./10 Sqm. With mechanical sprayer on B.T. surface and using B.T. stone aggregates as per required gradation with the asphalt of 60/70 grade at the rate of 1.99% i.e.19.90 Kg./M.T. by weight by mix including heating and mixing in drum mix plant, transporting the mix spreading the same by sensor paver finisher and consolidation by vibrator roller MORTH specification including cost of all materials, fuel labours, tools and plant etc. using contractor won drum mix plant etc. complete.**

#### **Built-Up Spray Grout (BUSG) Base – 37.5 mm Thick (Average)**

##### **1. Scope of Work**

The work shall consist of providing and laying a Built-Up Spray Grout (BUSG) base course of 37.5 mm average compacted thickness over an existing bituminous (B.T.) surface, in accordance with MORTH Specifications (latest revision).

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

###### **2.1 Bitumen**

- Grade: VG-30 (Equivalent to 60/70 penetration grade)
- Conforming to: IS:73 / MORTH specifications
- Usage:
  - Tack Coat: 2.5 kg per 10 sqm (0.25 kg/sqm)
  - BUSG mix: 1.99% by weight of aggregates (19.90 kg/MT)

###### **2.2 Aggregates**

- Type: Crushed stone aggregates (B.T. stone)
- Gradation: As per MORTH Clause 503 (BUSG)
- Properties:
  - Clean, hard, durable
  - Free from dust, organic matter, and deleterious materials
  - Conforming to:
    - Aggregate Impact Value
    - Los Angeles Abrasion
    - Water Absorption limits as per MORTH

##### **3. Equipment**

- Mechanical bitumen sprayer (calibrated)
- Drum Mix Plant (Contractor-owned)
- Sensor paver finisher
- Vibratory roller (8–10 tonne or as specified)
- Tippers for transportation
- Heating and mixing arrangements

##### **4. Construction Procedure**

###### **4.1 Surface Preparation**

- Existing B.T. surface shall be:
  - Cleaned of dust, dirt, and loose materials
  - Free from potholes and defects (repaired prior to work)

- Cleaning by:
  - Mechanical broom / air compressor

#### **4.2 Tack Coat Application**

- Bitumen (VG-30) applied using mechanical sprayer
- Rate: 2.5 kg per 10 sqm
- Uniform spraying ensured
- No pooling or streaking allowed
- Surface allowed to become tacky before next operation

#### **4.3 Preparation of Mix**

- Aggregates heated and dried in drum mix plant
- Bitumen added at 1.99% by weight of aggregates
- Proper mixing to ensure:
  - Uniform coating
  - No segregation

#### **4.4 Transportation**

- Mix transported in covered tippers
- No temperature loss or contamination allowed

#### **4.5 Laying**

- Mix laid using sensor paver finisher
- Uniform thickness maintained (37.5 mm compacted)
- No segregation during laying

#### **4.6 Compaction**

- Compaction by vibratory roller
- Rolling sequence:
  - Initial rolling
  - Intermediate rolling
  - Final finishing
- Achieve:
  - Proper density
  - Smooth surface without waves/cracks

#### **5. Quality Control**

- Bitumen content check
- Gradation tests of aggregates
- Temperature control during mixing and laying
- Surface evenness checks
- Thickness measurement

#### **6. Measurement**

- Measured in MT
- Based on compacted thickness (37.5 mm average)

#### **7. Rate Includes**

The rate shall include:

- Cost of bitumen, aggregates
- Heating, mixing, and laying
- Tack coat application
- Transportation
- Labour, fuel, tools & plants
- Contractor's drum mix plant
- All leads and lifts
- Complete execution as per specifications

#### **8. Payment**

- Payment will be made per sqm of completed BUSG work
- Accepted by Engineer-in-Charge as per MORTH standards

#### **9. Relevant MORTH Clauses**

- Clause 503 – Built-Up Spray Grout
- Clause 502 – Prime/Tack Coat
- Section 900 – Quality Control

Rate per MT of work complete.

