

**Name of work :-** REPAIRS TO ROAD OF BHUJ TALUKA. C.R. 2026 - 27. TAL, BHUJ.

## GENERAL TECHNICAL SPECIFICATION

### 1.0 GENERAL :

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

- |  |              |
|--|--------------|
| 1. Length and breadth  | 10 mm        |
| 2. height, depth or thickness of earthwork, sub-base, bases. surfacing, and structural members | 5 mm         |
| 3. Areas   | 0.01 Sq. Mt  |
| 4. Cubic contents  | 0.01 Cu. Mt. |

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

### 2.0 MEASUREMENT OF LEAD FOR MATERIALS

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

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

### 3.0 SURFACE REGULARITY OF SUBGRADE & PAVEMENT COURSES :

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

#### Permitted tolerance of surface regularity for pavement courses

Sr.	Type of Construction	Longitudinal Profile with 3 meter straight edge					Cross Profile
		Maximum permissible undulation in mm	Maximum undulation in any 300 m length exceeding in mm	number	permitted in		Maximum permissible variation from specified profile camber template in mm
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 @@	18	--	--	--	20	6

Notes :

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

in the TABLE.

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

3. Rectification :Where the surface irregularity of 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 his own cost.

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

(ii) Granular 1 Sub- base : Same as at (i) above except that the degree of compaction and the type of material to be used shall conform to the specified requirements.

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

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

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

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

#### **4. 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 appropriate specifications. 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. TESTS ON EARTH WORK OF EMBANKMENT CONSTRUCTION :**

##### **5.1 Borrow Material :**

<b>a</b>	Sand Content (IS : 2720 Part IV)	Two test per 8000 Cubic metres of soil
<b>b</b>	Plasticity Test (IS : 2720 Part-V)	Each type to be tested. Two tests per 8000 Cubic Metres of soil.
<b>c</b>	Density test (IS : 2720 Part VII)	Each soil type to be tested. Two tests per 8000 Cubic Metres of soil.
<b>d</b>	Moisture Content Test (IS : 2720 Part -11)	One test for every 250 Cubic Metres of soil.

## 5.2 Compaction Control :

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

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

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

### 7. BARREL THICKNESS OF PIPES OF DIFFERENT CLASS SHALL BE AS UNDER

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

## SPECIFICATION FOR MATERIALS

### M-1 Water:

1.1 Water shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil and injurious alkalis, salts, organic matter and other deleterious material which will either weaken the mortar or concrete or cause efflorescence or attack the steel in R.C.C. Container for transport, storage and handling of water shall be clean. Water shall conform to the standards specified in LS. 456-1978.

1.2. If required by Engineer-in-charge it shall be tested by comparison with distilled water. Comparison shall be made by means of standard cement tests for soundness, time of setting and mortar strength as specified in LS. 269-1976. Any indication of unsoundness, change in time of setting by 30 minutes or more or decrease of more than 10 per cent in strength of mortar prepared with water sample when compared with the results obtained with mortar prepared with distilled water shall be sufficient cause for rejection of water under test.

1.3. Water for curing mortar, concrete or masonry should not be too acidic or too alkaline. It shall be free of elements which significantly affect the hydration reaction or otherwise interfere with the hardening of concrete during curing or those which produce objectionable stains or other unsightly deposits on concrete or mortar surfaces.

1.4. Hard and bitter water shall not be used for curing.

1.5. Potable water will be generally found suitable for curing mortar or concrete.

### M-3 Cement:

3.1 Cement shall be ordinary Portland slag cement as per LS. 269-1976 or Portland slag cement as per I.S. 455-1976.

### M-6 Sand:

6.1. Sand shall be natural sand, clean, well graded, hard strong durable and gritty particle free from injurious amounts of dust clay, kankar nodules, soft or flaky particles shale, alkali; salts organic, matter, loam, mica or other deleterious substance and shall be got approved from the Engineer-in-charge. The sand shall not contain more than 8 percent of silt as determined by field test, if necessary the sand shall be washed to make it clean.

#### 6.2. Coarse Sand:

The fineness modulus of coarse sand shall not be less than 2.5 and shall not exceed 3.0. The sieve analysis of coarse shall be as under:

I. S. Sieve Designation	Percentage by weight passing sieve	I. S. Sieve Designation	Percentage by weight passing sieve
4.75 mm.	100	600 Micron	30 – 10
2.36 mm.	90 To 100	300 Micron	5 – 70
1.18 mm.	70 – 100	150 Micron	0 – 50

#### 6.3 Fine Sand:

The fineness modulus shall not exceed 1.0. The sieve analysis of fine sand shall be as under

I. S. Sieve Designation	Percentage by weight passing sieve	I. S. Sieve Designation	Percentage by weight passing sieve
4.75 mm.	100	600 Micron	40 – 85
2.36 mm.	100	300 Micron	5 – 50
1.18 mm.	70 – 100	150 Micron	0 - 10

### M-12 Stone Coarse Aggregate for Nominal Mix Concrete:

12.1. Coarse aggregate shall be machine crushed stone of black trap or equivalent and be hard, strong, dense, durable, clean and free from skin and coating likely to prevent proper adhesion of mortar.

12.2. The aggregate shall generally be cubical in shape. Unless special stones of particular quarries are mentioned aggregates shall be machine crushed from the best black trap or equivalent hard stone as approved. Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate for plain cement concrete and ordinary reinforced cement concrete shall generally be as per the table given below. However in case of reinforced cement concrete the maximum limit may be restricted to 6 mm. less than the minimum lateral clear distance between bars or 6 mm. less than the cover, whichever is smaller.

**TABLE**

I. S. Sieve Designation	Percentage passing for single sized aggregates of Nominal size			I. S. Sieve Designation	Percentage passing for single sized aggregates of Nominal size		
	40 mm	20 mm	10 mm		40 mm	20 mm	10 mm
80 mm.	---	---	---	12.5 mm.	---	---	---
63 mm.	100	---	---	10 mm.	0.5	0.02	0.30
40 mm.	85 – 100	100	---	4.75 mm.	---	0.5	0.5
20 mm.	0 – 20	85 – 100	100	2.35 mm.	---	---	---
16 mm.	---	---	85 – 100				

**Note:** This percentage may be varied some what by Engineer-in-charge when considered necessary for obtaining better density and strength of concrete.

12.3. The grading test shall be taken in the beginning and at the change of source of materials. The necessary test indicated in I.S. 383-1970 and I.S. 456-1978 shall have to be carried out to ensure the acceptability. The aggregates shall be stored separately and handled in such a manner as to prevent the intermixing of different aggregates. If the aggregates are covered with dust, they shall be washed with water to make them clean.

#### **M-13 Black Trap or Equivalent Hard Stone Coarse Aggregate:**

13.1. Aggregate For Design Mix Concrete: Coarse aggregate shall be of machine crushed stone of black trap or equivalent hard stone and be hard strong dense- durable clean and free from skin and coating likely to prevent proper adhesion of mortar.

13.2. The aggregates shall generally be cubical in shape. Unless special stones of particular quarries are mentioned, aggregates shall be machine crushed from the best, black trap or equivalent hard stones as approved. Aggregate shall have no deleterious reaction with cement.

13.3. The necessary tests indicated in I.S. 383-1970 and I.S. 456-1978 shall have to be carried out to ensure the acceptability of the material.

13.4. If aggregate is covered with dust it shall be washed with water to make it clean.

#### **M-14 Brick Bats Aggregate:**

14.1. Brick bat aggregate shall be broken from well burnt or slightly over burnt and dense brick. It shall be homogeneous in texture roughly cubical in shape, clean and free from dirt of any other foreign material. The brick bats shall be of 40 mm. to 50 mm. size unless otherwise specified in the item. The under burnt or over burnt brick bats shall not be allowed.

14.2. The brick hats shall be measured by volume by suitable boxes or as directed.

#### **M-18 Mild Steel Bars:**

18.1 Mild steel bars reinforcement for R.C.C. work shall conform to I.S. 432 (Part-II) 1966 and shall be of tested quality. It shall also comply with relevant part of I.S. -t56- 1978.

18.2 All the reinforcement shall be clean and free from dirt, paint, grease, mill scale or loose or thick rust at the time of placing.

18.3. For the purpose of payment, the bar shall be measured correct up to 100 mm. length and weight payable worked out at the rate specified below:

1.	6 mm.	0.22 Kg./Rmt.	8.	20 mm	2.47 Kg./Rmt.
2.	8 mm	0.39 Kg./Rmt.	9.	22 mm	2.98 Kg./Rmt.
3.	10 mm	0.62 Kg./Rmt.	10.	25 mm	3.85 Kg./Rmt.
4.	12 mm	0.89 Kg./Rmt.	11.	28 mm	4.83 Kg./Rmt.
5.	14 mm	1.21 Kg./Rmt.	12.	32 mm	6.31 Kg./Rmt.
6.	16 mm	1.58 Kg./Rmt.	13.	36 mm	7.99 Kg./Rmt.
7.	18 mm	2.00 Kg./Rmt.	14.	40 mm	9.86 Kg./Rmt.

#### **M-19 High Yield Strength Steel Deformed Bars:**

19.1. High yield strength steel deformed bars be either cold twisted or hot rolled shall conform to I.S. 1739-1966 and I.S. 1139- 1966 respectively.

19.2. Other provision and requirements shall conform to specification No. M-18 for Mild steel bars.

#### **M-20 High Tensile Steel Wires:**

20.1. The high tensile wires for the use in pre stressed concrete work shall confirm to I.S. 2090-1962.

20.2. The tensile strength of the high tensile steel bars shall be as specified in the item. In absence of the given strength, the minimum strength shall be taken as per Para 6.1 of I.S. 1785-1962. Testing shall be done as per I.S. requirements. 20.3. The high tensile steel shall be free from loose mill scale, rust oil, grease, or any other harmful matter. Cleaning of steel bars may be carried out by immersion in solvent solution, wire brushing or passing through a pressure box containing carborandum.

20.4. The high tensile wire shall be obtained from manufactures in coil having diameter not less than 350 times the diameter of wire itself so that wire springs back straight on being uncoiled.

#### **M-21 Mild Steel Binding Wires:**

21.1. The mild steel wire shall be of 1.63 mm. or 1.22 mm. (16 or 18 gauge) diameter and shall conform to I.S. 280-1972.

21.2. The use of black wire will be permitted for binding reinforcement bars. It shall be free from rust, oil paint, grease, loose mill scale or any other undesirable coating which may prevent adhesion of cement mortar.

## ITEM WISE SPECIFICATIONS

**Item No. 01 :** Providing and laying bituminous grout base course 37.50 mm thick using asphalt Grade VG-30 for tack coat at the rate of 3 Kg. / 10 Sq.mt. using B.T. stone aggregates as per required gradation with the asphalt of vg-30 grade at the rate of 1.99% i.e. 19.90 Kg./MT by weight by mix including heating and mixing in drum mix plant, transporting the mix spreading the same by paver finisher and consolidation by vibratory roller including cost of all materials, fuel labours, tools and plant etc. using contractors own drum mix plant etc. complete.

**Scope:-** The work shall consist of construction 37.5 mm. thick BSG on a previously prepared base to the requirement of these specifications.

Over and above MORT & H Clause 506 specification. The work shall be carried out by premixing the aggregates in drum mix plant & spreading by paver finisher. Payment shall be made on M.T. basis of work done.

**Materials:-**

**Binder:-** The binder shall be straight on bitumen of 60/70 grade satisfying the requirement of I.S. :73

**Coarse Aggregate:-** The coarse aggregate shall consist of crushed stone. These shall be strong, durable of fairly cubical shape and free from disintegrated pieces, organic or other low porosity and shall satisfy the physical requirement as per Schedule for testing of materials attached herewith / as directed by Engineer-in-charge.

**Fine Aggregate:-** The line aggregate shall consist of crusher run screening, natural sand or mixture of both. These shall be clean, hard, durable, uncoated dry and free injurious soft pr flaky pieces and organic deleterious substances.

**Aggregate Gradation:-** The mineral including mineral shall be so graded to combined as to conform to the grading set forth in table below.

Sieve Size	Percent by Weight aggregate
53.0	100
26.5	52-80
16.2	8-31
5.6	0-20
2.8	0-5

**Proportion using Minerals:-** The bitumen content for pre-mixing shall be 1.99 % by total weight of mix. The quantities of aggregate to be used shall be sufficient to yield the specified thickness after compaction.

**Variation in Proportioning of Material:-** The contractor shall have the responsibility for ensuring proper proportioning of materials and producing a uniform mix. A variation in binder content  $\pm 0.3$  percent by weight of total mix shall however, the permissible for individual specimen taken for quality control test vide Schedule for Testing of Materials attached herewith / as directed Engineer in charge Asphalt VG-30 at rate of 19.90 Kg / MT i.e. 1.99% by weight of the total mix shall be used for mixing.

**Construction Operations:-**

**Weather and Seasonal Limitations:-** The work of laying shall not be taken up during rainy or foggy weather or when the base course is damp or wet or during dust storm or when the atmospheric temperature in shade is  $10^0$  C or less.

