

Name of work: - 3054 S.R. to Shahpur Approach road, GIFT City Access Gandhinagar (Km.0/000 to 1/000 (Drain, Footpath and Road furniture work.)

## S P E C I F I C A T I O N

### 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

(C) By mechanical means in area of light jungle

### 201 CLEARING AND GRUBBING

#### 201.1 Scope

This work shall consist of cutting, removing and disposing of all materials such as trees, bushes, shrubs, stumps, roots, grass, weeds, top organic soil not exceeding 150 mm in thickness, rubbish etc., which in the opinion of the Engineer are unsuitable for incorporation in the works, from the area of road land containing road embankment, drains, cross drainage structures and such other areas as may be specified on the drawings or by the Engineer. It shall include necessary excavation, backfilling of pits resulting from uprooting of trees and stumps to required compaction, handling, salvaging, and disposal of cleared materials with all loads and lights. Clearing and grubbing shall be performed in advance of earthwork operations and in accordance with the requirements of these Specifications.

#### 201.2 Preservation of Property/Amenities

Roadside trees, shrubs, any other plants, pole lines, fences, signs, monuments, buildings, pipelines, sewers and all highway facilities within or adjacent to the highway which are not to be disturbed shall be protected from injury or damage. The Contractor shall provide and install at his own cost, suitable safeguards approved by the Engineer for this purpose. During clearing and grubbing, the Contractor shall take all adequate precautions against soil erosion, water pollution, etc., and where required, undertake additional works to that effect vide Clause 306. Before start of operations, the Contractor shall submit to the Engineer for approval, his work plan including the procedure to be followed for disposal of waste materials, etc., and the

schedules for carrying out temporary and permanent erosion control works as stipulated in Clause 306.3.

### **201.3 Methods, Tools and Equipment**

Only such methods, tools and equipment as are approved by the Engineer and which will not affect the property to be preserved shall be adopted for the Work. If the area has thick vegetation/roots/trees, a crawler or pneumatic tyred dozer of adequate capacity may be used for clearance purposes. The dozer shall have ripper attachments for removal of tree stumps. All trees, stumps, etc., falling within excavation and fill lines shall be cut to such depth below ground level that in no case these fall within 500 mm of the subgrade. Also, all vegetation such as roots, under-growth, grass and other deleterious matter unsuitable for incorporation in the embankment/subgrade shall be removed between fill lines to the satisfaction of the Engineer. All branches of trees extending above the roadway shall be trimmed as directed by the Engineer. All excavations below the general ground level arising out of the removal of trees, stumps, etc., shall be filled with suitable material and compacted thoroughly so as to make the surface at these points confirm to the surrounding area. Ant-hills both above and below the ground, as are liable to collapse and obstruct free subsoil water flow shall be removed and their workings, which may extend to several metres, shall be suitably treated.

### **201.4 Disposal of Materials**

All materials arising from clearing and grubbing operations shall be taken over and shall be disposed of by the Contractor with all loads and lifts. The rates deemed to include credit towards value of usable materials and salvage value of unusable materials. The offset price of cut trees and stumps as per guidelines/ estimates of State Forest Department shall be deducted from the amount due to the Contractor and deposited with the State Forest Department. The rate is deemed to account for this off-set price also.

### **201.5 Measurements for Payment**

Clearing and grubbing for road embankment, drains and cross-drainage structures shall be measured on area basis in terms of hectares. Clearing

and grubbing of borrow areas shall be deemed to be a part of works preparatory to embankment construction and shall be deemed to have been included in the rates quoted for the embankment construction item and no separate payment shall be made for the same. Cutting of trees upto 300 mm in girth including removal of stumps and roots, and trimming of branches of trees extending above the roadway shall be considered incidental to the clearing and grubbing operations. Cutting of trees, excluding removal of stumps and roots of trees of girth above 300 mm shall be measured in terms of number according to the sizes given below :-

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

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

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

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

## **201.6 Rates**

**201.6.1** The Contract unit rates for the various items of clearing and grubbing shall be payment in full for carrying out the required operations including full compensation for all labour, materials, tools, equipment and incidentals necessary to complete the work. These will also include removal of stumps of trees less than 300 mm girth excavation and back-filling to required density, where necessary, and handling, giving credit towards salvage value disposing of the cleared materials with all lifts and leads. Ground levels shall be taken prior to and after clearing and grubbing. Levels taken prior to clearing and grubbing shall be the base level and will be

accordingly used for computation of quantity of material arising due to clearing and grubbing, including the computation of unsuitable material, if any, which may be required to be removed as per the approval of the Engineer. The levels taken subsequent to clearing and grubbing shall be the base level for computation of earthwork for embankment. Clearing and grubbing shall be restricted to 150 mm only for payment purpose. Where clearing and grubbing is done a level beyond 150 mm, the excess excavation shall be made good as per Clause 301.3.3 and 301.6 to the satisfaction of the Engineer prior to taking up earthwork. This shall not be paid and shall be treated as part of clearing and grubbing.

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

**201.6.3** The Contract unit rate for removal of stumps and roots of trees girth above 300 mm shall include excavation and backfilling with suitable material to required compaction, handling, giving credit towards salvage value disposing of the cleared materials with all lifts and leads.

**201.6.4** The Contract unit rate is deemed to include credit towards value of usable materials and salvage value of unusable materials. The off-set price of cut trees and stumps as per guidelines/ estimates of State Forest Department shall be deducted from the amount due to the Contractor and deposited with the State Forest Department. The rate is deemed to account for this off-set price also.

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

#### **Measurements for Payment:**

**The rate shall be for a unit of one Hectare.**

##### **Item No.2**

Supplying and fixing **reinforced concrete heavy duty non-pressure pipes** with collars for culverts carrying heavy traffic as per IS 458- 1991

specifications including setting the pipes in C.M. 1:2 watering and laying (to level or slopes) of class NP3 of following internal diameters. (ii) 450mm dia.

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

(2) Reinforced concrete pipe shall be NP-3 type conforming to the requirements of IS: 458 and shall be of dia. as specified in the item. Every consignment of cement concrete pipes shall be inspected, if necessary and approved by the Engineer in charge, either at the place of manufacture or at the site before their incorporation in the works.

NP-3 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 manufactures on company's letter head the given hereinafter from.

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 equipment 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 R.C.C. pipes as per the requirement of IS:458 and also carry out the required test at our place. We have acquired equipments for carrying 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 1200,900,600,300 mm. The laying of pipes on the prepared foundation shall start from the outlet and proceed toward the inlet and be completed to the specified lines and grades. The pipes shall be fitted and matched so as 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 their cost of contractor.