#### **Item No:7**

**Providing & laying 20mm thick Mix Seal Surfacing using stone chipping & aggregate as per M.O.T.&.H. specification & asphalt grade VG-30 60/70 for mixing at the rate of 50.90 Kg./M.T i.e.5.09% of total weight of mix including heating the aggregate & asphalt in continuous batching drum mix plant & spreading the same by paver finisher & consolidation with vibratory roller & flushing sand @ 0.30 Cum/100 Smt. including providing all materials wquipments, tools & plants, fire wood, oil, kerosene, labour charges etc. complete using constructors own machinery drum mix plant & paver finisher**

**etc. complete.**

**1. DESCRIPTION:**

The work shall consist of construction in a single course, of 40 mm thick-asphalted concrete as wearing surface, 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 I.S.: 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 aggregate shall preferably be hydrophobic and of low porosity and shall satisfy the physical requirements set forth in Table given Below:

2.3 Fine aggregate: 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:

| Sieve size | % By weight passing the Sieve | % By weight passing the Sieve |
|------------|-------------------------------|-------------------------------|
| 12.5 mm    | -                             | 100                           |
| 10 mm      | 100                           | 70 – 100                      |
| 4.75 mm    | 40 – 85                       | 20 – 40                       |
| 2.35 mm    | 5 – 20                        | 5 – 20                        |
| 75 micron  | 0 – 4                         | 0 – 4                         |

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

2.7 The quantities of aggregate 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.

2.8 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 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 LBM is to be laid shall be prepared shaped and conditioned to the specified, lines, grade and cross section 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 meter area for an existing bitumen treated surface and 10 Kg per 10 square meter 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-ordinate set of essential units such as dryer for heating the aggregates, device 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 mixing 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 150mm 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 breakdown rolling shall be with 8-12 tonne three wheeled rollers and the surface finished by final rolling with 8-10 tonne tender rollers, or suitable pneumatic rollers.

The roller wheelers 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 payment. 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 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 weight bridge of suitable capacity for the purpose of weighment of dumpers at suitable place at his cost as directed. Weight of empty dumper and weight of loaded dumper will be recorded in bound and numbered register on plant side.

Department will be free to get some loaded dumper test checked at other weighbridge. Weigh bridge will be periodically got calibrated and verified from weight and measured 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 reduce 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 Additional Assistant Engineer if so authorized. Record of each dumper will be maintained separately in bound and numbered register, which will be maintained by departmental representatives and signed by the contractor. Proper gate pass system shall be established for the vehicles coming to 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 L.B.M shall be for payment in full for carrying out the required operations including full compensation listed in MOST Specification. Rate per MT.

#### Item No:8

**Providing & Applying Ashphalt pinting by spraying asphalt 80 / 100 grade of 5.00 kg / 10 smt. & than spreading sand at a rate 0.03 cmt / 10 smt. Including preparing surface heating asphalt etc. complete as directed.**

#### Scope:

This work shall consist of the application of a single coat of low viscosity liquid bituminous, material to a porous granular surface preparatory to the superimposition of bituminous treatment or mix.

#### Materials

#### Primer:

The choice of a bituminous primer shall depend upon the porosity characteristics of the surface to be primed as classified in IRC: 16. These are:

(i) Surfaces of low porosity; such as wet mix macadam and water bound macadam, (ii) Surfaces of medium porosity; such as cement stabilised soil base,

(iii) Surfaces of high porosity; such as a gravel base.

#### Primer viscosity:

The type and viscosity of the primer shall comply with the requirements of IS 8887, as sampled and tested for bituminous primer in accordance with these standards. Guidance on viscosity and rate of spray is given in Table 500-1.

TABLE 500-1 VISCOSITY REQUIREMENT AND QUANTITY OF LIQUID

#### BITUMINOUS PRIMER

| Type of surface | Kinematics Viscosity Quantity of | Bituminous Material |
|-----------------|----------------------------------|---------------------|
|                 | Liquid of Primer at 60°C         | Per 10 Sq. m.       |
|                 | (Centistokes)                    | (Kg)                |
| Low porosity    | 30-60                            | 6 To 9              |
| Medium porosity | 70-140                           | 9 To 12             |
| High porosity   | 250-500                          | 12 To 15            |

Choice of primer:

The primer shall be bitumen emulsion, complying with IS 8887 of a type and grade as specified in the Contract or as directed by the Engineer. The use of medium curing cutback as per IS 217 shall be restricted only for sites at sub-zero temperatures or for emergency applications as directed by the Engineer.