**Preparation of Base:-** The base on which B.S.G. is to be laid shall be prepared shapped and conditioned to the specified lines, grade and cross sections in accordance with Clause 501 and a priming coat where needed shall be applied in accordance with Clause 502 as directed by Engineer in charge.

**Tack coats:-** A tack coat as per Clause 503 shall be applied over the base as detailed in item description. Asphalt VG-30@ 3.0 Kg / 10 Sq.mt. on existing B.T. surface & 4 Kg / 10 Smt. on WBM surface.

**Preparation of Transportation of Mix:-**

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

The plant shall be drum mix type. The plant shall co-ordinate set of essential units capable of producing uniform mix within the job mix formula a such a laid down in Appendix-A.

(A) In case of drum mix plant the cold feed system shall have variable speed conveyors / or other suitable devices for regulating the accurate proportion of aggregates in to even flood flow automatically from a control operation / control cabin.

- (B) Bitumen control unit:- Capable of measuring / metering and spraying required quantity of bitumen at specified temperature with automatic synchronization of bitumen and aggregate feed.
- (C) Filter system:- A fines feeder system suitable to receive bagged or bulk supply of filler materials and its incorporation to the mix in the correct quantity shall be necessary auxiliary.
- (D) Dust Control:- A suitable built in dust control equipment for the dryer to contain the exhaust of fine dust in to atmosphere for environmental control, wherever so specified by the Engineer.
- (E) Suitable auxiliary bitumen boiler of adequate with the self heating arrangement and temperature control device. The boiler should be fitted with temperature indicating instruction.

The temperature of binder at the time of mixing shall be in the range of 150<sup>0</sup> C to 165<sup>0</sup> C and that of the aggregate in the range of 150<sup>0</sup> C to 170<sup>0</sup> C provided that the difference in the temperature between the binder and aggregate at no time exceeds 14<sup>0</sup> C.

Mixing shall be through to ensure that a homogenous mixture is obtained in which all particles of the aggregates are coated uniformly and the discharge temperature of mix shall be between 150<sup>0</sup> C to 160<sup>0</sup> C.

The mix shall be transported from the mixing plant to the point of use in suitable tipper vehicles. The vehicles employed for transport shall be clean and be covered in transit if so directed by the Engineer. Any tipper causing excessive segregation of materials by its spring suspension or other contributing factor of that which shows undue shall be removed from the work until such conditions are corrected.

#### **Spreading :-**

The mix transferred from the tipper at site to the paver shall be spread immediately by means of self propelled mechanical paver with suitable screeds capable of spreading, tamping and finishing the mix true to the specified lines, grades and cross sections. The paver finisher shall have the following essential features.

- a) Loading hoppers and suitable distributing mechanism.
- b) All drives having hydrostatic drive / control
- c) The machine shall have hydraulically extendable screed for appropriate width requirement.
- d) The screed shall tamping and vibrating arrangement for initial compaction to the layer as it is spread without rutting or otherwise marring the surface. It shall have adjustable amplitude and variable frequency.
- e) The paver shall be equipped with necessary control mechanism so as to ensure that the finished surface is free from surface blemishes.
- f) The paver shall be fitted with an electronic sensing device for automatic leveling and profile control within the specified tolerances.
- g) The screen shall have the internal heating arrangement.
- h) The paver shall be capable of laying either 2.5 to 4.0 mt. width or 4.0 to 7.0 mt. width as stipulated in the contract.
- i) The paver shall be so designed as to eliminate skidding / slippage of the tyres during operation

However in restricted locations and in narrow width, where the available plant cannot be operated in the opinion of the Engineer, he may permit manual laying of the mix.

The temperature of the mix at the time of laying shall be in the range of 100<sup>0</sup> C to 125<sup>0</sup> C. in the multi layer construction, the longitudinal joint in one layer shall offset that in the layer below by about 150 mm. However, the joint in the top most layer shall be at the lane line of the pavement.

Longitudinal joints and edges shall be constructed true to the delineating line parallel to the center line of the road. All joints shall be cut vertical to the full thickness of the previously laid mix and the surface painted with drum bitumen before placing fresh materials. Longitudinal and transverse joints shall be offset by a least 250 mm from the those in the lower courses and the joint on the top most layer shall not be allowed to fall within the wheel path. All transverse joint shall be cut vertically to the full thickness of the previously laid mix with asphalt cutter. Pavement breaker and surface painted with Drum bitumen before placing fresh material, longitudinal joint shall be preferably Drum joints. Cold longitudinal joints shall be properly heated with joint heater to attain a suitable temperature of about 80<sup>0</sup> C before laying of adjacent material.

#### **Compaction:-**

After the spreading mix, rolling shall be done by 8T to 10T rollers or other approved equipment. Rolling shall start as soon as possible after the material has been spread deploying set of rollers as the rolling is to be completed in limited time frame. The roller shall move at a speed not more than 5 Km/ HR. Rolling shall be done with care to avoid undue roughening of the pavement surface.

Rolling of the longitudinal joints shall be done immediately behind the paving operation. After this the rolling shall commence at the edges and progress towards the center longitudinal except that in super elevated and uni directional cambered portions. It shall progress from the lower to the upper edge parallel to the centre line of the pavement.



The initial break down rolling shall be done with 8T to 10T. Static weight smooth wheel roller (3 wheel or tandem), as soon as it is possible to roll the mix without cracking the surface or having the mix pick up on the roller wheels. The second of intermediate rolling shall follow the break down rolling with vibratory roller of 80 to 100 KN static weight of pneumatic tyred roller of 150 to 200 KN weight, with minimum 7 wheels and minimum tyre pressure of 0.7 mpa as closely as possible to the paver and be done while the paver mix is still at a temperature that will result in maximum density. The final rolling shall be done while materials is still workable enough for removal of roller marks with 60-80 KN tandem roller. During the final rolling, vibratory system shall be switches off. The joints and edges shall be rolled with a 80to 100 KN static roller.

When the roller has passed over the whole area once. Any high spots or depressions, which become aparent shall be corrected by removing or adding mix material. The rolling shall than be continued till the entire surface has been rolled to 95 percent of the average laboratory density. (Obtained for Marshall specimens compacted as defined in Table 500-100) There is no crushing of aggregates and all rollers marks have been eliminated, each pass of the roller shall uniformly overlap not less than one third of the track made in the preceding pass. The roller wheel shall be kept damp, if necessary to avoid bituminous material from sticking to the wheels and being picked up. In no case shall fuel, lubricating oil be used for this purpose nor excessive water poured on the wheels.

Rolling operation shall be competed in every respect before the temperature of the mix falls below 100<sup>0</sup>C.

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

#### **Surface Finish and Quality Control of Work:-**

The surface finish of construction shall conform to the requirement of clause 902. Control on the quality of materials and works shall be exercised by the Engineer in accordance with Section 900.

The mix shall be converted with either the next pavement course or wearing course. As the case may be without any delay. If there is to be any delay, the course shall be covered by seal coat to the requirement of clause 513 before allowing any traffic over it. The seal coat is such case shall be considered incidental to the work and shall not be paid for separately.

**Arrangement of Traffic:-** During the period of construction of arrangement of traffic shall be done to clause 112.

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

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

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

**Rates:-** The contract unit rate for B.S.G. work shall be payment in full for carrying out the required operations including full compensations for:-

- (i) Making arrangement to traffic to clause 112 except for initial treatment to the shoulders and constructions of diversions.
- (ii) Preparation of base except for laying of profile corrective course but including filling of potholes.
- (iii) Providing all materials to be incorporated in the work including arrangement for stock yards. All royalties, fees, rents where necessary and all lead and lift.
- (iv) All labour, tools, equipment, plants including installation of Drum mix plant paver supply units and all machineries, incidentals to complete the work to the specifications.
- (v) Carrying out the work in part widths of the road where directed.
- (vi) Carrying out all tests for control of quality

**Item No.- 02 :**

Providing and laying 25mm thick semi dense bituminous carpet in single course on existing BT surface with drum mix plan using crushed stone agg. of specified grading and stone dust as filler, including using asphalt VG-30 grade for tack coat @ 2.50 kg/10 smt and for mixing by weight of total mix @ 5.00 % (i.e. 50.00 kg/M.T.) incl. heating and mixing in drum mix plant transporting the mix, spreading the same by pavers finisher and consolidation as per MORTH specification incl. cost of all materials fuels, labours, tools and plant etc. using contractors own drum mix plant etc. comp. including flushing stone dust @ 0.03cmt/10smt.

And

**Item No.- 03 :**

Providing and laying 25 mm thick semi dense bituminous carpet in single course on existing B. T. surface with drum mix plan using crushed stone agg of specified grading and stone dust as filler, including using asphalt VG-30 (60-70 Grade) for mixing by weight of total mix @ 5.00 % (i.e. 50.00 Kg/Mt) incl. heating and mixing in drum mix plant transporting the mix , spreading the same by manually as per MORTH specification incl. cost of all materials fuels, labors, tools and plant etc. using contractors own drum mix plant etc. comp. including flushing stone dust @ 0.03 cmt/10 Sq,mt

periodically got calibrated and verified from weight and measure authorities.

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

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

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

**ITEM 14 Semi Dense Carpet**  
(As standardized by R & B Circular No. SSR-1087-205 (21) (C) dated : 29-10-1987.

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

**2. Materials**  
**2.1 Binder :** The binder shall be straight run bitumen of 60/70 or 80/100 grade satisfying the requirement of IS : 73. The actual grade of the binder to be used shall be decided by the Engineer-in-charge.  
**2.2 Coarse aggregates :** The coarse aggregate shall consist of crushed stone or crushed gravel. These shall be clean, durable, of cubical shape, free from disintegrated pieces, organic or other deleterious matter and adherent coatings. The aggregates shall preferably be hydrophobic and of low porosity and shall satisfy the physical requirements set forth in Table given in Item No. 18 Para 2.  
**2.3 Fine aggregates :** The fine aggregates shall consist of crusher run screenings, natural sand or a mixture of both. These shall be clean, hard, durable, uncoated, dry and free from injurious, soft or flaky pieces and organic or deleterious substances.  
**2.4 Filler :** The filler, where required, shall be an inert material the whole of which passes 600 micron sieve at least 90 percent passing 150 micron sieve and not less than 70 percent passing 75 micron sieve. The filler shall be cement, stone dust, hydrated lime, fly ash and other non-plastic mineral matter approved by the Engineer-in-charge.  
**2.5 Aggregate gradation :** The mineral aggregates, including mineral filler, shall be so graded or combined as to conform to gradings set forth in tables below :

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

Sieve Designation	% by weight passing the Sieve		Sieve Designation	% by weight passing the Sieve	
	For 25 mm thickness	For 20 mm thickness		For 25 mm thickness	For 20 mm thickness
20 mm	100	100	600 micron	10-22	10-22
12.5 mm	75-100	100	300 micron	6-16	6-16
10 mm	60-85	75-100	150 micron	4-12	4-12
4.75 mm	35-55	35-55	75 micron	2-8	2-8
2.36 mm	20-35	20-35			

**2.6 Proportioning of materials :** The binder content for premixing shall be 4.28 percent by weight of the total mix.  
The quantities of aggregates shall be sufficient to yield the specified thickness after compaction. The contractor shall get the job-mix formula for the mix approved by the Engineer-in-charge before starting the work.

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

**3. CONSTRUCTION OPERATIONS**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



## 7. MEASUREMENT FOR PAYMENT

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

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

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

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

## 8. RATE

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

### ANNEXURE - A

#### TECHNICAL REQUIREMENTS OF HOT MIX PLANT

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

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

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

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

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

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

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

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

#### ITEM - 20 40 mm Thick Asphaltic Concrete

##### 1. DESCRIPTION

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

**Item No. 4**

**Providing and laying 37.50 mm thick compacted B.M. using stone chips 0.66 Cum / 1 M.Ton mix as per gradation with Bitumen V.G.-30 for tack coat @ 2.50 kg. / 10 Smt. on B.T. surface and for mixing @ 34 kg/M.Ton (I.e. 3.40% of mix) including heating the and aggregate by contineous batching drum mix plant, transporting and mixed matrrial and spreading the same by paver finisher and consolidation by vibratory roller of 80 KN to 100 Kn static weight including the cost of labour oil, lubricants etc. using contractors own machineries and plant.**

**Scope :-** The work shall consist of construction one layer of 37.50 mm thick B.M. on a previously prepared base to the requirement of theses specifications

**Materials :-**

**Binder :-** The binder shall be straight run bitumen of **V.G-30 grade** satisfying the requirement of I.S. : 73.

**Coarse Aggregate :-** The coarse aggregate shall consist of crushed stone, crushed gravel. These shall be strong, durable of fairly cubical shape and free from disintegrated pieces, organic or other low porosity and shall satisfy the physical requirement as per Schedule for Testing of Materials attached herewith / as directed by Engineer in Charge.

**Fine Aggregate :-** The fine aggregate shall consist of crusher run screening, natural sand or mixture of both. These shall be clean, hard, durable, uncoated dry and free injurious soft pr flaky pieces and organic deleterious substances.

**Aggregate Gradation:-**

The mineral including mineral shall be so graded to combined as to conform th the grading set forth in table below.