(4) The pipes shall be jointed either by collar joints or by flush joints. 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 12 and 20 mm according to the diameter of the pipes. Caulking shall be slightly wet mix of 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 self centering joints with a joining space 13 cm wide. The joining space shall be filled with cement mortar 1 cement and 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 measure along their centre between their inlet and outlet ends in linear meters.

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

**Measurements for Payment:**

The rate shall be for a unit of one Running meter.

**Item No.3**

**Constructing brick masonry chamber for underground C.I. Inspection chamber and bends** with bricks having crushing strength not less than 35Kg/Cm<sup>2</sup> in C.M. 1:5 C.I. cover with frame (Light duty) 455mm x 610mm internal dimensions total weight of cover with frame to be not less than 38Kg. (Wt. of cover 23 Kg.) and Wt. of frame 15Kg. ) (R.C.C. top slabe with 1:2:4 mix (1-cement :2-coarse sand :4-graded stone aggregate 20mm size) foundation concrete 1:5:10 inside plaster 15mm thick with cement mortar 1:3 finished smooth with a floating coat of neat cement on walls and bed concrete etc. complete. (ii) **Inside dimensions 500mm x 700 mm and 450mm deep for pipe line with one or two inlets.**

**1.0 Materials :** Water shall conform to M-1. Cement shall conform to M-3. Coarse sand shall conform to M-5. Brick shall conform to M-15. Stone aggregate shall conform to M-12. Brick bat shaft shall conform to M-14. M.S. bar shall conform to M-18.

The inside dimension of brick masonry chamber shall be 500 mm. x 750 mm. and 450 mm. deep for pipe lines with three or more inlets.

## **2.0. Workmanship :**

2.1.C.I. inspection chamber with provision of C.I. bends of specified size with bolts, nuts and left washers for underground drain shall be enclosed in masonry chamber which shall be constructed as under:

2.2.The excavation shall be done true to dimensions and levels shown on the plans or as directed.

2.3.Bed concrete shall be of 15 cms. thick C.C. 1:5: 10 (1 cement: 5 coarse sand : 10 graded brick bat aggregates). The projection of bed concrete beyond the masonry walls shall be 7.5 cms.

2.4.The wall of the chamber shall be constructed in brick work with C.M. 1 5 and 23 Cms. thick as per relevant specifications of item

2.5. The walls and the bed concrete of chamber shall be plastered inside with 12 mm. thick cement plaster 1:3 (1 cement: 3 coarse sand) finished smooth.

2.6.The gully grating cover shall be hinged to frame to facilitate its opening for leaning and repairs. The frame of the gully gratings shall be fixed on the top of masonry walls of the chamber in 15 cms. thick C.C. 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm. nominal size) laid over the full thickness of walls.

## **2.7. Cover slab :**

2.7.1.The cover slab of R.C.C. 1:2:4 (1 cement: 2 coarse sand : 4 graded stone aggregate 20 mm. nominal 15 cms. thick reinforced with 10 mm. brass at 15 cms. C/C both ways, surface and edges finished fair. Full bearing equal to the width of wall shall be given to the slab on all sides. The frame of manhole cover shall be embedded firmly in R.C.C. Slab so that the top of the frame remains flush with the top of R.C.C. slab.

## **3.0. Mode of measurements & payment :**

3.1.The earth work in excavation providing and laying C.I. inspection chamber and bends shall be measured and paid for separately.

**3.2. The rate shall be for a unit of one number.**



Item No.4

Earthwork in cutting in all sorts of soil and soft murrum including conveying and spreading the stuff, embankment as and where directed within 200meters from the end of the cutting with all required lead and lift.

1. The land width required for the roadway, gutter side slopes and catch water gutters shall be cleared of all trees having a girth of 30 cm and less, loose, stones, vegetation, bushes, slumps 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. 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 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 line, 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 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 incl. the road side gutters to be excavated shall be laid at suitable intervals of 10 m. to 50 m. or other intervals as directed by Engineer to conform to the curved or straight alignment, section 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 may 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 passage 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 his 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 contract 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 accident. Warning signals shall be displayed at 7 mt. 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, animal etc. due to the negligence of the contractor, he will be responsible and liable to all the consequences incl. compensation.

6 All the excavated materials shall be property of Govt. When the useful excavated materials is to be used in embankment within a lead of 200 meter 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 materials 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 Govt. land is available but the excavated useful stuff is to be staked temporarily before use under the same agreement. The contractor shall make his own arrangement 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 materials 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 above 400 up to 500 mt. from the end of the cutting on either side. with all lead and lift.

7. If the contractor does not wish to utilize the quantity of cutting within the specified lead for any reason. Then he may do the embankment work with the earth from other sources ( except borrow pits in the length of the road where cutting stuff is to be utilized) but in that case the full or part quantity on 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 contractor rate shall be a unit of one cubic meter for the start mentioned in the wording of the item of excavation acceptably completed, limited to the dimensions shown on the plans or as directed by the Engineer. Excavation shall be measured in its original positions by taking cross sections before the work starts and after it is entirely completed. The quantity shall be worked by the average end area method. When the classification of the strata changes, the contractor shall bring this to notice of the Engineer, who will then verify and if necessary take levels of the changed strata for purpose of measurement.

#### **Measurements for Payment:**

**The rate shall be for a unit of one cubic metre.**

|                  |  |
|------------------|--|
| <b>Item No.5</b> | Providing and laying <b>cement concrete 1:2:4</b> (1-<br>Cement : 2- coarse sand : 4- graded stone aggregates<br>40 mm nominal size) and curing complete excluding<br>cost of formwork in <b>(A) Foundation and Plinth</b> |
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#### **1.0. Materials:**

**1.1.** Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Grit shall conform to M-8. Graded stone aggregate 20mm nominal size shall conform to M-12.

## 2.0. General:

2.1. The concrete mix is not required to be designed by preliminary tests. The proportion of the concrete mix shall be 1:2:4 (1: cement, 2 coarse sand, 4 graded stone aggregate 10mm nominal size) by volume concrete work shall have exposed concrete surface or as specified in the item.

2.2. The designation ordinary M-100, M-200, M-250 specified as per I. S. corresponding approximately to 1:3:6, 1:2:4, 1:1 1/2 : 3 and 1:1:2 nominal mix of ordinary concrete by volume respectively.