Weather and Seasonal Limitations

Bituminous primer shall not be applied to a wet surface (see 502.4.2) or during a dust storm or when the weather is foggy, rainy or windy or when the temperature in the shade is less than 10°C. Surfaces which are to receive emulsion primer should be damp, but no free or standing water shall be present.

Construction

Equipment:

The primer distributor shall be a self-propelled or towed bitumen pressure sprayer equipped for spraying the material uniformly at specified rates and temperatures. Hand spraying of small areas, inaccessible to the distributor, or in narrow strips shall be sprayed with a pressure hand sprayer, or as directed by the Engineer.

Preparation of road surface:

The surface to be primed shall be prepared in accordance with Clauses 501.8 and 902 as appropriate. Immediately prior to applying the primer the surface shall be carefully swept clean of dust and loose particles, care being taken not to disturb the interlocked aggregate. This is best achieved when the surface layer is slightly moist (lightly sprayed with water and the surface allowed to dry) and the surface should be kept moist until the primer is applied.

Application of bituminous primer:

The viscosity and rate of application of the primer shall be as specified in the Contract, or as determined by site trials carried out as directed by the Engineer. Where a geo synthetic is proposed for use, the requirements of Clauses 703.3.2 and 703.4 shall apply. The bituminous primer shall be sprayed uniformly in accordance with Clause 501. The method for application of the primer will depend on the type of equipment to be used, size of nozzles, pressure at the spray bar and speed of forward movement. The Contractor shall demonstrate at a spraying trial, that the equipment and method to be used is capable of producing a uniform spray, within the tolerances specified.

Curing of primer and opening to traffic:

A primed surface shall be allowed to cure for at least 24 hours or such other period as is found to be necessary to allow all the volatiles to evaporate before any subsequent surface treatment or mix is laid. Any unabsorbed primer shall first be blotted with an application of sand, using the minimum quantity possible. A primed surface shall not be opened to traffic other than that necessary to lay the next course. A very thin layer of clean sand may be applied to the surface of the primer, to prevent the primer picking up under the wheels of the paver and the trucks delivering bituminous material to the paver.

Tack coat:

Over the primed surface, a tack coat should be applied in accordance with Clause 503.

Quality Control of Work

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

Arrangements for Traffic

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

Measurement for Payment

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

Rate

The contract unit rate for prime coat with adjustments as described in Clause 502.7 shall be payment in full for carrying out the required operations including full compensation for all components listed in Clause 401.8 (i) to (v) and as applicable to the work specified in these Specifications. Payment shall be made on the basis of the provision of prime coat at an application rate of 0.75 kg per square metre, with adjustment, plus or minus, for the variation between this amount and the actual amount approved by the Engineer after the preliminary trials referred to in Clause

The payment shall be made on Smt basis of work done

**Item No:9**

**Road marking with hot applied thermoplastic paints with reflectorizing glass beads on bitumen surface providing and laying a hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250gms per sqm area, thickness of 2.5mm is excluding of surface applied glass beds as per IRC:35-2015. The finished surface to be level, uniform and free from streaks and holes. zebra patta /bump patta lane/center line/ edge line/cut patta. The white color marking should provide luminance coefficient on cement road shall be min 130mcd/m2/lux and Asphalt road shall be min 100 mcd/m2/lux during the service life during the day time. The marking should meet the performance criteria for night time reflectivity, wet reflectivity and skid resistance as mentioned in the section-15 of IRC 35-2015. Warranty for the Retro reflectivity should be two years.**

**1.1 ROAD MARKINGS**

**1.1.1 Description**

This work shall consist of the provision and installation of reflecting road studs and application of continuous or intermittent lines, stop lines, arrows, letters or figures as shown on the Drawings or directed by the Engineer. The work shall include the supply of all labour, tools and equipment, materials, traffic signs as necessary for the safe and efficient completion of the entire work.

**1.1.2 Materials**

Materials for permanent road markings shall be thermoplastic material as described in Section 1.1.2.1 or road marking paint as described in Section 1.1.2.2. Kerb markings shall be painted with road marking paint as described in Section 1.1.2.2. Road markings shall be white or yellow as shown on the drawings. Reflecting road studs are described in Section 1.1.2.3.