**Bituminous. Macadam**

Sieve Size	Percent by Weight aggregate
26.5	100%
19.0	90-100%
13.2	56-88%
4.75	16-36%
2.36	4-19%
0.90	2-10%
0.075	0-8%

**Proportioning Materials :-**

The bitumen content for pre-mixing shall be 3.4% by weight of the total mix

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

**Variation in Proportioning of Material :-**

The contractor shall have the responsibility for ensuring proper proportioning of materials and producing a uniform mix. A variation in binder content  $\pm 0.3$  percent by weight of total mix shall however, the permissible for individual specimen taken for quality control test vide Schedule for Testing of Materials attached herewith / as directed Engineer in Charge

**Construction Operations:-**

**1 Preparation of bae :** The surface on which the tack coat is to be applied shall be cleaned of dust and extraneous material before the application of the binder by using mechanical broom or any other approved equipment / method as specified by the Engineer

**2 Application of binder :** Binder may be heated to the the temperature appropriate to the grade of bitumen used and approved by the engineer and sprayed on the base at the rate specified in item of work .The normal range of spraying temperature for bitumen V.G-30 grade. It shall be the responsibility of the contractor to carefully handle the inflammable bituminous material so as to safe guard against any fire mishap. The binder shall be applied uniformly with the aid of either self propelled or towed bitumen pressure sprayer with self heating arrangement and spraying bar with nozzles having constant volume or pressure system, capable of spraying bitumen at specified rate and temperature so as to provide a uniformly unbroken spread of bitumen. Work should be planned so that no more than the necessary tack coat for the day's operation is placed on the surface. After application and prior to succeeding construction allow the tack coat to cure, without being disturbed, until the water/ cutter has completely evaporated as determined by Engineer.

**3. Quality control of work :** Control on the quality of material and works shall be exercised by the Engineer in charge in accordance with section 900 of MORTH specification.

**4. Arrangement of traffic:** During the period of application of binder for tack coat the arrangement of traffic shall be done to MORTH specification clause 112 of MORTH Specification.

**5. Mode of measurement and payment:**

The payment shall be made on sq.mt basis of for rate of application as specified in tender item. The rate is inclusive of cost of asphalt, tools and plants required for applying binder.

**504.3.3. Tack Coat:** A tack coat in accordance with Clause 503 shall be applied as specified in the Contract or as directed by the Engineer.**For Tack coat Bitumen V.G.-30 Grade shall be used.**

**Weather and Seasonal Limitations:-**

The work of laying shall not be taken up during rainy or foggy weather or when the base course is damp or wet or during dust storm or when the atmospheric temperature in shade is 10°C or less.

**Preparation of Base:-**

The base on which bituminous macadam is to be laid shall be prepared shaped and conditioned to the specified lines, grade and cross sections in accordance with Clause 501 and a priming coat where needed shall be applied in accordance with Clause 502 as directed by Engineer in charge.

**Preparation and Transportation of Mix:-**

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

The plant shall be drum mix type. The plant shall co-ordinate set of essential units capable of producing uniform mix within the job mix formula as such as laid down in Appendix A

(A) In case of drum mix plant the cold feed system shall have variable speed conveyors / or other suitable devices for regulating the accurate proportion of aggregates in to even flow automatically from a control operation / Control cabin.

(B) Bitumen control Unit:- Capable of measuring /metering and spraying required quantity of bitumen at specified temperature with automatic synchronization of bitumen and aggregate feed.

(C) Filler system :- A fines feeder system suitable to receive bagged or bulk supply of filler materials and its incorporation to the mix in the correct quantity shall be necessary auxiliary

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

(E) Suitable auxiliary bitumen boiler of adequate with the self heating arrangement and temperature control device. The boiler should be fitted with temperature indicating instruction.

The temperature of binder at the time of mixing shall be in the range of 150°C. to 165°C. and that of the aggregate in the range of 150°C. to 170°C. provided that the difference in the temperature between the binder and aggregate at no time exceeds 14°C.

Mixing shall be through to ensure that a homogenous mixture is obtained in which all particles of the aggregates are coated uniformly and the discharge temperature of mix shall be between 150°C. to 160°C.

The mix shall be transported from the mixing plant to the point of use in suitable tipper vehicles. The vehicles employed for transport shall be clean and be covered in transit if so directed by the Engineer. Any tipper causing excessive segregation of materials by its spring suspension or other contributing factors of that which shows undue shall be removed from the work until such conditions are corrected.

Spreading :-

The mix transferred from the tipper at site to the paver shall be spread immediately by means of self propelled mechanical paver with suitable screeds capable of spreading, tamping and finishing the mix true to the specified lines, grades and cross sections. The paver finisher shall have the following essential features.

- a). Loading hoppers and suitable distributing mechanism
- b). All drives having hydrostatic drive / control
- c). The machine shall have hydraulically extendable screed for appropriate width requirement.
- d). 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. It shall have adjustable amplitude and variable frequency.
- e). The paver shall be equipped with necessary control mechanism so as to ensure that the finished surface is free from surface blemishes.
- f). The paver shall be fitted with an electronic sensing device for automatic leveling and profile control within the specified tolerances.
- g). The screed shall have the internal heating arrangement.
- h). The paver shall be capable of laying either 2.5 to 4.0 mt. width or 4.0 to 7.0 mt. width as stipulated in the contract.
- i). The paver shall be so designed as to eliminate skidding / slippage of the tyres during operation.

However in restricted locations and in narrow width, where the available plant can not be operation in the opinion of the Engineer, he may permit manual laying of the mix.

The temperature of the mix at the time of laying shall be in the range of 100°C. to 125°C. in the multi layer construction, the longitudinal joint in one layer shall offset that in the layer below by about 150mm. However, the joint in the top most layer shall be at the lane line of the pavement.

Longitudinal joints and edges shall be constructed true to the delineating line parallel to the center line of the road. All joints shall be cut vertical to the full thickness of the previously laid mix and the surface painted with Drum bitumen before placing fresh materials. Longitudinal and transverse joints shall be offset by at least 250mm from the those in the lower courses and the joint on the top most layer shall not be allowed to fall within the wheel path. All transverse joint shall be cut vertically to the full thickness of the previously laid mix with asphalt cutter. Pavement breaker and surface painted with Drum bitumen before placing fresh material, longitudinal joint shall be preferably Drum joints. Cold longitudinal joints shall be properly heated with joint heater to attain a suitable temperature of about 80°C. before laying of adjacent material.

Compaction.:-

After the spreading of mix, rolling shall be done by 8T to 10T rollers or other approved equipment. Rolling shall start as soon as possible after the material has been spread deploying set of rollers as the rolling is to be completed in limited time frame. The roller shall move at a speed not more than 5 Km / Hr. Rolling shall be done with care to avoid undue roughening of the pavement surface.

Rolling of the longitudinal joints shall be done immediately behind the paving operation. After this the rolling shall commence at the edges and progress towards the center longitudinal except that in super elevated and uni directional cambered portions. It shall progress from the lower to the upper edge parallel to the center line of the pavement.

The initial break down rolling shall be done with 8T to 10T. Static weight smooth wheel roller (3 wheel or tandem), as soon as it is possible to roll the mix without cracking the surface or having the mix pick up on the roller wheels. The second of intermediate rolling shall follow the break down rolling with vibratory roller of 80 to 100KN static weight or pneumatic tyred roller of 150 to 200 KN weight, with



minimum 7 wheels and minimum tyre pressure of 0.7 mpa as closely as possible to the paver and be done while the paving mix is still at a temperature that will result in maximum density. The final rolling shall be done while materials is still workable enough for removal of roller marks with 60-80 KN tandem roller. During the final rolling, vibratory system shall be switches off. The joints and edges shall be rolled with a 80 to 100 KN static roller.

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

Rolling operation shall be competed in every respect before the temperature of the mix falls below 100°C

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

Surface Finish and Quality Control of Work :-

The surface finish of construction shall conform to the requirement of Clause 902. Control on the quality of materials and works shall be exercised by the Engineer in accordance with Section 900.

The bituminous macadam shall be converted with either the next pavement course or wearing course. As the case may be without any delay. If there is to be any delay, the course shall be covered by seal coat to the requirement of Clause 513 before allowing any traffic over it. The seal coat in such case shall be considered incidental to the work and shall not be paid for separately.

Arrangement of Traffic:- During the period of construction arrangement of traffic shall be done to Clause-112

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

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

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

Rates:- The contract unit rate for B.M. work shall be payment in full for carrying out the required operations including full compensations for :-

- (i) Making arrangement for traffic to clause 112 except for initial treatment to verge shoulders and constructions of diversions.
- (ii) Preparation of base except for laying of profile corrective course but including filling of potholes
- (iii) Providing all materials to be incorporated in the work including arrangement for stock yards. All Royalties, fees, rents where necessary and all lead and lift.



- (iv) All labour , tools, equipment, plants including installation of Drum mix plant paver supply units and all machineries, incidentals to complete the work to the specifications.
- (v) Carrying out the work in part widths of the road where directed.
- (vi) Carrying out all tests for control of quality

**Item No : 5**

**Providing and Laying 20 mm thick mix seal surface using stone chips as per gradation on prepared surface with spesified grade crushed stone agg. as per MORTH & H specification and asphalt grade V.G.-30 for mixing at rate of 5.10 % by weight of mix and including heating the asphalt and aggregate by drum mix plant and spreading the same by paver finisher and consolidating by vibratory roller to achive the desired density incl. providing tools, plant,oil, kerosene, lubricating etc. comp. using contractors own machinery, drum mix plant and paver finisher etc. complete.**

**1 512.1. Scope**

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

**512.1.2.** Close graded premix surfacing shall be of Type A or Type B as specified in the Contract documents.

**512.2. Materials**

**512.2.1. Binder :** The provisions of Clause 511.1.2.1 shall apply

**512.2.2. Coarse aggregates :** The provisions of Clause 511.1.2.2 shall apply.

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

**512.2.4. Aggregate gradation:** The coarse and fine aggregates shall be so graded or combined as to conform to one or the other gradings shown in Table 500-26, as specified in the contract.

TABLE 500-26. AGGREGATE GRADATION

IS Sieve Designation (mm)	Cumulative per total weight of total aggregate passing	
	Type A	Type B
13.2mm	--	100
11.2mm	100	88-100
5.6mm	52-88	31-52
2.8mm	14-38	5-25
0.090 mm	0-5	0-5

**512.2.5. Proportioning of materials:** The total quantity of aggregates used for Type A or B close-graded premix surfacing shall be 20mm thickness. The quantity of binder used for premixing in terms of straight-run bitumen shall be 22.0 kg and 19.0 kg per 10 square metre area for Type A and Type B surfacing respectively.

### **512.3. Construction Operations**

The provisions of Clause 511.1.3.1 through 511.1.3.5 shall apply.

### **512.4. Opening to Traffic**

Traffic may be allowed after completion of the final rolling when the mix has cooled down to the surrounding temperature. Excessive traffic speeds should not be permitted.

### **512.5. Surface Finish and Quality Control of Work**

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

### **512.6. Arrangements for Traffic**

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

### **512.7. Measurements for Payment**

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

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

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

Rates:- The contract unit rate for M.S.S. work shall be payment in full for carrying out the required operations including full compensations for :-

- (i) Making arrangement for traffic to clause 112 except for initial treatment to verge shoulders and constructions of diversions.
- (ii) Preparation of base except for laying of profile corrective course but including filling of potholes
- (iii) Providing all materials to be incorporated in the work including arrangement for stock yards. All Royalties, fees, rents where necessary and all lead and lift.
- (iv) All labour , tools, equipment, plants including installation of Drum mix plant paver supply units and all machineries, incidentals to complete the work to the specifications.
- (v) Carrying out the work in part widths of the road where directed.
- (vi) Carrying out all tests for control of quality

## **Item No : 6**

**Providing and laying bituminous sealcoat with stone chips 6 to 10mm size 0.24 cmt /10 smt. i.e. using 0.66 cmt agg.per M.T. mix using asphalt V.G.-30 @ of 4.50 % of mix inc. heating the asphalt and agg. By continuous batching drum mix plant and paver finisher and consolidating by vibratory roller incl. providing equipments, tools, plants, firewood ,oil, kerosene, labour charges etc, comp, using the contractor's own machinery.**

### **1 DESCRIPTION**

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

### **2. MATERIALS:-**

#### **2.1 Binder :-**

The binder shall be straight run bitumen of V.G.-30 grade satisfying the requirement of IS:73. The actual grade of the binder to be used shall be decided by the Engineer-in-charge and it shall have to be brought by contractor to the site at his own cost unless otherwise specified in schedule 'A'.

#### **2.2 Coarse aggregates :**

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

#### **2.3 Fine aggregates :**

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

#### **2.4 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 grading set forth below

The gradation for Sealcoat {Type C} should be followed as stated hereunder instead of Para 2.5 of Item

Stone Chips for Type C Seal Coat : The stone chips shall consist of angular fragment of clean, hard and durable rock of uniform quality throughout. The stone chips shall be free of soft or disintegrated organic or other deleterious matter and shall be of 6.7 mm size defined as 100 percent passing through 9.5mm sieve and retained on 2.36 mm sieve. The quantity used for spreading shall be **0.18 Cu.M. per 10 Sq.Mt.area./ 0.24 Cu.M. per 10 Sq.Mt.** The chips shall satisfy the quality requirement in Table 500.3 {M.O.R. T. & H.} except that the upper limit for water absorption value shall be 1 percent

#### **2.6 Proportioning of materials :**

The binder content for premixing shall be 45.00 kg per M.T. (4.50% by weight) for mixing aggregate.