2.3. The ingredients required for ordinary concrete containing one bag of cement of 50 kg by weight for different proportions of mix shall be as under.

| Grade of Concrete | Total quantity of dry aggregate by volume per 50Kgs of cement to be taken as the sum of individual volume of fine and coarse aggregates, maximum | Proportion of fine aggregate to coarse aggregate               | Quantity of water per 50Kgs of cement maximum |
|-------------------|--|--|---|
| 1                 | 2  | 3  | 4   |
| M-100 (1:3:6)     | 300 Liters   | Generally 1:2 for fine aggregate to coarse aggregate by volume | 34 Liters                                     |
| M-150 (1:2:4)     | 220 "  |  | 32 "  |
| M-200             | 160 "  |  | 30 "  |
| (1:1 1/2 : 3)     | 100 "  | but subject to and upper limit of 1:1 1/2 and lower limit 1:3  | 27 "  |
| M-250 (1:1:2)     |  |  |   |

2.4. The water cement ratios shall not more than those specified in the above table. The cement content of specified in the table shall be increased if the quantity of water in a mix has to be increased to overcome the difficulties of placement and compaction so that the water cement ratio specified in the table is not exceeded.

2.5. Workability of the concrete shall be controlled by maintaining a water cement ratio that is bound to give a concrete mix which is just sufficiently wet to be placed and compacted without difficulty with the means available.

2.6. The maximum size of coarse aggregate shall be as large as possible within the limits specified but in no case greater than one fourth of the minimum thickness of the member, provided that the concrete can be placed

without difficulty so as to surround all reinforcement thoroughly and to fill the corners of the form.

2.7. For reinforced concrete work, coarse aggregates having a nominal size of 20mm are generally considered satisfactory.

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

2.9. Where the reinforcement is widely spaced as in soloed slabs, limitations of size of the aggregate may not be so strict and its nominal maximum size may sometimes be as great as or greater than the minimum cover.

2.10. Admixture may be used in concrete only with approval of engineer in charge based upon the evidence that with the passage of time, neither the compressive strength of concrete is reduced nor are other requisite qualities of concrete and steel impaired by the use of such admixtures.

### **3.0. Workmanship:**

3.1. Proportioning: Proportioning shall be done by volume except cement which shall be measured in terms of bags of 50 kg weight. The volume of one such bag being taken as 0.0342 cu. Metre. Boxes of suitable sizes shall be used for measuring sand and aggregate. The size of the boxes shall be 35cms. X 25 cms and 40 cms deep. While measuring the aggregate and sand, the box shall be filled without shaking ramming or hammering. The proportioning of sand shall be on the basis of its dry volume and in case of damp sand allowances for bulking shall be made.

### **3.2. Mixing:**

3.2.1. For all work concrete shall be mixed in a mechanical mixer which along with other accessories shall be kept in first class working condition and so maintained throughout the construction. Measured quantity of aggregate, sand, cement required for each batch shall be poured into the drum of the mechanical mixer in one minute. Mixing shall be continued till materials are uniformly distributed and uniform colour of the entire mass is

obtained and each individual particle of the coarse aggregate shows complete coating of mortar containing its proportionate amount of cement. In no case shall the mixing be done for less than 2 minutes after all ingredients have been put into the mixer.

3.2.2. When hand mixing is permitted by the engineer in charge for small jobs or for certain other reasons. It shall be done on the smooth watertight platform large enough to allow efficient turning over the ingredients of concrete before and after adding water. Mixing platform shall be so arranged that no foreign material gets mixed with concrete nor does the mixing water flow out. Cement in required number of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregate, which shall also be spread in a layer of uniform thickness on the mixing platform. Dry coarse and fine aggregate and cement shall then be mixed thoroughly by 7 turning over to get a mixture of uniform colour. Specified quantity of water shall then be added gradually through a rose can and the mass turned over till a mix of required consistency is obtained. In hand mixing quantity of cement shall be increased by 10 percent above that specified.

3.2.3. 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 mixture shall contain only two thirds of normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

### **3.3. Consistency:**

3.3.1. The degree of consistency which shall depend upon the nature of the work and methods of vibration of concrete shall be determined by regular slump tests in accordance with I.S.1199-1959. The slump of 10 mm to 25mm shall be adopted when vibrators are used and 80 mm when vibrators are not used.

### **3.4. Inspection:**

3.4.1. Contractor shall give the Engineer-in-charge due notice before placing any concrete in the forms to permit him to inspect and accept the work and forms as to their strength, alignment, and general fitness but such

inspection shall not relieve the contractor of his responsibility for the safety of men, machinery, materials and for results obtained. Immediately before concreting, all forms shall be thoroughly cleaned.

3.4.2. Centering design and its erection shall be got approved from the Engineer-in-charge. One carpenter with helper shall invariably be kept present throughout the period of concreting. Movement of labour and other persons shall be totally prohibited for reinforcement laid in position. For access to different parts, suitable mobile platforms shall be provided so that steel reinforcement in position is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, kapachi or metal pieces shall not be used for this purpose.

### **3.5. Transporting and laying:**

3.5.1 The method of Transporting and placing concrete shall be as approved. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material take place. All form work shall be cleaned and made free from standing water, dust snow or ice immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the engineer in charge has been obtained.

3.5.2. Concreting 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. Except where otherwise agreed by the engineer in charge concrete shall be deposited in exceeding 0.30 metre in all other cases.

3.5.3. Unless otherwise agreed to by the engineer in charge concrete shall not be dropped into place from a height exceeding 2 metres. When trunking or chutes are used they shall be kept close and used in such a way as to avoid segregation. When concreting has to be resumed on a surface which has hardened, it shall be roughened, swept clean, thoroughly wetted and covered with a 13mm thick layer of mortar composed of cement and sand in the same ratio as in the concrete mix itself. This 13mm layer or mortar composed of cement and sand in the same ratio as in the concrete mix itself.



Where concrete has not fully hardened all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgement of any particles of coarse aggregate. The surface shall then be thoroughly wetted, all free water removed and then coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 150mm in thickness and shall be well rammed against old work, particular attention being given to corners and close spots.

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

Concrete shall be cream up to form an even surface, compaction shall be completed before the initial setting starts within 30 minutes of addition of water to dry mixture. During compaction it shall be observed that needle vibrators are not applied on reinforcement which is likely to destroy the bond between concrete and reinforcement.

### **3.6. Curing:**

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

### **3.7. Sampling and Testing of concrete:**

3.7.1. Samples from fresh concrete shall be taken as per I.S 1199-1959 and cubes shall be made cured and tested at 7 days or 28 days as per requirements in accordance with I.S 516-1959. A random sampling procedures shall be adopted to ensure that each concrete batch shall have a reasonable chance of being tested the sampling should be spread over the

entire period of concreting and cover all mixing units. The minimum frequency of sampling of concrete of each grade shall be in accordance with following.

| Quantity of concrete in the work | No. of Samples             | Quantity of concrete in the works         | No. of samples |
|----------------------------------|----------------------------|---|----------------|
| 1-5 Cmt                          | 1                          | 16-30 Cmt                                 | 3              |
| 6-15 Cmt                         | 2                          | 31-50 Cmt                                 | 4              |
| 51 and above                     | 4 + one additional thereof | for each additional 50 M. or part thereof |                |

NOTE: At least one sample shall be taken from each shift. Ten test specimens shall be made from each sample, five for testing at 7 days and the remaining five at 28 days. The samples of concrete shall be taken on each day of the concreting as per above frequency. The number of specimens may be suitably increased as deemed necessary by the engineer in charge when procedure of tests given above reveals a poor quality of concrete and in other special cases.