#### 1.1.2.1 Hot Applied Thermoplastic Materials

The thermoplastic material shall be factory mixed, from an approved manufacturer and shall be of a tropical grade suitable for application, by the means proposed, to the specified road surfaces, and must demonstrate skid resistance appropriate to local traffic conditions. The material shall comply with BS3262: 1987 'Specification for Hot applied Thermoplastic Road Marking Materials'.

The material shall be supplied in containers which do not contaminate the contents and which protect the contents from contamination and shall be stored in accordance with the manufacturer's instructions. Ballotini (glass beads) may be incorporated in the mixture during the manufacture of the thermoplastic material. The quantity of ballotini included shall be between 13% and 22% by weight of the total mix and shall be counted as part of the aggregate. The Ballotini shall comply with BS6088: 1981 (1993) 'Specification for Solid Glass Beads for use with Road Markings'.

Alternatively the Ballotini (glass beads) may be applied to the surface of the thermoplastic immediately application is complete. Application of the beads shall be at least 300 grams / square metre or as otherwise directed by the Engineer. The Ballotini shall comply with BS6088: 1981 (1993) 'Specification for Solid Glass Beads for use with Road Markings'.

#### 1.1.2.2 Road Marking Paint

All paints shall be road marking paint conforming to BS6044: 1987 'Specification for Pavement Marking Paints' and made by an approved manufacturer and suitable for application, by the means proposed, to the specified road surfaces.

The paint shall be suitable for applying by brush or mechanical means. The following particulars of the paint shall be supplied:

- 1) Composition (analysis by weight)
- 2) Application (brush or spray)
- 3) Type and maximum amount of reducer (thinner)
- 4) Drying time (wheel dry)
- 5) Setting time (to recoat)
- 6) recommended coverage (liters per linear kilometer of 100 mm stripe)
- 7) Heat resistance i.e. maximum road temperature
- 8) Details of any primer, undercoat or tack coat required.

The paint shall be supplied fresh and ready for use in sealed containers which shall be stored in accordance with the manufacturer's instructions.

If required Ballotini (glass beads) may be applied to the surface of the paint immediately application is complete. Application of the beads shall be at least 300 grams / square metre or as otherwise directed by the Engineer. The Ballotini shall comply with BS6088: 1981 (1993) 'Specification for Solid Glass Beads for use with Road Markings'.

#### 1.1.2.3 Reflecting Road Studs

Reflecting road studs shall conform to BS 873: Part 4: 1987 'Road Traffic Signs and Internally Illuminated Bollards – Specification for Road Studs'. Road studs shall show red or white and be uni-directional, bi-directional or omni-directional, as shown on the Drawings or as otherwise directed by the Engineer. They shall incorporate one or more corner cube retro reflective lenses, and the area of lens facing each direction of traffic shall be at least 300 square millimeters. The studs shall be capable of withstanding impacts and no contact shall be possible between the lenses and the vehicle tyres. The studs shall not project more than 20 mm above the level of the surrounding road surface and the lowest part of the lenses shall be more than 5 mm above the surrounding road surface. The studs may be either bonded to, or anchored within, the road surface. The design shall be such as to ensure ample key to the road pavement with adequate load distribution and such that it shall not be possible for heavy equipment such as road rollers and tracked vehicles travelling in the direction of the road axis to meet with any sharp edges whereby the removal of the stud might be facilitated.

#### 1.1.3 Construction Methods

##### 1.1.3.1 Thermoplastic Materials

##### A) Preparation of Road Surface

The material shall be applied only on a surface which is clean and dry. It shall not be laid over loose detritus, mud or similar extraneous matter, or over an old paint marking, or over an old thermoplastic marking which is faulty. New surfaces must be allowed to weather and compact for at least 72 hours before applying the marking. In the case of smooth polished surfaces, e.g. smooth concrete, old asphalt surfacing with smooth polished surface stones, and/or where the method of application requires or the Engineer directs, a tack coat shall be applied to the surface prior to the application. The tack coat shall be as recommended by the manufacturer of the thermoplastic material and to the approval of the Engineer. Faulty thermoplastic markings shall be removed if required by the Engineer.