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

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

#### **2.7 Variation in Proportioning of material :**

The Contractor shall have the responsibility of ensuring proper proportioning of materials in accordance with the approved job mix formula and producing a uniform mix' A variation in binder content of  $\pm 0.3$

percent by weight of total mix shall, however, be permissible in individual specimen taken for quality control tests vide MOST Specification Section 900.

### **3. CONSTRUCTION OPERATIONS**

#### **3.1 Weather and seasonal limitation :**

Premix seal coat shall not be laid during rainy weather or when base course is damp or wet.

#### **3.2. Preparation of base :**

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

#### **3.3 Preparation of the mix:**

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

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

#### **3.4 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 road, Longitudinal joints shall be offset by at least 150 mm from those in the binder course. All joints shall be cut vertical to the full thickness of the previously laid mix and the surface painted with hot bitumen before placing fresh material. .

#### **3.5 Rolling:**

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

The roller wheels shall be kept damp to prevent the mix adhering to them but in no case shall fuel lubricating oil be used for this purpose. Rolling shall commence longitudinally from the edge and progress towards the centre except that at super elevated portions, it shall progress from the lower to upper edges parallel to the centre line of the pavement. The roller should proceed on the fresh material with rear or fixed wheel leading so as to minimize the pushing of the mix and each pass of the roller shall uniformly overlap not less than one third of the track made in the preceding pass Rolling shall continue until the entire surface has been roller 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 MORD Spe. Clause 901 Control on the quality of material and works shall be exercised by the Engineer-in-charge in accordance with MOST Specification MORD Spe. Clause 902.

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

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

#### **7. MEASUREMENT FOR PAYMENT**

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

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

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

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

**8. RATE:** The Contract unit rate for seal coat shall be for payment for carrying out the required operations including full compensation for all components listed in MOST Specification MORD Spe. Clause 503.7

#### **Item No. 7**

**Providing, laying, spreading and compacting 150mm thick graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub-base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.**

#### **406. WET MIX MACADAM SUB-BASE/BASE**

##### **406.1. 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 subgrade/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 are used, the compacted depth of a single layer of the sub-base course may be increased to 200 mm upon approval of the Engineer.

## 406.2. Materials

### 406.2.1. Aggregates

**406.2.1.1. 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 REQUIREMENTS OF COARSE AGGREGATES**

FOR WET MIX MACADAM FOR SUB-BASE/BASE COURSES		
Test	Test Method	Requirements
1 * Los Angeles Abrasion value Or * Aggregate Impact value	IS:2386 (Part-4)  IS:2386 (Part-4) or IS:5640	40 per cent (Max)  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).

**406.2.1.2. 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.

#### **406.3. Construction Operations**

**406.3.1. Preparation of base :** Clause 404.3.1. shall apply.

**406.3.2. 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 407.4.1.

**406.3.3. 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.

**406.3.4. 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.

**406.3.5. 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 over-lapping 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 subgrade is soft or yielding or when it causes a wave-like motion in the sub-base/base course or subgrade. If irregularities develop during rolling which exceed 12 mm when tested with a 3 metre 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.

**406.3.6. Setting and drying:** After final compaction of wet mix macadam course, the road shall be allowed to dry for 24 hours.

#### **406.4. 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.

#### **406.5. Surface Finish and Quality Control of Work**

**406.5.1. Surface evenness :** The surface finish of construction shall conform to the requirements of Clause 902.

**406.5.2. Quality control :** Control or, the quality of materials and works shall be exercised by the Engineer in accordance with Section 900.

#### **406.6. 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.

#### **406.7. Arrangement for Traffic**

During the period of construction, arrangement of traffic shall be done as per Clause 112.

#### **406.8. Measurements for Payment**

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

#### **406.9. 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.



**Item No. - : 8**

**Supplying and Stacking Hand broken stone aggregate of 25 / 90 mm size on road side including filling the measure boxes & including all taxes & royalties etc. complete with all lead & lift.**

1. The stone Metal shall be of approved quarry as shown on the quarry chart as well as approved by the Executive Engineer prior to collection
2. The Hand Broken. metal shall be hard, rough, sound, durable black trap field metal of close texture, free from decay and weathering. Each piece of the stone shall be angular and roughly cubical in shape and round elongated or flaky materials shall be rejected. No. round or oblong pebbles or angular chips larger or smaller than specified size shall be allowed.
3. All unsound, weathered or disintegrated stone obtained from the upper surface layer of the quarry or other layer of boulder shall be rejected.
4. The physical requirement for standard size metal shall conform to the test result indicated in the table below.

**TABLE : PHYSICAL REQUIREMENTS OF COURSE AGGREGATES FOR WATER BOUND MACADAM FOR SUB-BASE/BASE/SURFACING COURSES**

Test	Sub-base	Base	Surfacing
Aggregate Impact Test (IS:2386 Part 4 or IS:5640)	Less than 50	Less than 40	Less than 30
Flakiness Index Test (IS:2386 Part 1)	Less than 30	Less than 25	Less than 20
Soundness Test (IS:2386 Part 1)			
- Loss with Sodium Sulphate	Less than 12%	Less than 12%	Less than 12%
- Loss with Magnesium Sulphate	Less than 18%	Less than 18%	Less than 18%

The frequency of test shall be as per Ministry of Surface transport specifications.

5. The grading requirements of metal to be used for WBM shall be as under

**TABLE : GRADING REQUIREMENTS OF COARSE AGGREGATES : 25 / 90 MM SIZE**

Size Range	IS Sieve Designation	Per cent by weight passing
<b>25 mm to 90 mm</b>	125 mm	100
	90 mm	90-100
	63 mm	25-60
	45 mm	0-15
	22.4 mm	0-5

6. Wherever and doubt exists as to where the above requirement are satisfied in whole or part, the collection of Hand Broken metal shall be got screened by the contractor, if so ordered by the Executive Engineer and for which no extra payment shall be claimed by the contractor.

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

8. For road work complete stacking of metal as per requirement shall be carried out in 2 Km. Length before spreading. The metal stack shall be measured and recorded and got cross checked by other deputy executive Engineer as per rules before spreading. The collection shall always commence at one end of the Km. And be carried continuously towards the other and unless the engineer in charge shall direct otherwise.

9. The payment shall be on cubic meter bases without deduction for voids. The contractor shall maintain all stacks in regular and proper size till the whole material shall not be measured and finally accepted by the department. The spreading of material shall not be allowed till material are fully stacked and completed Kilometer wise.

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

### **Item No. 9**

**Providing and laying W.B.M. of M.C. metal of size 45 mm to 63 mm size including 0.12 Cu.M. Stone screening & 0.08 Cu.M. stone dust as filler including spreading, watering & consolidation by vibratory roller 80KN to 100KN static weight. 75 mm thick compacted each layer.**

#### **404.1. Scope**

**404.1.1.** This work shall consist of clean, crushed aggregates mechanically interlocked by rolling and bonding together with screening, binding material where necessary and water laid on a properly prepared subgrade/ sub-base/ base or existing pavement, as the case may be and finished in accordance with the requirements of these Specifications and in close conformity with the lines, grades, cross-sections and thickness as per approved plans or as directed by the Engineer.

**404.1.2.** It is, however, not desirable to lay water bound macadam on an existing thin black topped surface without providing adequate drainage facility for water that would get accumulated at the interface of existing bituminous surface and water bound macadam.

#### **404.2. Materials**

**404.2.1. Coarse aggregates :** Coarse aggregates shall be either crushed or broken stone, crushed slag, overburnt (Jhama) brick aggregates or any other naturally occurring aggregates such as kankar and laterite of suitable quality. Materials other than crushed or broken stone and crushed slag shall be used in sub-base courses only. 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 400-6. The type and size range of the aggregate shall be specified in the Contract or shall be as specified by the Engineer. 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).

**404.2.2. Crushed or broken stone:** The crushed or broken stone shall be hard, durable and free from excess flat, elongated, soft and disintegrated particles, dirt and other deleterious material.

**TABLE 400-6. PHYSICAL REQUIREMENTS OF COARSE AGGREGATES FOR WATER BOUND MACADAM FOR SUB-BASE/BASE COURSES**

Test	Test Method	Requirements
1 * Los Angeles Abrasion value Or * Aggregate Impact value	IS:2386 (Part-4)  IS:2386 (Part-4) or IS:5640**	40 per cent (Max)  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.

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

\*\*\* The requirement of flakiness index and elongation index shall be enforced only in the case of crushed broken stone and crushed slag.

**404.2.3. Crushed slag :** Crushed slag shall be made from air-cooled blast furnace slag. It shall be of angular shape, reasonably uniform in quality and density and generally free from thin, elongated and soft pieces, dirt or other deleterious materials. The weight of crushed slag shall not be less than 11.2 kN per m<sup>3</sup> and the percentage of glossy material shall not be more than 20. It should also comply with the following requirements:

- (i) Chemical stability : To comply with requirement of appendix of BS : 1047
- (ii) Sulphur content : Maximum 2 per cent
- (iii) Water absorption : Maximum 10 per cent

**404.2.4. Overburnt (Jhama) brick aggregates :** Jhama brick aggregates shall be made from overburnt bricks or brick bats and be free from dust and other objectionable and deleterious materials.

**404.2.5. Grading requirement of coarse aggregates :** The coarse aggregates shall conform to one of the Gradings given in Table 400-7 as specified, provided, however, the use of Grading No.1 shall be restricted to sub-base courses only.

**TABLE 400-7. GRADING REQUIREMENTS OF COARSE AGGREGATES**

Grading No.	Size Range	IS Sieve Designation	Per cent by weight passing
1.	90 mm to 45 mm	125 mm	100
		90 mm	90-100
		63 mm	25-60
		45 mm	0-15
		22.4 mm	0-5
2.	63 mm to 45 mm	90 mm	100
		63 mm	90-100
		53 mm	25-75
		45 mm	0-15
		22.4 mm	0-5
3.	53 mm to 22.4 mm	63 mm	100
		53 mm	95-100
		45 mm	65-90
		22.4 mm	0-10
		11.2 mm	0-5

Note : The compacted thickness for a layer with Grading 1 shall be 100 mm while for layer with other Gradings i.e. 2 & 3, it shall be 75 mm

**404.2.6. Screenings:** Screenings to fill voids in the coarse aggregate shall generally consist of the same material as the coarse aggregate. However, where permitted, predominantly non-plastic material such as moorum or gravel (other than rounded river borne material) may be used for this purpose provided liquid limit and plasticity index of such material are below 20 and 6 respectively and fraction passing 75 micron sieve does not exceed 10 per cent.

Screenings shall conform to the grading set forth in Table 400-8. The consolidated details of quantity of screenings required for various grades of stone aggregates are given in Table 400-9. The table also gives the quantities of materials (loose) required for 10 m<sup>2</sup> for sub-base/base compacted thickness of 100/75 mm.

The use of screenings shall be omitted in the case of soft aggregates such as brick metal, kankar, laterites, etc. as they are likely to get crushed to a certain extent under rollers.

TABLE 400-8. GRADING FOR SCREENINGS

Grading Classification	Size of Screenings	IS Sieve Designation	Per cent by weight passing the IS Sieve
A	13.2 mm	13.2 mm	100
		11.2 mm	95-100
		5.6 mm	15-35
		180 micron	0-10
B	11.2 mm	11.2 mm	100
		5.6 mm	90-100
		180 micron	15-35

TABLE 400-9. APPROXIMATE QUANTITIES OF COARSE AGGREGATES AND SCREENINGS REQUIRED FOR 100/75 MM COMPACTED THICKNESS OF WATER BOUND MACADAM (WBM) SLB-BASE/BASE COURSE FOR 10M<sup>2</sup> AREA

Classification	Size Range	Compacted thickness	Loose Qty.	Screenings			
				Stone Screening		Crushable type such as Moorum or Gravel	
				Grading Classification & Size	For. WHM Sub-base/base course (Loose quantity)	Grading Classification & Size	Loose Qty.
Grading 1	90 mm to 45 mm	100 mm	1.21 to 1.43m <sup>3</sup>	Type A 13.2mm	0.27 to 0.30 m <sup>3</sup>	Not uniform	0.30 to 0.30 m <sup>3</sup>
Grading 2	63 mm to 45mm	75 mm	0.91 to 1.07 m <sup>3</sup>	Type A 13.2mm	0.12 to 0.15 m <sup>3</sup>	-do-	0.22 to 0.24 m <sup>3</sup>
-do-	-do-	-do-	-do-	Type B 11.2mm	0.20 to 0.22 m <sup>3</sup>	-do-	-do-
Grading 3	53mm to 22.4mm	75 mm	-do-	-do-	0.18 to 0.21 m <sup>3</sup>	-do-	-do-

**404.2.7. Binding material :** Binding material to be used for water bound macadam as a filler material meant for preventing ravelling, shall comprise of a suitable material approved by the Engineer having a Plasticity Index(PI) value of less than 6 as determined in accordance with IS: 2720 (Part-5).