**3.7.2** The average strength of the group of cubes cast for each date shall not be less than the specified strength of 150 kg./cm at 28 days. 20% of the cubes cast for each day may have value less than the specified strength provided the lowest value is not less than 85% of the specified strength. If the concrete made in accordance with the proportions given for a particular grade, does not yield the specified strength, such concrete shall be classified as belonging to the appropriate lower grade. Concrete made in accordance with the proportions given for a particular grade shall not however, be placed in a higher grade on the ground that the test strength are higher than the minimum specified.

### **3.8. Stripping:**

**3.8.1.** The engineer in charge shall be informed in advance by the contractor of his intention to strike the form work. While fixing the time for removal of form work, due consideration shall be given to local conditions, character of the structure the weather and other condition that influence the setting of concrete and of the materials used in the mix. In normal circumstances where temperatures are above 20 c and where ordinary

concrete is used. Forms may be struck after expiry of periods specified in item no. 9.1 (A) for respective item of form work.

**3.8.2.** All form work shall be removed without causing any shock or vibration as would damage the concrete. Before the soffit and struts are removed, the concrete surface shall be exposed where necessary in order to ascertain that the concrete has sufficiently hardened. Centering shall be gradually and uniformly lowered in such manner as to permit the concrete take stresses due to its own weight uniformly. Whether internal metal ties are permitted they or their removable parts shall be extracted without causing any damage to the concrete and remaining holes filled with mortar. No permanently embedded metal part shall have less than 25 mm cover to the finished concrete surface. Where it is intended to reuse the form work, it shall be cleaned and made good to the satisfaction of the engineer in charge. After removal of form work and shuttering, the executive the engineer shall inspect the work and satisfy by random checks that concrete produced is of good quality.

**3.8.3.** Immediately after the removal of forms, all exposed bolts etc., passing through the cement concrete member and unused of shuttering or any other purpose shall be cut inside the cement concrete member to a depth of at least 25mm below the surface of the concrete and the resulting holes be filled by cement mortar. All fine caused by form joints all cavities produced by the removal of form ties and all other holes and depressions honeycomb spots, broken edges or corners and other defects shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in then proportions used in the grade of concrete that is being finished and of as dry consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which are pointed shall be kept moist for a period of 24 hours.

If rock pockets/ honeycombs in the opinion of the engineer in charge are such an extent or characters as to effect the strength of the structure materially or to endanger the life of the steel reinforcement he may declare the concrete defective and require the removal and replacement of the portions of the structure affected.

#### 4.0. Mode of Measurement and payment:

4.1. The consolidated cubical contents of concrete work as specified in item shall be measured. The concrete laid in excess of section shown drawings or as directed shall not be measured. No deduction shall be made for-

(a) Ends of dissimilar materials such as joints, beams, posts, girders, rafters, purloin trusses corbels and steps etc, up to 500 Sq. Cm. in section.

(b) Opening up to 0.1 Sq. M.

4.2. The rate includes cost of all materials, labour, tools and plant required for mixing, placing in position, vibrating and compacting, finishing as directed, curing and all other incidental expenses for producing concrete of specified strength. The rate excludes the cost of form work.

4.3. The rate shall be for a unit of one cubic metre.

#### Item No.6

Providing and fixing pre-cast concrete kerb stone of gray cement based concrete block 30cm length, 30cm height and 15cm thick of M200 grade concrete as per approved design and including excavation for fixing in proper line and level, filling the joint with C:M 1:3 (1 cement:3 fine sand) etc complete.

#### **General**

This work shall consist of Providing and fixing pre-cast concrete kerb stone of the shape and dimensions shown on the drawings and conforming to these Specifications or as approved by the Engineer in charge.

#### **Material**

pre-cast concrete kerb stone shall be of gray cement based concrete block 30 cm length, 30 cm height and 15cm thick of 200 grade concrete as per approved design

#### **Cement**

Cement shall conform specification no M-3 from booklet of specification for building works

### Water

water shall confirm specification no M-1 from booklet of specification for building works

### Sand

Sand shall confirm specification no M-6 from booklet of specification for building works. Cement and sand for base layer shall be mixed in proportions of 1:3 ( 1 cement : 3coarse sand by volume) Cement and sand shall be proportioned by volume after makingdue allowance for bulking. The require quantity of water shall then be added and themortar mixed to produce workable consistency before mixing platform shall bethoroughly cleaned before changing from one type of cement to another.

For painting on C.C. kerb shall be carried out as per instruction and upto satisfaction of Engineer-in-charge.

### Mode of measurement:

The Item shall be measured for its Length limiting dimensions to those specified on plan or as directed.

**The rate shall be for a unit of one running meter.**

#### Item No.7

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

### **MATIRIAL**

Pre-cast Interlocking cement concrete tiles pre-cast interlocking cement concrete tiles shall be made in M-300 Concrete gradeand of approved brand, make and design as approved by Engineer in chargeThe size shape and design of pre-cast cement concrete interlocking tiles shallgenerally be as per

manufacturers product or as directed by the Engineer in charge and Architect. The pre-cast cement concrete interlocking tiles shall satisfy the tests as regards transverse strength, resistance to wear and water absorption. The colour, size, shape and design of the pre-cast cement concrete interlocking tiles shall be directed by Engineer Or Architect. The pre-cast cement concrete interlocking tiles shall be of best quality as approved by the Engineer In charge. They shall be flat and true to shape. They shall be free from cracks, crazing spots, chipped edges and corners. The glazing shall be of uniform shade.

### **Sand**

Sand shall conform specification no M-6 of specification booklet for Building works

### **2.0 WORKMANSHIP.**

The pre-cast cement concrete interlocking tiles shall be laid on a 75 mm thick perfectly leveled sand layer in proper grade and slope. Pre-cast cement concrete interlocking tiles of approved quality, shape and design shall be laid in approved pattern evenly to level and slope as directed by Engineer in charge over a bed of a base of sand layer. Sand for base layer shall be compacted and shall be in true level and slope. Laying: The pre-cast cement concrete interlocking tiles shall be laid in plain, diagonal or other pattern as directed. The concrete blocks shall be laid properly and set home by gentle tapping.