##### B) Preparation of Thermoplastic Material

The material shall be melted in accordance with the manufacturer's instructions in a heater fitted with a stirrer to give a smooth consistency to the thermoplastic and such that local overheating shall be avoided. The temperature of the mass shall be within the range specified by the manufacturer and shall on no account be allowed to exceed the maximum temperature stated by the manufacturer. The molten material shall be used as expeditiously as possible and for thermoplastics which have natural resin binders or are otherwise sensitive to prolonged heating, the material shall not be maintained in a molten condition for more than 4 hours.

### C) Laying of Thermoplastic Material

Markings may be applied by hand-screening, hand propelled machine or by self-propelled machine as approved or directed by the Engineer. After transfer to the laying apparatus the material shall be maintained within the temperature range specified by the manufacturer and stirred to maintain the right consistency for laying.

In the case of screened application, material shall be laid to a thickness of not less than 3 mm or more than 6 mm, unless specifically authorized by the Engineer. In the case of sprayed application, the material shall be laid to a thickness of not less than 1.5 mm unless specifically authorized by the Engineer. In all cases, the surface produced shall be uniform, appreciably free from bubbles and streaks.

The Contractor shall not proceed with the marking work until the equipment, method of application, and rate of application, as established by a test section, have been approved by the Engineer.

The work shall be carried out very carefully to a regular alignment in accordance with the Drawings. Straight edges and templates shall be used if required by the Engineer.

Where applicable the Ballotini (glass beads) shall be applied to the surface of the thermoplastic immediately application is complete and shall be applied in a controlled manner by use of a spreading device which will permit an even spread from a fixed height of between 300mm and 400mm or otherwise as the Manufacturer may recommend. (A wheel mounted, variable width, funnel applicator may be suitable). The loss of glass beads after 3 weeks traffic shall not exceed 10 percent of the total applied.

### D) Re-use of Thermoplastic Material

At the end of the day's work, as much as possible of the material remaining in the heater and/or laying apparatus shall be removed. This may be broken and used again, provided that the maximum heating temperature has not been exceeded and that the total time during which it is in a molten condition does not exceed the requirements.

#### 1.1.3.2 Road Marking Paint

##### A) Preparation of Road Surface

The paint shall be applied only on a surface which is clean and dry. It shall not be laid over loose detritus, mud or similar extraneous matter or over a thermoplastic marking or over an old paint marking which is faulty or incompatible with the paint being applied. New surfaces must be allowed to weather and compact for at least 72 hours before applying the marking. If a primer or undercoat is necessary to ensure proper adhesion of the marking paint to the road surface without bleeding or discolouration, the primer or undercoat shall be fully compatible with the marking paint and the road surface, and shall be applied only if, and at the rate of application approved by the Engineer.

##### B) Preparation of Paint

All cold-applied paint shall be thoroughly field mixed before applying in order to keep the pigments in uniform suspension. Hot-applied paints shall be heated in a properly designed heater, to the correct laying temperature at which it shall be maintained as required for the method of application. The paint shall on no account be allowed to exceed the maximum temperature specified by the paint manufacturer. The use of thinner or other additives shall not be permitted unless otherwise agreed to by the Engineer.

##### C) Laying of Paint

Markings shall be applied by brush, spray, hand-propelled or self-propelled machine according to the marking configuration and the type of paint approved for use or as directed by the Engineer. The rate of application of paint for each coat shall be that recommended by the manufacturer and shall produce a minimum total cover rate of untinned paint of 0.5 liter per square meter, unless otherwise directed by the Engineer.

Where a spray machine is to be used the Contractor shall not proceed with the marking work until the equipment, method of application, and rate of application, as established by a test section, have been approved by the Engineer.

When more than one coat is used, the succeeding coat shall not be applied until the previous coat has fully set.

The work shall be carried out very carefully to a regular alignment in accordance with the Drawings. Straight edges and templates shall be used if required by the Engineer.

Where applicable the Ballotini (glass beads) shall be applied to the surface of the paint immediately application is complete and shall be applied in a controlled manner by use of a spreading device which will permit an even spread from a fixed height of between 300mm and 400mm or otherwise as the Manufacturer may recommend. (A wheel mounted, variable width, funnel applicator may be suitable). The loss of glass beads after 3 weeks traffic shall not exceed 10 percent of the total applied.

##### D) Protection of Paint Markings

All markings shall be protected from traffic until they have dried sufficiently.