The quantity of binding material where it is to be used, will depend on the type of screenings. Generally, the quantity required for 75 mm compacted thickness of water bound macadam will be 0.06-0.09 m<sup>3</sup>/10m<sup>2</sup> and 0.08-0.10m<sup>3</sup>/10m<sup>2</sup> for 100 mm compacted thickness.

The above mentioned quantities should be taken as a guide only, for estimation of quantities for construction etc.

Application of binding materials may not be necessary when the screenings used are of crushable type such as moorum or gravel.

#### **404.3. Construction Operations**

**404.3.1. Preparation of base:** The surface of the subgrade/ sub-base/base to receive the water bound macadam course shall be prepared to the specified lines and crossfall (camber) and made free of dust and other extraneous material. Any ruts or soft yielding places shall be corrected in an approved manner and rolled until firm surface is obtained if necessary by sprinkling water. Any sub-base/base/surface irregularities, where predominant, shall be made good by providing appropriate type of profile corrective course (levelling course) to Clause 501 of these Specifications.

As far as possible, laying water bound macadam course over an existing thick bituminous layer may be avoided since it will cause problems of internal drainage of the pavement at the interface of two courses. It is desirable to completely pick out the existing thin bituminous wearing course where water bound macadam is proposed to be laid over it. However, where the intensity of rain is low and the interface drainage facility is efficient, water bound macadam can be laid over the existing thin bituminous surface by cutting 50 mm x 50 mm furrows at an angle of 45 degrees to the centre line of the pavement at one metre intervals in the existing road. The directions and depth of furrows shall be such that they provide adequate bondage and also serve to drain water to the existing granular base course beneath the existing thin bituminous surface.

**404.3.2. Inverted choke :** If water bound macadam is to be laid directly over the subgrade, without any other intervening pavement course, a 25 mm course of screenings (Grading B) or coarse sand shall be spread on the prepared subgrade before application of the aggregates. In case of a fine sand or silty or clayey subgrade, it is advisable to lay 100 mm insulating layer of screening or coarse sand on top of Fine grained soil, the gradation of which will depend upon whether it is intended to act as a drainage layer as well. As a preferred alternative to inverted choke, appropriate geosynthetics performing functions of separation and drainage may be used over the prepared subgrade as directed by the Engineer. Section 700 shall be applicable for use of geosynthetics.

**404.3.3. Spreading coarse aggregates :** The coarse aggregates shall be spread uniformly and evenly upon the prepared subgrade/sub-base/ base to proper profile by using templates placed across the road about 6 m apart, in such quantities that the thickness of each compacted layer is not more than 100 mm for Grading 1 and 75 mm for Grading 1 and 3, as specified in Clause 404.2.5. Wherever possible, approved mechanical devices such as aggregate spreader shall be used to spread the aggregates uniformly so as to minimise the need for manual rectification afterwards. Aggregates placed at locations which are inaccessible to the spreading equipment, may be spread in one or more layers by any approved means so as to achieve the specified results.

The spreading shall be done from stockpiles along the side of the roadway or directly from vehicles. No segregation of large or fine aggregates shall be allowed and the coarse aggregate as spread shall be of uniform gradation with no pockets of fine material.

The surface of the aggregates spread shall be carefully checked with templates and all high or low spots remedied by removing or adding aggregates as may be required. The surface shall be checked frequently with a straight edge while spreading and rolling so as to ensure a finished surface as per approved drawings.

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

**404.3.4. Rolling:** Immediately following the spreading of the coarse aggregate, rolling shall be started with three wheeled power rollers of 80 to 100 kN capacity or tandem or vibratory rollers of 80 to 100 kN static weight. The type of roller to be used shall be approved by the Engineer based on trial run.

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

width. Rolling shall be discontinued when the aggregates are partially compacted with sufficient void space in them to permit application of screenings. However, where screenings are not to be applied, as in the case of crushed aggregates like brick metal, laterite and kankar, compaction shall be continued until the aggregates are thoroughly keyed. During rolling, slight sprinkling of water may be done, if necessary. Rolling shall not be done when the subgrade is soft or yielding or when it causes a wave-like motion in the subgrade or sub-base course.

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

Material which gets crushed excessively during compaction or becomes segregated shall be removed and replaced with suitable aggregates.

It shall be ensured that shoulders are built up simultaneously along with water bound macadam courses as per Clause 407.4.1.

**404.3.5. Application of screenings:** After the coarse aggregate has been rolled to Clause 404.3.4, screenings to completely fill the interstices shall be applied gradually over the surface. These shall not be damp or wet at the time of application. Dry rolling shall be done while the screenings are being spread so that vibrations of the roller cause them to settle into the voids of the coarse aggregate. The screenings shall not be dumped in piles but be spread uniformly in successive thin layers either by the spreading motions of hand shovels or by mechanical spreaders, or directly from tipper with suitable grit spreading arrangement. Tipper operating for spreading the screenings shall be so driven as not to disturb the coarse aggregate.

The screenings shall be applied at a slow and uniform rate (in three or more applications) so as to ensure filling of all voids. This shall be accompanied by dry rolling and brooming with mechanical brooms, hand-brooms or both. In no case shall the screenings be applied so fast and thick as to form cakes or ridges on the surface in such a manner as would prevent filling of voids or prevent the direct bearing of the roller on the coarse aggregate. These operations shall continue until no more screenings can be forced into the voids of the coarse aggregate.

**The spreading, rolling, and brooming of screenings shall be carried out in only such lengths of the road which could be completed within one day's operation.**

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

In case of lime treated soil sub-base, construction of water bound macadam on top of it can cause excessive water to flow down to the lime treated sub-base before it has picked up enough strength (is still "green") and thus cause damage to the sub-base layer. The laying of water bound macadam layer in such cases shall be done after the sub-base attains adequate strength, as directed by the Engineer.

**404.3.7. Application of binding material:** After the application of screenings in accordance with Clauses 404.3.5 and 404.3.6, the binding material where it is required to be used (Clause 404.2.7) shall be applied successively in two or more thin layers at a slow and uniform rate. After each application, the surface shall be copiously sprinkled with water, the resulting slurry swept in with hand brooms, or mechanical brooms to fill the voids properly, and rolled during which water shall be applied to the wheels of the rollers if necessary to wash down the binding material sticking to them. These operations shall continue until the resulting slurry after filling of voids, forms a wave ahead of the wheels of the moving roller.

**404.3.8. Setting and drying:** After the final compaction of water bound macadam course, the pavement shall be allowed to dry overnight. Next morning hungry spots shall be filled with screenings or binding material as directed, lightly sprinkled with water if necessary and rolled. No traffic shall be allowed on the road until the macadam has set. The Engineer shall have the discretion to stop hauling traffic from

using the completed water bound macadam course, if in his opinion it would cause excessive damage to the surface.

The compacted water bound macadam course should be allowed to completely dry and set before the next pavement course is laid over it.

#### **404.4. Surface Finish and Quality Control of Work**

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

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

**404.4.3.** The water bound macadam work shall not be carried out when the atmospheric temperature is less than 0°C in the shade.

**404.4.4.** Reconstruction of defective macadam: The finished surface of water bound macadam shall conform to the tolerance of surface regularity as prescribed in Clause 902. However, where the surface irregularity of the course exceeds the tolerances or where the course is otherwise defective due to subgrade soil mixing with the aggregates, the course to its full thickness shall be scarified over the affected area, reshaped with added material or removed and replaced with fresh material as applicable and recompacted. In no case shall depressions be filled up with screenings or binding material.

#### **404.5. Arrangement for Traffic**

During the period of construction, the arrangement of traffic shall be done as per Clause 112.

#### **404.6. Measurements for payment**

Water bound macadam shall be measured as finished work in position in cubic metres.

#### **404.7. Rate**

The Contract unit rate for water bound macadam sub-base/base course shall be payable in full for carrying out the required operations including full compensation for all components listed in Clause 401.8 (i) to (v) including arrangement of water used in the work as approved by the Engineer.

### **Item No. 10**

**Clearing and Grubbing road land including uprooting rank, vegetation, grass bushes, shrubs, saplings and trees girth up to 300 mm removal of stumps of trees cut earlier and disposal of unseviceable materials and stacking of serviceable materials to be use (A) By mechanical means in area of light jungle**

1.Before starting the work the site shown on plans shall be cleared of all obstructions loose stones and materials, rubbish of all kinds as well as all trees and brush wooden except those marked for prevention, the roots being entirely grubbed up. No trees to be cut down before obtaining permission from Engineer in charge.

2.The stuff obtained from clearance shall be stacked in such a place and in such a manner as ordered by the Engineer in charge and the ground shall be left in a perfectly clean condition.

3.In jungle cleaning, all trees, not specially marked for preventions, bamboos, jungle wood and brush wood shall be cut down their roots rubbed up. All wood and materials available as directed by the Engineer in charge.

4.All holes or hollows, where originally or products by digging up roots shall be carefully filled up with earth well rammed and leveled up neatly as directed.

5.After completion of the work, but before its acceptance, the site shall be cleared of all scaffolding, surplus materials and rubbish etc. as per contract. No extra payment shall be made for site clearance.

The rate for this item of work shall be for the complete job and shall be paid at the hector rate tendered for the work on completion of the entire work.

#### **Item - 11**

##### **Engaging the JCB for the different type of work on road side with machineries, oil, fuel, driver etc. complete**

**1. Scope :-** The work shall consist of supplying of J. C. B. (excavator) for road work or as instructed by engineer in charge at and where required and as directed by engineer in charge.

J.C.B. shall be supply with driver holding valid license including fuel and oil required including all type of maintenance and repairing work if required. J.C.B. shall be with valid and appropriate insurance.

**2. Mode of measurement payment:** The measurement of work done by J.C.B. shall be measured in our only in working condition as specified.

**3. Unit :** Unit shall be one hour

#### **Item - 12**

##### **Tractor on hire charges with trailer diesel, driver, necessary equipment.**

**1. Scope :-** The work shall consist of supplying of tractor with trailer for road work or as instructed by engineer in charge at and where required and as directed by engineer in charge.

tractor shall be supply with driver holding valid license including fuel and oil required including all type of maintenance and repairing work if required. And with all risk and cost Tractor shall be with valid and appropriate insurance.

**2. Mode of measurement payment:** The measurement of work done by tractor shall be measured in Day only in working condition as specified.

**3. Unit :** Unit shall be one Day

#### **Item No - 13**

##### **Earth work for embankment including breaking clods, dressing with all lead and lift (excluding watering and consolidation) from borrow pits within land width**

**And**

#### **Item No - 14**

##### **Earth work for embankment including breaking clods, dressing, with all, lead and lift (incl. watering and consolidation) From borrow area with all lead and lift (C) From borrow pits within 1 k.m. lead**

1.The land width on which the earth work is to be done shall be cleared off all the trees having girth of 30 cm and less, loose stones, vegetations, bushes, slumps and all other objectionable material shall be arranged in convenient stack along the road boundary or as directed at place within 50 meters lead and handed over to the department in convenient section. Unsuitable material shall be burnt or otherwise disposed off by the contractor at his own cost without causing any nuisance, inconvenience or damage to the works property or people in the neighborhood. In all cases the materials shall be disposed off in an a neat manner.

2.After cleaning the site, the alignment of the road shall be properly set out true to line, curves, slopes, graded and sections as shown on the plan or directed by the Engineer in charge. The contractor shall provide all labours and materials such as lime, strings, pegs, nails, bamboos, stone, mortar, concrete etc. required for setting out, establishing bench marks and giving profiles. The contractor shall be responsible for maintaining benchmarks, profiles, alignments and other marks as long as they are required for the work in the opinion of the Engineer in charge. If the contractor defaults in this respect they may be restored by the department at the cost of contractor.

3.When existing embankment is to be widened, continuous horizontal benches, each at least 0.30meter wide shall be cut into the existing slopes for insuring adequate bond with the fresh embankment material to be added. The material obtained from the cutting of benches can be utilized in the widening of the embankment. Where the width of widened portion, is insufficient to permit the use of rollers. Compaction shall be carried out with the help of tandem / sheep foot rollers, hand rollers, mechanical tampers or other approved plant. The dumping of material from trucks for widening operations shall be avoided except in difficult circumstances when the extra width is too narrow to permit the movement of any other type of hauling equipment.

4.The soil to be used for the embankment shall be free from trees, slumps, roots, rubbish or any other objectionable materials. Only materials considered suitable by the Engineer in charge shall be used for the



construction and that considered unsuitable other disposed off as directed by him. The selection the materials to be used in the construction of embankment shall be made after the soil surveys and investigations are carried out by the department. The embankment shall consist of earth available from road side borrow pits on either side with lead and all lifts and within land width in the manner specified in para 12 below. The road, if any required for the purpose haulage of earth by men, animals or vehicles will be constructed (if not existing) and maintained by the contractor at his own cost. The material satisfying the density requirements given in the table below shall be employed for embankment construction

Type of Work	Laboratory Dry Density when tested as per IS 2720 {Part VII}
Embankment upto 3 meter height	Not less than 1.44 gm/cc
Embankment exceeding 3 meter height or embankment of any height subject to lon period of inundation.	Not less than 1.52 gm/cc
Top 0.50 meter of embankment below the subgrade level and shoulder {where earth shoulder are specified}	Not less than 1.65 gm/cc

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

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

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

7.Where an embankment is to be placed on sloping ground the surface of the ground shall be benched in the steps of trenches or broken up in such a manner that the material shall have perfect bond with the existing surface. Where the embankment is to be laid over an existing road surface the surface shall be scarified to minimum depth of 5 cm so as to provide ample bond between the old and new material. However when the pavement shall be broken up in please not to exceeding 0.1 mt and may be left under the new embankment. If the existing road surface is of granular or bituminous type and line within 1 mt. of the new subgrade level the same shall be scarified to a depth of minimum 50mm so as to provide ample bond between the old and the new material.