### **Mode of Measurement & Payment :**

The item shall be measured for its breadth and height limiting dimensions to those specified on plan or as directed. The rate shall be for a unit of one square meter. The payment will be made on square meter basis of the finished work.

**The rate shall be for a unit of one Square Meter.**

**Item No.8** Providing and fixing lighting on steel hollow circular poles of standard specifications on service road. 5m high fixed on footpath with cement concrete, 20m a part and fitted with one LED on one arm.

#### **Steel Tubular Poles (OH-PL/STP)**

##### **Scope:**

##### **Specification No (OH-PL/STP)**

Supply of steel tubular swaged pole (Swan type or other wise) as per IS 2713: Part 2 1980, fabricated with earthing stud, pole base plate with required numbers of holes as per drawing and erecting the pole, including painting in provided foundation as per method of construction.

##### **Material:**

***Pole:*** Steel tubular swaged pole (Swan type or other wise) as per Table No 8/1

***Base plate:*** MS Base plate of 30x30x0.6 cms.

***Pole Cap:*** Pole cap 4 mm thick with inside diameter equal to outside Dia. of the pole and minimum height shall be 100 mm and welded or fixed with set screws.

***Earth Stud:*** Earth stud 5/8"mm Dia. bolt welded to pole with required size nut and double G.I. /M.S. washers

***Paint:*** Red oxide paint as primer, bituminous paint, Aluminium paint/ any other paint as per the instructions of engineer-in-charge.

##### **Method of construction:**

Before erection of pole base plate of size 30x30x0.6 cm shall be full length welded or fixed with 4 set screws at the bottom of the pole, a suitable hole of required diameter and at specified height shall be drilled and welded with

knock out nipple for laying wires for street light poles at required height. The pole shall be then painted by 2 coats of red oxide paint and one coat of bituminous paint before erection for min 1/6 length which is to be buried in ground & after erection remaining portion to be painted by twocoats of aluminium paint. The pole shall be erected in provided pit with cement Concrete foundation and muffing in perfect plumb.

**Mode of Measurement:**

Executed quantity will be measured on number basis. (I.e. each)

Table 8.1/1

Swaged Poles Made From Steel of Ultimate as per IS: 2713 (Part-II) 1980

| Designation | Overall Length in mtr | Planting Depth in mtr | Height above Ground in mtr | Length of Sections in mtr |           |        | Outside Diameter / Thickness of Sections |              |              | Approx Weight of Pole. Kg |
|-------------|-----------------------|-----------------------|----------------------------|---------------------------|-----------|--------|--|--------------|--------------|---------------------------|
|             |                       |                       |                            | Bottom h3                 | Middle h2 | Top h1 | Bottom                                   | Middle       | Top          |                           |
| 410 SP-28   | 9.00                  | 1.50                  | 7.50                       | 5.00                      | 2.00      | 2.00   | 139.7 x 4.50                             | 114.3 x 3.65 | 88.9 x 3.25  | 113                       |
| 410 SP-31   | 9.00                  | 1.50                  | 7.50                       | 5.00                      | 2.00      | 2.00   | 165.1 x 4.50                             | 139.7 x 4.50 | 114.3 x 3.65 | 147                       |
| 410 SP-52   | 11.00                 | 1.80                  | 9.20                       | 5.60                      | 2.70      | 2.70   | 165.1 x 4.50                             | 139.7 x 4.50 | 114.3 x 3.65 | 175                       |
| 410 SP-60   | 12.00                 | 2.00                  | 0.60                       | 5.80                      | 3.10      | 3.10   | 165.1 x 5.40                             | 139.7 x 4.50 | 114.3 x 3.65 | 208                       |

**Item No.9** Supply of exposed finish **precast concrete beanches** with necessary reianforcement in grey colour of size 1200 x 540 x 400/830 mm.

**Material :**

1. Concrete mix design M-30 Grade concrete mix in accordance with IS : 10269/Latest in gray cement by using vibro - compaction technique and with reinforcement as detailed inGovng. specn.



2. Reinforcement steel TMT reinforcement bars conforming to IS : 1786/latest of dia 10 mm used as main reinforcement bar and 4 mm dia mild steel bars used as stirrups as per drawing

3. Material for connecting seating plank with leg 12 mm dia X 65 mm long galvanized steel countersunk bolts Confmng. to IS : 1367 / latest with EVA washer

4. Material for connecting back rest plank with leg Half threaded carriage bolts and nuts of size 165 mm length X 8 mm dia with EVA and steel washers

**Generic :**

1. Governing Specification Surface Mount Reinforcement Bench Conforming to RDSO specn.
2. Chair / Bench Arms : Without
3. Scope of supply Scope of supply includes Erection and installation of precast concrete reinforce benches with backrest
4. Seat / plank length  $\pm 3$  mm : 1200 mm
5. Seat height  $\pm 3$  mm : 540 mm
6. Seat width  $\pm 3$  mm : 400 mm
7. Total bench height (including backrest )  $\pm 3$  mm : 830 mm
8. Leg width  $\pm 3$  mm : 140 mm

**WARRANTY :** 1. Warranty period in number of years : 1 - Year

**Measurements for Payment:**

**The rate shall be for a unit of one Number.**

**Item No.10** Providing and laying 25 mm thick (compacted) Semi-Dence Bituminous Concrete on existing bituminous surface and using specified graded black trapped machine crushed aggregate with 5% Bitumen VG-30 grade bitumen by Wt. of total mix as per MORT & H gradation and specification

including heating and mixing of asphalt with B.T. Chips in continuous batch mix plant and transporting same at site and spreading by sensor paver finisher and consolidation the same with pair of 8 tonnes to 10 tonnes vibratory roller to achieve desired density and including flushing the stone dust @ 0.03 Cum./10 Sqm. including cost of required tools, plants all materials, equipments, fire wood, oil, kerosene, labour charges etc complete.

## **508. SEMI-DENSE BITUMINOUS CONCRETE**

### **508.1 Scope:**

This clause specifies the construction of semi Dense Bituminous Concrete, for use in wearing / binder and profile corrective courses. This work shall consist of construction in a single or multiple layers of semi dense bituminous concrete on a previously prepared bituminous bound surface. A single layer shall be 25 mm to 100 mm in thickness.

### **508.2 Materials:**

#### **508.2.1 Bitumen:**

The bitumen shall be paving bitumen of VG-30 penetration grade complying with Indian Standard Specification for paving Bitumen, IS: 73

#### **508.2.2 Coarse Aggregates:**

The coarse aggregates shall be generally as specified in Clause 507.2.2 except that the aggregates shall satisfy the physical requirement of Table 500-14.