#### 1.1.3.3 Reflecting Road Studs

Road studs shall not be installed over road markings or joints in the road surface. The road surface shall be cleaned, and dust, oil, grease and other contaminants removed. New surfaces shall be allowed to compact and weather for at least 72 hours prior to the installation of the studs. Acceptable methods of fixing include: bonding with an adhesive; anchoring with a road nail; and setting the stud into a drilled cavity in the pavement. However, the method of fixing, including any adhesive or grout used, must be suitable for the specified road surface and the tropical climate. The studs shall be fixed in accordance with the manufacturer's instructions. Studs which become loose or free during the defects liability period will be considered a defect.

#### 1.1.3.4 Tolerances

All forms of line marking and road studs shall be subject to the following tolerances where applicable:

a) Longitudinal lines such as center lines, edge lines and other lines of a continuous nature shall not vary from the design



longitudinal dimensions by more than 10%. Transverse dimensions (line width) shall have a tolerance of – 0% + 10%.

b) Longitudinal lines such as center lines, edge lines, other lines of a continuous nature and road studs shall not vary from the designed alignment by more than 300mm on a curve or 150mm on a straight section.

c) Transverse and other incidental road markings shall not vary from the specified dimensions by more than – 5% of the overall dimension. Alignments shall not vary by more than 20mm from the designed alignment except in the case of center line chain age location which shall not vary by more than 0.5 meters.

#### 1.1.3.5 Defective Materials of Workmanship

Materials which are defective or have been applied in an unsatisfactory manner or to incorrect dimensions or in a wrong location shall be removed, the road pavement made good and the materials replaced, reconstructed and/or properly located, all at the Contractor's expense and to the satisfaction of the Engineer.

#### 1.1.3.6 Protection of Traffic

The Contractor shall protect pedestrian, vehicular and other traffic adjacent to the working area against damage or disfigurement by construction equipment, tools and materials or by splatters, splashes and smirches of paint or other construction materials and shall during the course of the work provide and maintain adequate signs and signals for the warning and guidance of traffic.

#### 1.1.4 Measurement

Markings shall be measured for payment by the area in square meters completed and accepted in place. Where the width or length of laid marking proves to be greater than that specified and is accepted by the Engineer, the specified width or length shall be used when calculating areas for payment. Where the width or length of laid marking proves to be less than that specified and is accepted by the Engineer, the actual width or length of laid marking shall be used when calculating areas for payment.

Temporary markings will not be measured as such, the payment therefore shall be considered incidental to the lump sum for maintenance of traffic.

Reflecting road studs shall be measured by the actual number of studs supplied, installed and accepted.

#### 1.1.5 Payment

The work measured as provided above shall be paid for at the Contract unit prices for each of the items listed in the Bill of Quantities.

The payment shall be full compensation for providing and applying the materials including all labour, equipment, tools and incidentals necessary to complete the work.

Pay items shall be:

|  |              |
|--|--------------|
| 1/1/1 Road Marking - Thermoplastic Material<br>(Indicate whether screed or spray application is required)                    | Square Meter |
| 1/1/2 Road Marking - Road Marking Paint  | Square Meter |
| 1/1/3 Reflecting Road Studs  | Number       |
| 1/1/4 Application of Ballotini<br>(Indicate whether Ballotini is to be applied to the<br>Surface of the marking or mixed in) | Square Meter |

#### Item No:10

**Cat Eye / Road Stud / RPM: Supplying Raised Pavement Markers made of polycarbonate and ABS moulded body and reflective panels with Micro prismatic lens (No Glass bead lens) capable of providing total internal reflection of the light entering the lens face and shall support a load of 13635 kgs. tested in accordance to ASTM D 4280 Type H and complying to Specifications of Category A of MORTH Circular No RW/NH/33023/10-97 & DO III Dt 11.06. 1997. The height, width and length shall not exceed 20 mm, 130 mm and 130 mm and with minimum reflective area of 13 Sqcm on each side and the slope to the base shall be 35 +/- 5 degree. The body of the marker should having finger grip for easy and accurate placement and application with epoxy / bituminous Adhesive as recommended by the manufacturer of the marker. The color of the marker should be as per the IRC 35-2015 and as directed by Engineer-in-charge.**

- As per Description given above and Directed by Engineer in Charge.

**Chief Officer  
Kheralu Nagarpalika**