8.To avoid interference with the construction of abutment, wing walls or return wall, culvers / bridge structures, the contractor shall at point to be determined by the Engineer in charge, suspend the work on embankment forming approaches to such structures, until such time as the construction of the latter is sufficiently advanced to permit the completion of approaches without the risk of interference or damage to the bridge work. Unless directed otherwise the filling ground culverts, bridges and other structure upto a distance to twice the height of the embankment from the back of the embankment shall be carried out independent of the work on the main embankment. The fill material shall not be placed against any abutment or wing walls unless permission has been given by the Engineer in charge but in any case not until the concrete or masonry has been in position for 14 days. The embankment shall be brought up simultaneously with the laying of fill material. The material used for the filter shall conform to the requirements for filter medium and will be paid extra in the relevant item. Where it may be impracticable to use power roller or other heavy equipment, the compaction shall be carried out by mechanical tampers or

other methods approved by the Engineer in charge. Care shall be taken to see that the compaction plant does not hit or come to close to any structural member so as to cause any damage to them.

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

10. The consolidation of earth work including rolling and watering at OMC as per laboratory requirement shall be carried out by the contractor. The field and laboratory investigations and testing of sample shall be carried out by the department. However, the contractor shall give full co operations and shall be made the charges for labours and collection of samples for testing at authorized Government laboratory. The work of laying of earthwork in layers shall be synchronized with the field and laboratory testing. When density measurements reveal any soft area as in the embankment the Engineer in charge directed that these areas shall be compacted further. If inspire of that, specified compaction is not achieved the materials in the soft areas shall be removed as directed and replaced by the approved materials.

11. The earthwork measurements shall be paid on cross sectional measurements and computing the volumes of earthwork in cubic meter by average area method. The contractor shall sign day to day leveling work and also original cross section, longitudinal section etc., on token of his acceptance. The working section both longitudinal and cross of the ground shall be taken by the Engineer in charge before the actual work is started. The contractor or his authorized representative shall attend day to day leveling work and sigh with date the field book daily, in token of his acceptance. If there is any disagreement, the contractor shall inform of it in writing the officer concerned with specified reference to the section officer before starting further work. Once the work is started, no cognizance of any complaint will be taken. Merely not signing of level books shall not be deemed as disagreement. The Executive Engineer shall also verify leveling work to the extent of 5% before commencement of earthwork and on finalization. The contractor shall maintain the embankment by filling the rust, raincuts, depressions due to shrinkage etc. to proper formation and grade till this item is finally measured and accepted by the Department. The measurements shall be taken on compacted earthwork. No deduction for shrinkage shall be made from gross measured quantity of compacted earthwork. However the contractor shall have to bear loss of quantity due to all settlement as well as other types of deformations etc., if any, that might have taken place at the time of taking final measurements of this item.

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

#### **Item No. 15**

**Supplying, stacking and spreading quarry spall with all lead and lift and including watering and rolling and consolidation of sub grade in layers at OMC to required dry density including filling depression which occurs during the process using vibratory roller of 80 KN to 100KN (selected quarry spall having CBR value not less than 30.0)**

**1. Scope:-** The work shall consist of constructing shoulder on either side of pavement with quarry spalls with the requirement of these specifications and in conformity with the lines, grades and cross sections shown on the drawings or as directed.

**2. Materials :** Mataterials shaal be Quarry spalls confirming to the requirements as specified below.

**2.1** The quarry spalls to be used for the work shall be free from organic or other deleterious constituent and conform to grading given the Table 2.1

**Table 2.1**

IS Sieve Designation		Per Cent by weight passing the I S Sieve
53.0	mm	100
26.5	mm	50-80
9.50	mm	
4.75	mm	15-35
2.36	mm	
0.425	mm	
0.075	mm	>10
<b>CBR Value (Minimum)</b>		<b>30</b>

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

## 2.2 Physical requirement:-

The quarry spalls shall have a 10 percent fines value of 50 KN or more (for sample in soaked condition) when tested in compliance with BS: 812 (Part 111). The water absorption value of the quarry spalls shall be determined as per IS: 2386 (Part 3); if this value is greater than 2 percent, the soundness test shall be carried out on the quarry spalls delivered to site as per IS: 383. The CBR shall be determined at the density and moisture content likely to be developed in equilibrium conditions which shall be taken as being the density relating to a uniform air voids content of 5 percent.

## 3. Mode of Measurement and Payment:-

The side shoulder with quarry spalls shall be measured as finished work in position in cubic meters. The finished thickness of work done shall be paid on volume basis.

## Item No. - 16

**Supplying and stacking murrum of good quality murrum to filling interstices including filling the measure boxes including all lead lift with all royalties and taxes etc. comp.**

1.0 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 Materials shall be collected from quarries approved by the Executive Engineer. The materials shall be granular and gritty.

2.0 The materials shall be got approved by the Executive Engineer prior to collection on site. It shall be free from all rubbish, dust and any organic materials as well as clods of bask cotton soils. Materials shall not be allowed to be collected from within the road boundary. materials to be used as crust and for side shoulders shall be as per C.B.R. report and that to be used 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 materials to be used should be got tested prior to use in road construction. Testing shall be borne by the contractor.

3.0 River or Nala or Sea sand required for the work shall be clear, sound, properly, graded, free from organic materials silt clay etc. and shall be got approved by the Engineer-in-charge. The sand shall be obtained and brought from the source approved by Engineer-in-charge. The sand shall be well graded. The payment shall be made on Cubic Metre basis.

4.0 Stacking shall be done by filling in the standard steel boxes of 2 m X 1.5 X 0.5 m size which shall be supplied by the Department if available on rent. Otherwise contractor shall make his own arrangement. No deduction for voids shall be made from the grade measurements. Where any doubt exists as to whether the quantity of stacks of Murrum in an hectometer is not confirming with the cubic content of the standard Pharnas (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 cmt. the entire collection in the hectometer shall be paid on the basis of the quantity so found. Regular stacks shall be done by the Contractor on a fairly level ground. Stacking of the Murrum shall be done in a manner as directed by the Engineer-in-charge.

5.0 For road work completed stacking of Murrum as per requirement shall be carried out 2 Km. length before spreading. The collection shall always, be commenced at one end of the Km. and be carried continuously toward the other end unless the Engineer-in-charge shall direct otherwise.

**Item No 17**

**Supplying and fixing reinforced cement concrete heavy duty non pressure pipe with collars for culvert including setting and jointing the pipes in C.M. 1:2 , watering and laying ( to level or slope) IS class NP3 of 900 mm internal diameter.**

**And**

**Item No 18**

**Supplying and fixing reinforced cement concrete heavy duty non pressure pipe with collars for culvert including setting and jointing the pipes in C.M. 1:2 , watering and laying ( to level or slope) IS class NP3 of 600 mm internal diameter.**

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 drawing or as ordered by the Engineer in charge.

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

NP3 pipes are used for R.C.C. pipes where testing of pipe will not be feasible the contractor will have to produce a certificate from the manufacture on company's letter head the given herein after form.

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

**FORM OF CERTIFICATE FOR NP3 PIPES**

We..... Manufacture of R.C.C. pipes produce R.C.C. pipe as per requirement of IS : 458 and also carry out the required test at our place. We have required equipment for carrying out test and are prepared to carry out test at our factory site,

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 :..... Manufacture's sign.....

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

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

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

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

**Item No. 19**

**Providing and fixing ordinary kilometer stone of pre-cast C.C. 1:2:4 including necessary reinforcement as per I.R.C. type design fixing in C.C. 1:4:8 including letter and paints etc. complete.**

1. Kilometer stone shall be of approved quality and shall be of precast 1:2:4 R.C.C. as specified in the item.
2. The size, manner of fixing, painting and lettering of K.M. stone shall conform specification as per I.R.C. - 8 (Type design for Highway kilometer stones). The fixing of K.M. stone shall be carried out in ordinary concrete of grade specified in the item using hand broken metal field metal or gravel. The measurement for payment shall be made per No. of K.M. stone fixed in position.
3. Unit rate for kilometer stone includes the cost of all materials, labour, tools, fixing, finishing curing, lettering and painting as directed by the Engineer-in-charge.

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

**Item No. 20**

**Providing and fixing guard stone as per I.R.C. type design including white washing etc. complete (ii) Fixing in c.c. 1:5:10**

The work shall be carried out as per the item of ordinary kilometer stone except that the size of guard stone shall be as per I.R.C. and fixing shall be in C.C. 1:5:10 which will consist of one part of cement, five parts of good sand and ten parts of good brick bats. The measurement for payment as well as the operations included in the unit rate shall be as per ordinary kilometers stone. Rate includes all labour and curing etc. necessary for concrete.

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

**Item No.- 21**

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

**(1) Non reflective type.**

1. The board shall consist of a 90 cm x 90 cm. triangular plate of 6 mm thickness at the top and a 90 cm x 61 cm rectangular plate of 6 mm thickness below if fixed at suitable distance. This shall be fixed to the angles iron post of 75 mm x 75 mm x 6 mm size by means of welding or riveting as directed by the Engineer-in-charge. The angle iron post shall be split at the bottom end to 10 cm (minimum) in length and shall be fixed at right angle to the central line of the road in ordinary concrete of grade as specified in the item. using hand broken metal, field metal or gravel. Two steel bars of 12 mm dia. shall also be embedded in concrete for fixing as directed by the Engineer-in-charge. The top of the post shall be at a height of 25 cm. as above the ground level. Concrete platform shall be of the size 45 cm x 45 cm and shall project 2.5 cm above ground level and shall be at least 60 cm below ground level. Total height of post shall be 3 mt. (minimum). The exposed platform shall be neatly finished and its shape shall be as directed by the Engineer-in-charge.
2. The post will be painted with two coats alternatively in black and white strips 23 cm. in height after applying one coat of anticorrosive paint. The paint shall be approved quality. The board shall be painted with approved color and lettering shall be in accordance with I.R.C. 30 (Standard Letters and Numerals of Different Heights for use on Highway designs) and as per notified signs of Motor Vehicle Act. respectively.
3. The measurement for payment shall be per number of sign board fixed in position.
4. The unit rate includes the cost of materials, labour tools, drilling holes, riveting or welding, fixing, curing, lettering, painting as directed by the Engineer-in-charge.

**Item No. 22**

**Cautionary Warning Sign :-**Providing and fixing sing boards made out of 2mm aluminium sheet; size 90 x 90 x 90 cms. equilateral triangle as per design of IRC-67-1977. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with retro reflectivesheeting as per latest M.O.S.T.Specifications; 3.1m long stand postand frame fabricated from suitable sizeiron angle of 35 x 35 x 3mm, 75 x 75 x 6mm as required; painted with bestquality epoxy coatings in black andwhite bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge.(A) Engineer Grade(VR)

**801.3.1. General requirements:**

The retro-reflective sheeting used on the sign shall consist of the white or coloured sheeting having a smooth outer surface which has the property of retro-reflection over its entire surface. It shall be weather-resistant and show colour fastness. It shall be new and unused and shall show no evidence of cracking, scaling, and pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having tested the sheeting for these properties in an unprotected outdoor exposure facing the sun for two years and its having passed these tests shall be obtained from a reputed laboratory, by the manufacturer of the sheeting. The reflective sheeting shall be either of Engineering Grade material with enclosed lens or of High Intensity Grade with encapsulated lens. The type of the sheeting to be used would depend upon the type, functional hierarchy and importance of the road.

**801.3.2. High intensity grade sheeting:** This sheeting shall be of encapsulated lens type consisting of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent water-proof plastic having a smooth surface. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM Standard E: 810) as indicated in Table 800-1

**TABLE 800-1 ACCEPTABLE MINIMUM COEFFICIENT OF RETRO REFLECTION FOR HIGH INTENSITY GRADE SHEETING (CANDELAS PER LUX PER SQUARE METRE)**

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

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

**801.3.3. Engineering grade sheeting:** This sheeting shall be of enclosed lens type consisting of microscopic lens elements embedded beneath the surface of a smooth, flexible, transparent, water-proof plastic, resulting in a non-exposed lens optical reflecting system. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined in accordance with ASTM Standard: E-810) as indicated in Table 800-2.