The coarse aggregated shall consist of crushed rock crushed gravel or other hard materials retained on the 2.36 mm sieve. They shall be clean, hard, durable, of cubical shape, free from dust and soft or friable matter, organic or other deleterious substances. Where the contractor's selected source of aggregates have poor affinity for bitumen, as a condition for the approval of that source, the bitumen shall be treated with an

approved anti - stripping agent, as per the manufacturer's recommendations, without additional payment. Before approval of the source, the aggregates shall be tested for stripping. The aggregates shall satisfy the physical requirements specified in Table-500-8, for dense bituminous macadam.

Where crushed gravel is proposed for use as aggregated, not less than 90% by weight of the crushed material retained on the 4.75 mm sieve shall have at least two fractured faces.

### 508.2.3. Fine aggregates:

Fine aggregates shall consist of crushed or naturally occurring mineral material, or a combination of the two passing the 2.36 mm sieve and retained on the 75 micron sieve. They shall be clean, hard, durable, dry and free from dust, and soft or friable matter, organic or other deleterious matter.

The fine aggregate shall have a sand equivalent value of not less than 50 when tested in accordance with the requirement of IS: 2720 (Part-37).

**TABLE 500-8.**  
**PHYSICAL REQUIREMENTS FOR COURSE AGGREGATE FOR SEMI DENSE**  
**BITUMINOUS MACADAM.**

| Property              | Test   | Specification                    |
|-----------------------|--|----------------------------------|
| Cleanliness<br>(dust) | Grain size analysis  | Max 5% passing<br>0.075 mm sieve |
| particle shape        | Flakiness and<br>Elongation Index<br>(combined) <sup>2</sup>         | Max 30%                          |
| Strength*             | Los Angeles Abrasion<br>Value <sup>3</sup><br>Aggregate Impact Value | Max 35%                          |
| Polishing             | Polished stone Value <sup>5</sup>                                    | Max 27%                          |
| Durability            | Soundness : 6  | Min 55%                          |
|                       | Sodium Sulphate  | Max 12%                          |

|                     |  |                              |
|---------------------|--|------------------------------|
|                     | Magnesium Sulphate                                   | Max 18%                      |
| Water Absorption    | Water absorption 7                                   | Max 2%                       |
| Stripping           | Coating and stripping of bitumen Aggregate Mixture 9 | Minimum Retained coating 95% |
| water sensitivity** | Retained Tensile Strength.                           | Min 80%                      |

Notes:

1. IS: 2386 Part-I 6. IS: 2386 Part 5

2. IS: 2386 Part 1 7. IS: 2386 Part 3

(The elongation test may be done on non-flaky aggregates in the sample)

3. IS: 2386 Part 4\* 8. AASHTO T283\*\*

4. IS: 2386 Part 4\* 9. IS: 6241

5. BS: 812 Part 114

\* Aggregate may Satisfy requirement of either of these two tests.

\*\* The water sensitivity test is only required if the minimum retained coating in the stripping test is less than 95%.

#### 508.2.5 Aggregate grading and binder content:

When tested in accordance with IS: 2386 Part-I (Wet sieving method), the combined grading of the coarse and fine aggregates and added filler shall fall within the limits shown in Table 500-15 for grading 1 or 2 as specified in the contract.

#### 508.3. Mixture Design:

##### 508.3.1 Requirement for the mixture:

Apart from conformity with the grading and quality requirement of individual ingredients the mixture shall meet the requirements set out in Table 500-16.

**TABLE 500-14.**

PHYSICAL REQUIREMENTS FOR COURSE AGGREGATE FOR SEMI DENSE  
BITUMENTIOUS CONCRETE PAVEMENT LAYERS.

| Property            | Test   | Specification                 |
|---------------------|--|-------------------------------|
| Cleanliness (dust)  | Grain size analysis  | Max 5% passing 0.075 mm sieve |
| particle shape      | Flakiness and Elongation Index (combined) <sup>2</sup>             | Max 30%                       |
| Strength*           | Lose Angeles Abrasion Value <sup>3</sup><br>Aggregate Impact Value | Max 35%                       |
| Polishing           | Polished stone Value <sup>5</sup>                                  | Max 27%                       |
| Durability          | Soundness : 6  | Min 55%                       |
|                     | Sodium Sulphate  | Max 12%                       |
|                     | Magnesium Sulphate   | Max 18%                       |
| Water Absorption    | Water absorption 7   | Max 2%                        |
| Stripping           | Coating and stripping of bitumen Aggregate Mixture 9               | Minimum Retained coating 95%  |
| water sensitivity** | Retained Tensile Strength.   | Min 80%                       |

Notes:

1. IS: 2386 Part-I                      6. IS: 2386 Part 5

2. IS: 2386 Part 1                      7 IS: 2386 Part 3

(The elongation test may be done on non-flaky aggregates in the sample)

- 3 IS: 2386 Part 4\* 8 AASHTO T283\*\*

- 4 IS: 2386 Part 4\* 9 IS: 6241

- 5 BS: 812 Part 114

\* Aggregate may Satisfy requirement of either of these two tests.

\*\* The water sensitivity test is only required if the minimum retained coating in the stripping test is less than 95%.

The requirements for minimum test is only required if the mineral aggregate (VMA) are set out in Table 500-12.

### 508.3.2 Binder Content:

The binder content shall be optimized to achieve the requirement of the mixture set out in Table 500-16 and the traffic volume as specified in the contract. The marshall method for determining the optimum binder content shall be adopted as described in the Asphalt Institute Manual MS\_2, replacing the aggregates retained on the 26.5 mm sieve an retained on the 22.4 mm sieve, where approved by the Engineer. Asphalt VG-30@ 5% i.e. 50 Kg./M.T. by wt. of the total mix shall be used for mixing.

TABLE 500-15.

#### COMPOSITION OF SEMI DENSE BITUMINOUS CONCRETE PAVEMEMNT LAYERS

| Grading                | 1  | 2        |
|------------------------|--|----------|
| Nominal aggregate size | 13 mm  | 10 mm    |
| Layer Thickness        | 35049 mm   | 25-30 mm |
| IS sieve 1(mm)         | Cumulative % by weight of total aggregate passing. |          |
| 45                     |  |          |
| 37.5                   |  |          |
| 26.5                   |  |          |
| 19                     | 100  |          |
| 13.2                   | 90-100   | 100      |
| 9.5                    | 70-90  | 90-100   |
| 4.75                   | 35-51  | 35-51    |
| 2.36                   | 24-39  | 24-39    |
| 1.18                   | 15-30  | 15-30    |
| 0.6                    | -  | -        |
| 0.3                    | 9-19   | 9-19     |
| 0.15                   | -  | -        |
| 0.075                  | 3-8  | 3-8      |
| Bitumen content %by    | Min 4.5  | Min 5.0  |

|                                |       |       |
|--------------------------------|-------|-------|
| mass of total mix <sup>2</sup> |       |       |
| Bitumen grade (Pen)            | 60/70 | 60/70 |

Note:

1. The combined aggregate grading shall not vary from the low limit on one sieve to the high limit on the adjacent sieve.
2. Determined by the marshall method.