**TABLE 800-2 ACCEPTABLE MINIMUM COEFFICIENT OF RETRO-REFLECTION FOR HIGH INTENSITY GRADE SHEETING (CANDELAS / LUX PER SQUARE METRE)**

Observation angle (in degrees)	Entrance angle (in degrees)	White	Yellow	Orange	Green	Red	Blue
0.2	-4	70	50	25	9.0	14.5	4.0
0.2	+30	30	22	7.0	3.5	6.0	1.7
0.5	-4	30	25	13.5	4.5	7.5	2.0
0.5	+30	15	13	4.0	2.2	3.0	0.8

When totally wet, the sheeting shall not show less than 90 per cent of the values, of retro-reflection indicated in Table 800-2. At the end of 5 years, the sheeting shall retain at loss 50 % of its original retro-reflectance.

**801.3.4. Messages/borders:**

The messages (legends, letters, numerals etc.) and borders shall either be screen printed or of cut-outs. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. Cut-outs shall be of materials as specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer.

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

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

**801.3.7. Colour:**

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

- Blue - is Colour No. 166: French Blue
- Red - is Colour No. 537: Signal Red
- Green - is Colour No. 284: India Green
- Orange - IS Colour No. 591: Deep Orange.

The Colours shall be durable and uniform in acceptable hue when viewed in day light or under normal headlights at night.

**801.3.8. Adhesives:**

The sheeting shall either have a pressure sensitive adhesive of the aggressive-tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, or a tack free adhesive activated by heat, applied in a heat-vacuum applicator, in a manner recommended by the sheeting manufacturer. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. In case of pressure-sensitive adhesive sheeting, the sheeting shall be - applied in accordance with the manufacturer's Specifications. Sheeting with adhesives requiring use of solvents or other preparation for adhesive shall be applied strictly in accordance with the manufacturer's instructions.

### **801.3.9. Refurbishment:**

Where existing signs are specified for refurbishment, the sheeting shall have a semi-rigid aluminium backing pre-coated with aggressive tack type pressure sensitive adhesive. The adhesive shall be suitable for the type of material used for the sign and should thoroughly bond with that material.

### **801.3.10. Fabrication:**

**801.3.10.1.** Surface to be reflectorised shall be effectively prepared to receive the retro reflective sheeting. The aluminium sheeting shall be de-greased -either by acid or hot alkaline etching and all scale,/dust removed to obtain a smooth plain surface before the application of retro reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting.

**801.3.10.2.** Complete sheets of the material shall be used on the signs except where it is unavoidable. At Splices, sheeting with pressure sensitive adhesives shall be overlapped not less than 5 mm. Sheeting with heat-activated adhesives may be spliced with an overlap not less than 5 mm or butted -with a gap not exceeding 0.75 mm. Where screen printing with transparent Colours is proposed, only butt jointing shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

**801.3.11. Warranty and Durability:** The Contractor shall obtain from the manufacturer a seven year warranty for satisfactory field performance including stipulated retro reflectance of the retro reflective sheeting of high intensity grade and a five year warranty for the adhesive sheeting of engineering grade, and submit the same to the Engineer. In addition, a seven year and a five year warranty for satisfactory in-field performance of the finished sign with retro reflective sheeting of high intensity grade and engineering grade respectively, inclusive of the screen printed or cut out letters/legends and their bonding to the retro reflective sheeting shall be obtained from the Contractor/supplier and passed on to the Engineer. The Contractor/supplier shall also furnish a certification that the signs and materials supplied against the assigned work meets all the stipulated requirements and carry the stipulated warranty.

Processed and applied in accordance with recommended procedures, the reflective material shall be weather resistant and, following cleaning, shall show no appreciable discolouration, cracking, blistering or dimensional change and shall not have less than 50 per cent of the specified minimum reflective intensity values (Tables 800-1 and 800-2) when subjected to accelerated weathering for 1000 hours, using type E or EH Watherometre (AASHTO Designation M 268).

### **801.4. Installation:**

**801.4.1.** Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally, signs with an area up to 0.9 Smt shall be mounted on a single post, and for greater area two or more supports shall be provided. Sign supports may be of mild steel, reinforced concrete or galvanised iron (G.I). Post-end (s) shall be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant Specifications as specified.

**801.4.2.** All components of signs and supports, other than the reflective portion and G.I. posts shall be thoroughly decaled, cleaned, primed and painted with two coats of epoxy paint. Any part of mild steel (M.S.) post below ground shall be painted with three coats of red lead paint.

**801.4.3.** The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers, of suitable size in the case of reinforced concrete or GI posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.



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

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

### **801.6. Rate**

The Contract unit rate shall be payment in full for the cost of making the informatory cum logo sign board as per item description, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications.

#### **Item No. 23**

**Supp. And Fixi. flood gauge as per drawing and instruction. Made of M.S. pipe of size 100 x 50 mm size and 2.05 mtr. long rectangle pipe Incl.fabrication,Welding, applying a coat of primer coat and two coat of oil paint and painting letters & calibration as per drawing etc. comp. at road site**

Item covers the preparation, painting, lettering and fixing of flood gauge post.

The gauge post should be of M. S. plate and angle or as directed by Engineer in charge.

After Fixing the gauge should be painted with approved quality enamel paint {two coats} with primer coat of red oxide

Color of paint, necessary marking and lettering should be carried as directed by Engineer in Charge.

Finished rain gauge post should be fixed in head wall of causeway as directed by Engineer in Charge

Payment shall be made on No. basis and rate inclusive of all kind of labour and materials to carry out item as directed by Engineer in Charge.

#### **Item No. 24**

**Supplying, Stacking & Laying rubble of required size for soling on road site including packing & filling in the interstice as directed**

1.The work shall consist of laying boulders directly on the prepared surface for protections against scour.

2. The stone used apron shall be sound, hard, durable and fairly regularly in shape. Stone subjected to marked deterioration by water or weather shall not be used the thickness and shape of apron shall be as indicated on the drawings or as directed by the engineer-in-charge. The surface on which the apron is to be laid shall be leveled and prepared for the length and width as shown on the drawing. The size of stones shall be as large as possible and weights shall be as specified in the item but in no case any fragment shall weight less than 40 kg. The specific gravity of the stone shall be as high as possible and it shall not be less than 2.50. to ensure regular and orderly deposition of the full intended quantity of stone in the apron, template cross walls in dry masonry shall be built about a meter wide and two the full height of the specified thickness of the apron at interval of 30 meters and all along the length and width of the apron. Within the walls, the stone then shall be hand packed.

3. Payment shall be made on Cubic. Meters. Bases of stack the material shall have to be stacked at site before laying. Preparation of base for laying bedding shall be deemed incidental to the work. Nothing shall deduct for voids.

4. The rate shall include cost of material, labour, and tools to complete the job.

#### **Item No. 25**

**Providing & Laying cement concrete 1:4:8 (1-Cement 4-Coarse sand 8-machine crushed stone aggregates 40mm nominal size) and curing complete in foundation and plinth.**

Providing and laying ordinary cement concrete 1:4:8 for foundation including cost of formwork if required using cement, sand and machine crushed stone aggregates of 40mm nominal size.

1. In no case of ordinary cement concrete mix is not required to be designed by preliminary tests and proportions of cement, fine aggregates and coarse aggregates are specified by volume as given in item,

2. The ordinary cement concrete mix shall general be specified by volume for cement which normally cement in bags and is available by weight, volume shall be worked out taking 50 Kg. cement as 0.035

Cu.M. in volume. While measuring aggregate by volume, shaking ramming or hammering shall not be done. Proportioning of sand shall be as per its dry volume incase it is damp allowance for bulking shall be made as IS : 2386 {Part III}

3. Ingredient required for ordinary cement concrete containing one 5 Kg. bag of cement for different proportions of mix shall be as given the table below.

Grade of Concrete	Sand in Cu.M.	Aggregates in Cu.M.
1	2	3
1:4:8	0.135	0.27
1:5:10	0.165	0.33

4. **Cement** :- Cement shall be ordinary Portland stab cement as per IS 1975 properties of cement as per IS 455 1976.

#### 5. Sand

5.1 Sand shall be natural sand, clean well graded, hard strong, durable and gritty particularly free from immures amounts of dust, clay, kankar modules, soft or flaky particles shell, alkali slats, organic matter, lean mica or other deleterious substances and shall be got approved from the Engineer in charge. The sand shall not contain more than 8 percent of silt as determined by field test, if necessary the sand.

5.2 Coarse sand :- The fineness modules of coarse sand shall not be less than 2.5 and shall not exceeds

3.0. The sieve analysis of coarse sand be as under.

I..S. Sieve Designation	% by weight passing
4.75 mm	100
2.36 mm	90 to 100
1.18 mm	70 to 100
600 MC	30 to 100
300 MC	85 to 70
150 MC	00 to 50

5.3 **Fine sand** :- The fineness module shall not exceeds 1.0 to sieve analysis of fine sand be as under :-

I..S. Sieve Designation	% by weight passing
4.75 mm	100
2.36 mm	100
1.18 mm	75 to 100
600 MC	40 to 85
300 MC	0 to 50
150 MC	00 to 10

6.0 Stone coarse aggregates for nominal mix concrete :- Coarse aggregates shall be or machine crushed stone of black trap or equivalent and hard, strong, dense, durable, clean and free from skin and coating likely to prevent proper adhesion of mortar.

The aggregates shall be generally be cubical in shape unless special stones of particular quarries are mentioned aggregated shall be machine crushed from the best black trap of equivalent hand done as approved. Aggregates shall have no deleterious reaction with cement. The size of the coarse aggregates for plain concrete and ordinary reinforced cement. The concrete shall generally be as per the table given below, if however in case of reinforced cement concrete the minimum limit may be

restricted to unless that the minimum lateral clear distance between bars or 6mm less than the cover whatever is smaller.

I.S. Sieve Designation	Percentage passing for single sized aggregates of nominal size		
	40 mm	20 mm	16 mm
80 mm	--	--	--
63 mm	100	--	--
40 mm	85-100	100	0
20 mm	0-20	85-100	100
16 mm	--	--	85-100
12.5 mm	--	--	--
10 mm	0.50	0.20	0.30
4.75 mm	--	0.50	0.50
2.35 mm	--	--	

Note :- This percentage may be varied somewhat by the Engineer in charge when considered necessary containing better density and strength of concrete.

The grading test shall be taken in the beginning and at the change of source of material. The necessary test indicates in IS 383-1970 and IS 456-1976 shall have to be carried out to ensure the acceptability. Aggregates shall be stored separately and handled in such a manner as to prevent the intermixing of different aggregates. If the aggregates are covered with dust, they shall be washed with water to make them clean.

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

8. Cement shall be stored above the ground level in perfectly dry and watertight sheds and shall be stocked not more than eight bags high. Cement more than 3 to 4 months old shall invariably be tested to ascertain that the acceptability requirements. The aggregates shall be stored in such a way as to prevent admixture of foreign materials. Different sizes of the fine or coarse aggregates shall be stored in separate stock piles sufficiently removed from each other to prevent mixing the materials at the edge of the piles.

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

10. **Workmanship :** Before starting concreting the road of foundation trenches shall be cleared of all loose materials leveled, watered and rammed as directed.

11. **Mixing:-** The concrete shall be mixed in a mechanical mixer. If quantity of cement concrete is very small after taking prior permission of Engineer in charge. Mixing shall be done on a smooth water tight platform large enough to allow efficient turning over of the ingredients of concrete before and after adding water. Mixing platform shall be so arranged that no foreign material shall be mixed with concrete nor does the mixing water flow out. Cement in required numbers of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregates, which shall also be spread in layers of uniform thickness on the mixing platform. Dry coarse and fine aggregates and cement shall then be mixed thoroughly by turning over to get a mixture of uniform colour, enough water shall then be gradually added thoroughly by 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.

12. For mass concrete work, the concrete shall be mixed in mechanical mixer. The method of transporting and placing concrete shall be approved by the Engineer in charge. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes place. All formwork and reinforcement contained in it shall be cleared 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.

13. Unless otherwise agreed to by the Engineer in charge concrete shall not be dropped into place from a height exceeding 2 meter. When trenching or chutes are used they shall be kept clean and used in such a way as to avoid segregation. When concrete has to be resumed on a surface which has hardened, it shall be roughening, swept, clean, thoroughly wetted, and covered with a 13mm thick layer of mortar composed cement and sand in the same ratio as in the concrete mix itself. This 13mm layer of mortar shall be freshly mixed and placed immediately before placing on new concrete. Where concrete has not fully hardened all balance shall be removed by scrubbing the wet surface with wire or bristle brushes, care should be taken to avoid dislodgement of any particles of coarse aggregates. The surface shall then be thoroughly wetted, all free water removed, and the 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.

#### **14. Formwork if required.**

Form work shall include all temporary or permanent forms required for forming the concrete. Together with all temporary construction required for their support. Forms for concrete shall be constructed of metal or timber suitably line and be of substantial and rigid construction true to shape and dimensions shown on the drawings. Where metal forms are used, all bolts and rivets shall be countersunk and well ground to provide a smooth and plane surface. Where timber is used it shall be well seasoned. For exposed concrete faces, timbers for shuttering shall be wrought on all faces in contractor with concrete.

15. The Engineer in charge shall be informed in advance by the contractor of his intention to strike any formwork. While fixing the time for removal of formwork due consideration shall be given to local conditions, character or the structure. The weather and other conditions that influence the setting of concrete and of the materials used in the mix. Vertical forms of beams, columns and walls maybe removed after 2 days. All formwork shall be removed without causing any damage to the concrete.