Table 500-16.

REQUIREMENTS FOR SEMI DENSE BITUMINOUS PAVEMENT LAYERS.

|   |   |
|---|---|
| minimums stability (KN at 60 C)           | 8.2   |
| Minimum Flow (mm)                         | 2   |
| Maximum flow (mm)                         | 4   |
| Compaction level (Number of blows)        | 75 blows on each of the two faces of the specimen |
| Per cent air voids                        | 3-5   |
| per cent voids in mineral aggregate (VMA) | see Table 500-12                                  |
| Per cent voids filled with bitumen (VFB)  | 65-78   |

508.3. **Job Mix Formula:**

The contractor shall inform the Engineer in writing, at least 20 days before the start of the work, of the job mix formula proposed for use in the works, and shall give the following details:

- i) Source and location all materials:
- ii) Proportions of all materials expressed as follows where each is applicable:
  - a) Binder type, and percentage by weight of total mixture.
  - b) Coarse aggregate / Fine aggregate / Mieral filler as percentage by weight in the combined grading.

- iii) A single definite percentage passing each sieve for the mixed aggregate:
- iv) The individual grading of the individual aggregate fractions, and the proportion of each in the combined grading.
- v) The results of tests enumerated in Table 500-11 as obtained by the Contractor:
- vi) Where the mixer is a batch mixer, the individual weights of each type of aggregate, and binder per batch.
- vii) Test results of physical characteristics of aggregates to be used:
- viii) Mixing temperature and compacting temperature.

While establishing the job formula, the contractor shall ensure that it is based on a correct and truly representative sample of the materials that will actually be used in the work and that the mixture and its different ingredients satisfy the physical and strength requirement of these specifications.

Approval of the job mix formula shall be based on independent testing by the Engineer of which samples of all ingredients of the mix shall be furnished by the Contractor as required by the Engineer.

The approved job mix formula shall remain effective unless and until a relives job mix formula is approved. Should a change in the source of materials be proposed, a new job mix formula shall be forwarded to the Engineer for approval before the material.

#### **508.3.4.Plant trials - permissible variation in job mix formula :**

Once the laboratory job mix formula is approved, the contractor shall carry out plant trials at the mixer to establish that the plant can be set up to produce a uniform mix conforming to the approved job mix formula. The permissible variations of the individual percentages of the various ingredients in the actual mix from the job mix formula to be used shall be within the limits as specified in table 500-13. These variations are intended to apply to individual specimens taken for quality control tests in accordance with section. 900.



**TABLE 500-13. PERMISSIBLE VARIATIONS FROM THE JOB MI FORMULA**

| Description                                | Permissible variation |                |
|--|-----------------------|----------------|
|  | Base/binder course    | Wearing course |
| Aggregate passing 19 mm sieve or large     | +/- 8%                | +/- 7%         |
| Aggregate passing 13.2 mm, 9.5 mm          | +/- 7%                | +/- 6%         |
| Aggregate passing 4.75 mm                  | +/- 6%                | +/- 5%         |
| Aggregate passing 2.36 mm, 1.18 mm, 0.6 mm | +/- 5%                | +/- 4%         |
| Aggregate passing 0.3 mm, 0.15 mm          | +/- 4%                | +/- 3%         |
| Aggregate passing 0.075 mm                 | +/- 2%                | +/- 1.5%       |
| Binder content                             | +/- 0.3%              | +/- 0.32%      |
| Mixing temperature                         | +/- 10 C              | +/- 10 C       |

Once the plant trials have demonstrated the capability of the plant, and the trials are approved, the laying operation may commence. Over the period of the first month of production for laying on the works, the Engineer shall required additional testing of the product to establish the reliability and consistency of the plant.

### 508.3.5 Laying trails :

Once the plant trials have been successfully completed and approved, the contractor shall carry out laying trials, to demonstrate that the proposed mix can be successfully laid, and compacted all in accordance with Clause 501. The laying trial shall be carried out on a suitable area which is not to form part of th works, unless specifically approved in writing, by the Engineer. The area of the laying trials shall be minimum of 100 sq.m. of construction similar to that of the project road, and it shall be in all respects, particularly compaction, the same as the project construction, on which the bituminous materials is to be laid.

The contractor shall previously inform the Engineer of the proposed method for laying and compacting the materials. The plant trials shall then establish if the proposed laying plant, compaction plant, and methodology is capable of producing satisfactory results. The density of the finished paving layer shall be determined by taking course, no sooner than 24 hours after laying, or by other approved method.

Once the laying trials have been approved, the same plant and methodology shall be applied to the laying of the material on the project, and no variation of either shall be acceptable, unless approved in writing by the Engineer, who may at his discretion require further laying trials.

#### **508.4. Construction operations**

##### **508.4.1 Weather and seasonal limitations:**

Laying shall be suspended while free -standing water is present on the surface to be covered, or during rain, fog and dust storms. After rain, the bituminous surface, primer or tack coat, shall be blown off with a high pressure air jet to remove excess moisture, or the surface left to dry before laying shall start. Laying of bituminous mixtures shall not be carried out when the air temperature at the surface on which it is to be laid is below 10 c or when the wind speed at any temperature exceeds 40 km./h at 2 m height unless specifically approved by the Engineer.

##### **508.4.2 Preparation of base.**

The surface on which the semi dense bituminous material is to be laid shall be prepared in accordance with clauses 501 and 902 as appropriate, or as directed by the Engineer. The surface shall be thoroughly swept clean by mechanical broom and dust removed by compressed air. In locations where a mechanical broom cannot access, other approved methods shall be used as directed by the Engineer.

##### **508.4.3 Geosynthetics:**

Where Geosynthetics are specified in the Contract this shall be in accordance with the requirements stted in clause 703.

##### **508.4.4. Stress absorbing layer:**

Where a stress absorbing layer is specified it the contract, this shall be applied in accordance with the requirement of Clause 522.

##### **508.4.6 Mixing and transportation of the mixture:**

Pre - mixed bituminous materials, incl. bituminous macadam, dense bituminous macadam, semi dense bituminous concrete and

bituminous concrete, shall be prepared in a batch mix plant of adequate capacity and capable of yielding a mix of proper and uniform quality with through coated aggregates. Appropriate mixing temperatures can be found in Table 500-5 of these specifications. the difference in temp. between the binder and aggregate should at no time exceed 14 C. In order to ensure uniform quality of the mix and better coating of aggregates, the batch mix plant shall be calibrated from time to time.

If a continuous mixing plant is to be used for mixing the bituminous bound macadam, the contractor must demonstrate by laboratory analysis that the cold feed combed grading is within the grading limits specified for that bituminous bound materials. In the case of a designed job mix, the bitumen and filler intent shall be derived using this combined grading. Further details are available in the manual for constructional end supervision of bituminous works.

Bituminous materials shall be transported in clean insulated vehicles, and unless otherwise agreed by the Engineer, shall be covered while in transit or awaiting tipping. Subject to the approval of the Engineer, a thin of diesel or lubricating oil may be applied to the interior of the vehicle to prevent sticking and to facilitate discharge of the materials.

#### **508.4.7 Spreading:**

Except in areas where a mechanical paver cannot access, bituminous materials shall be spread, leveled and tamped by an approved self propelled paving machine. As soon as possible after arrival at site, the material shall be supplied continuously to the paver and laid without delay.

The rate of delivery of materials to the paver shall be regulated to enable the paver to operate continuously. The travel rate of the paver, and its method of operations, shall be adjusted to ensure an even and uniform flow of bituminous material across the screed, free from dragging, tearing and segregation of the materials. In areas with restricted space where a mechanical paver cannot be used, the material shall be

spread, raked and leveled with suitable hand tools by experienced staff, and compacted to the satisfaction of the Engineer.

**508.4.8. Rolling:**

Bituminous materials shall be laid and compacted in layers which enable the specified thickness, surface level, regularity requirement and compaction to be achieved.

Compaction of bituminous materials shall commence as soon as possible after laying. Compaction shall be substantially completed before the temperature falls below the minimum rolling temperatures stated in the relevant part of these specifications. Rolling of the longitudinal joints shall be done immediately behind the paving operation. After this, rolling shall commence at the edges and progress towards the centre longitudinally except that on super elevated and unidirectional cambered portions, it shall progress from the lower to the upper edge parallel to the centre line of the pavement. Rolling shall continue until all roller marks have been removed from the surface. All deficiencies in the surface after laying shall be made good by the attendants behind the paver, before initial rolling is commenced. The initial or breakdown rolling shall be done with 8-10 tones dead weight smooth wheeled dead weight or vibratory roller or with a pneumatic typed roller of 12 to 15 tones weight having nine wheels, with a tyre pressure of at least 5.6 kg./Sq.cm. The finish rolling shall be done with 6 to 8 tonnes smooth wheeled tandem rollers.

Where compaction is to be determined by density of cores the requirements to prove the performance of rollers shall apply in order to demonstrate that the specified density can be achieved. In such cases the contractor shall nominate the plant, and the method by which he intends to achieve the specified level of compaction and finish at temperature above the minimum specified rolling temperature. Laying trials shall then demonstrate the acceptability of the plant and method used.

Bituminous materials shall be rolled in a longitudinal direction, with the driven rolls nearest the paver. The roller shall first compact metals adjacent to joints and then work from the lower to the upper side of the layer.

In portions with super elevated and unit directional camber, after the edge has been rolled, the roller shall progress from the lower to the upper edge.

Roller should move at a speed of not more than 5 Kg./per hour. The roller shall not be permitted to stand on pavement which has not been fully compacted, and necessary precautions shall be taken to prevent dropping of oil, grease, petrol or other foreign matter on the pavement shall be kept moist with water and the spray system provided with the machine shall be in good working order, to prevent the mixture from adhering to the wheels. Only sufficient moisture to prevent adhesion between the wheels of rollers and the mixture should be used. Surplus water shall not be allowed to stand on the partially compacted pavement.

Joints:

Where longitudinal joints are made in pre-mixed bituminous materials, the material shall be fully compacted and the joint made flush in one of the following ways, only method (iii) shall be used for transverse joints:

- (i) By heating the joins with an approved joint heater when the adjacent width is being laid, but without cutting back or coating with binder. The heater shall raise the temperature of the full depth of material, to within the specified range of minimum rolling temperature and maximum temperature at any stage for the materials, for a width not less than 75 mm. The contractor shall have equipment available, for use in the event of a heater breakdown, to form joints by method (iii).
- (ii) By using two or more pavers operating in echelon, where this is practicable, and in sufficient proximity for adjacent widths to be fully compacted by continuous rolling.

- (iii) By cutting the exposed joint, for a distance equal to the specified layer thickness, to a vertical face, discarding all loosened material and coating the vertical face completely with VG-30 penetration grade hot bitumen, or cold-applied bitumen, or polymer modified adhesive bitumen tape with a minimum thickness of 2 mm, before the adjacent width is laid.

All joints shall be offset at least 300 mm from parallel joints in the layer beneath or as directed, and in layout approved by the Engineer. Joints in the wearing course shall coincide with edge the lane marking, which ever is appropriate. Longitudinal joints shall not be situated in wheel track zones.

**508.5. Opening to Traffic:**

The newly laid surface shall not be open to traffic for at least 24 hours after laying and the completion of compaction, without the express approval of the Engineer in writing.

**508.6. Surface Finish and quality control:**

The surface finish of the completed construction shall conform to the requirement of Clause 902. All materials and workmanship shall comply with the provisions set out in section 900 of this specification.

**508.7. Arrangements for Traffic:**

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

**508.8 Measurement for payment:**

Dense Graded Bituminous Materials shall be measured as finished work in tons or at a specified thickness as detailed on the contract drawings, or documents, or as directed by the Engineer.

508.9

**Rate:**

The contract unit rate for Dense Graded Bituminous Macadam shall be payment in full for carrying out the all required operations as specified and shall include, but not necessarily limited to all components listed in (i) Making arrangements for traffic to Clause 112 except for initial treatment to verge shoulder and construction of diversions. (xi) The cost of all plant and laying trials as specified to prove the mixing and laying methods is deemed to be included in the contractor's rates for the materials.

The variance in actual percentage of bitumen used will be assessed and the payment adjusted, up or down, accordingly, except that the rate shall incl. provision of bitumen at 5.0 percent, by weight of total mixture. The variance in actual percentage of bitumen used will be assessed and the payment adjusted up, side only.

**Measurements for Payment:**

**The rate shall be for a unit of one Metric Tonne.**

Dated Signature  
of the Contractor

Executive Engineer,  
Capital Project Division No.3,  
Gandhinagar.