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

The payment should be made on Cmt.basis.

#### **Item No. 26**

**Providing and laying cement concrete 1:2:4 (1 Cement : 2 coarse sand :4 graded stone aggregate 20m.m. nominal size) and curring complete excluding cost of form work in : (a) Foundation and plinth.**

**And**

#### **Item No. 28**

**Providing and filling in foundation with ordinary cement concret M150 mix and providing necessary vetical pin headers including formwork vibrating ramming and curing complete.**

1. In case of ordinary concrete mix in not required to be designed by preliminary tests and proportions of cement, fine aggregates and coarse aggregates are specified by volume as given in tables below for different grades of concrete designated as ordinary M100, M150, M200 and M250.
2. IN the designation of a concrete mix, letter "M" refers to the mix and the number the specified 28 days works cube compressive strength of that mix on 150mm cubes expressed in Kg/Cm<sup>2</sup>.
3. The ordinary concrete mix shall generally be specified by volume. For cement which normally comes in bags and issued by weight, volume shall be worked out taking 50 Kg. of cement as 0.035 Cu.M. in volume. While measuring aggregates by volume, shaking, ramming or hammering shall not be done. Proportioning of sand shall be as per its dry volume. In case it is dump, allowance for bulking shall be made as per IS : 2386 {Part : III}

3. Ingredient required for ordinary cement concrete containing one 50 Kg. bag of cement for different proportions of mix shall be as given the table below.

Grade of Concrete	Mix by Volume	Total Quantity of dry aggregates by volume per 50 Kg. of cement to be taken as sum of the individual volumes of fine and coarse aggregates mix	Proportion of fine aggregates to coarse aggregates	Quantity of water per 5 Kg. of cement max.
Ordinary	Liter	One Cubic meter = 1000 liters		Liter
M100	1:3:6	300	General 1:2 for fine agg. To coarse agg. By volumes but subject to a upper limit of 1 : 1 ½ & a lower limit of 1:3	34
M150	1:2:4	220		32
M200	1:1 ½ : 3	160		30
M250	1:1:2	100		27

Note :- The proportion of the aggregates shall be adjusted from upper limit to lower limit progressively as the grading of the fine aggregates becomes finer & the maximum size of coarse aggregates becomes larger.

Example : For an average grading of fine aggregates (that is zone II or IS 383-1963) the proportions shall be 1 : 1 ½ 1:2 and 1:3 for maximum size of aggregates 10mm, 20mm and 40mm respectively (after carrying out sieve analysis).

Note : 2 A mix leaner than the M100 (1:3:6)m may be used for non structural parts, if provided in the contract, in such case grading of aggregates shall be by volume. Other requirement for mixing and placing & curing shall be the same.

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

Sr. No.	Item of Construction	Maximum nominal size of coarse aggregates
1.	R.C.C. Well curbs, R.C.C. well staining and R.C.C. piles	40mm
2.	R.C.C. well staining	63mm
3.	Well cap or pile cap, solid type piers, abutment and wing walls and other pier caps	40mm
4.	R.C.C. work in cross girders, deck slab, wearing course, kerb, light post, blast walls, approach slab, etc. and hollow type piers, abutments, wing walls, and their pier cap	20mm
5.	R.C.C. bearings	20mm
6.	For any other items of construction not covered by Item 1 to 4.	As specified on the drawing or as desired by the Engineer in charge in case it is not specified on drawing.

For heavily reinforced concrete members as in the case of ribs of main beams nominal maximum size of aggregate shall be usually be restricted to 5mmless than the minimum cover to the reinforcement which is the smaller.

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

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

8. Cement shall be stored above the ground level in perfectly dry and watertight sheds. Wherever bulk storage containers are used, their capacity should be sufficient to cater to the requirements at site and should be cleaned at least one every 3 to 4 months. The aggregates shall be stored in such a way as to prevent admixture of foreign materials. Different sizes of the fine or coarse aggregates shall be stored in separate stock piles sufficiently removed from each other to prevent inter mixing of the materials.
9. The water for mixing shall be potable water to satisfaction of the Engineer in charge. The quality of water shall be just sufficient to produce a dense concrete of required workability for the job.
10. For all work concrete shall be mixed in a mechanical mixer which along with other accessories shall be kept in first class working condition and so maintained throughout the construction. Mixing shall be continued till materials are uniformly distributed and uniform colour of the entire mass is obtained and each individual particle of the coarse aggregates show complete coating of mortar containing its proportionate amount of cement. In no case shall the mixing be done for less than 2 minutes after all ingredients have been put into the mixer.
11. When hand mixing is permitted by the Engineer in charge for small jobs or for certain other reasons. It shall be done on a smooth watertight platform large enough to allow efficient turning over of the ingredients of concrete before and after adding water. Mixing platform shall be so arranged that no foreign material shall be mixed with concrete nor does the mixing water flow out. Cement in required numbers of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregates, which shall also be spread in layers of uniform thickness on the mixing platform. Dry coarse and fine aggregates and cement shall then be mixed thoroughly by turning over to get a mixture of uniform colour, enough water shall then be gradually added thoroughly by 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.
12. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before putting in new batch. Unless otherwise agreed to by the Engineer in charge, the first batch of concrete from the mixer shall contain only two thirds of normal quantity of coarse aggregates. Mixing plant shall be thoroughly cleaned before changing from one type cement to another.
13. The method of transporting and placing concrete shall be approved by the Engineer in charge. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes place. All formwork and reinforcement contained in it shall be cleaned and made free from standing water, dust, snow or ice immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the Engineer in charge has been obtained.
14. If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer in charge. Concreting being given it shall proceed continuously over the area between construction joints. Fresh concrete shall not be laid against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly designed agitators, operating continuously. When this time shall be within 2 hours of the addition of cement to the mix and within 30 minutes of its discharge from the agitator. Except where otherwise depth of not more than 45 minutes when internal vibrators are used and not exceeding 0.30 meter in all other cases.
15. Unless otherwise agreed to by the Engineer in charge concrete shall not be dropped into place from a height exceeding 2 meters. When trunking or chutes are used they shall be kept clean and used in such a way as to avoid segregation. When concreting has to resume on 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 ratios as in the concrete mix itself. This 13mm layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened all laitance shall be removed by scrubbing the wall surface with wire or bristly brushed, 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 corner and close spots.

16. All concrete shall be compacted to produce a dense homogenous mass with the assistance of vibrators unless otherwise permitted by the Engineer in charge for exceptional cases such as concrete 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.

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

18. Formwork shall include all temporary or permanent forms required for forming the concrete together with all temporary construction required for their support. Formwork shall however be divided into following two distinct categories.

1. Shuttering i.e. formwork required for forming the concrete
2. Scaffolding i.e. formwork required for supporting shuttering.

Forms for shuttering shall be constructed only in metal suitably lined. Forms for scaffolding shall be constructed of metal or timber. Both shuttering and scaffolding shall be of substantial rigid construction and shuttering shall be true to shape and dimension shown on the drawings. All bolts and rivets shall be countersunk and well ground to provide a smooth plane surface.

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

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

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

22. The Engineer in charge shall be informed in advance by the contractor of his intentions to strike any formwork. When fixing the time for removal of formwork due consideration shall be given to local condition, character of the structure, the weather and other conditions that influence the setting of

concrete and of the materials used in the mix. Where field operations are controlled by the strength tests of concrete the removal of the load supporting or soffit forms may commence when concrete has attained strength equal to at least twice the stress to which the concrete will be subjected at the time of striking props including the effect of any further addition of loads. When field operations are not controlled by strength tests of concrete the vertical forms of beams, columns and wall may be removed after 2 days. The props of slabs and beams may be removed after 14 and 21 day respectively. All formwork shall be removed without causing any damage to the concrete. Centering shall be gradually and uniformly lowered in such a manner as to permit the concrete to take stress due to its own weight uniformly and gradually. Where internal metal ties are permitted they or their removable parts shall be extracted without causing any damage to the concrete and remaining holes filled with mortar. No permanent embedded metal part shall have less than 25mm cover to the finished concrete surface. Where it is intended to reuse the formwork, it shall be cleaned and made good to the satisfaction of the Engineer in charge.

23. Immediately after the removal of forms all exposed bars or bolts passing through the cement concrete members and used for 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 fins caused by form joints all cavities produced by the removal of the form ties and all other holes and depressions, honeycomb spots, broken edges or corners and other defects shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry as consistency as is possible to sue. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surface which have been pointed shall be kept moist for a periods of twenty four hours. If rock pockets / honeycombs in the opinion of the Engineer in charge are of such an extent or character as to affect the strength of the structure materially or to endanger the life of the steel reinforcement he may declare the concrete defective and required the removal and replacement of the portion of the structure affected.

24. In the case of reinforcement work workability shall be such that the concrete surrounds and properly grips all reinforcement. The degree of consistency which shall depend upon the nature of work and methods of vibration of concrete shall be determined by regular slumps tests. Following slump shall be adopted for different type of works.

	Type of work	Slumps	
		Where vibrator are used	Where vibrator are not used
(i)	Mass concrete in RCC foundations, footing and retaining walls.	10mm to 25mm	80 mm
(ii)	Beams, slab and columns simply reinforced.	25mm to 40 mm	100mm to 120 mm
(iii)	Thin RCC section or section with congested	40mm to 50mm	125mm to 150mm

25. Works strength test shall be made in accordance with IS 516. Each test shall be conducted on ten specimens five of which shall be tested at seven days and the remaining five at 28 days. The sample of concrete shall be taken on each day of concreting and cubes shall be made at the rate of one for every 5 Cu.M. of concrete or a part thereof. However if concreting done in a day is less than 15 Cu.M. the minimum number of cubes can be reduced to 6 with the specific permission of the Engineer in charge. Similar works test shall be carried out whenever the quality and grading of materials is charges irrespective of the quantity concrete poured. The number of specimens may be suitably increased as deemed necessary by the Engineer in charge, when procedure of tests given above reveal a poor quality of concrete and in other special cases.



26. The average strength of the group of cubes cast for each day shall not be less than the specified work cube strength 20 percent of the cubes cast for each day may have values less than the specified strength, provided the lowest value is not less than 85 percent of the specific strength.
27. R.C.C. work shall have exposed concrete surfaces. Centering design and its erection shall approved by the Engineer in charge. One carpenter with helper will invariably be kept present throughout the period of concreting. Movement of labour and other persons shall be totally prohibited over reinforcement laid in position. For access to different parts, suitable mobile platforms shall 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. Concreting of important structural members shall always be done in the presence and under the supervision of departmental person not below the rank of Assistant Engineer / Addl. Asst. Engineer, Overseer or as instructed by the Engineer in charge. After removal work checks that concrete produced is of good quality. Plastering shall not be allowed to the expressed faces of concrete.
28. In reinforced concrete the volume occupied by reinforcement shall not be deducted. The slab shall be measured as running continuously through and the beam as the portion below the slab.
29. All necessary labours, materials, equipment etc for sampling preparing test cubes, curing etc. comp. shall be provided by the contractor. Testing of the materials and concrete may be arranged by the Engineer in charge in an approved laboratory at the cost of contractor
- 30 The payment shall be made on Cu.M. basis for the finished work.
31. The unit rate for concrete shall include the cost of all materials, labour, tools and plant required for mixing, placing in position, vibrating and compacting, finishing as per the directions of the Engineer in charge, curing and all other incidental expenses for producing concrete of specified strength to complete the structure or its components as shown on the drawings and according to these specifications. The rate shall also include the cost of making / fixing and removing of all centers and forms required for the work.

**Item No.- 27**

**Proving and laying cement concrete Grade M20 (1-cement : 1.5 sand : 3 coarse agg. Of 20mm nominal size) for CC road and curing etc. comp. incl. cost of form work. Finishing the cement concrete road by Tri-mix process inclusive of labour charges for trimix vacume dewatering process on cement conc. road by using vacume dewatering pump, surface floater, including channelling and making grooves & rough finish to surface, providing expansion joint, construction joint incl. filling the joint with asphalt filler as per direction by engineer in charge and as per specification.**

1. In case of ordinary concrete mix is not required to be designed by preliminary tests and proportions of cement, fine aggregates and coarse aggregates are specified by volume as given in tables below for different grades of concrete designated as ordinary M100, M150, M200 and M250.
2. IN the designation of a concrete mix, letter "M" refers to the mix and the number the specified 28 days works cube compressive strength of that mix on 150mm cubes expressed in Kg/Cm<sup>2</sup>.
3. The ordinary concrete mix shall generally be specified by volume. For cement which normally comes in bags and issued by weight, volume shall be worked out taking 50 Kg. of cement as 0.035 Cu.M. In volume. While measuring aggregates by volume, shaking, ramming or hammering shall not be done. Proportioning of sand shall be as per its dry volume. In case it is dump, allowance for bulking shall be made as per IS : 2386 {Part : III}
3. Ingredient required for ordinary cement concrete containing one 50 Kg. bag of cement for different proportions of mix shall be as given the table below.

Grade of Concrete	Mix by Volume	Total Quantity of dry aggregates by volume per 50 Kg. of cement to be taken as sum of the individual volumes of fine and coarse aggregates mix	Proportion of fine aggregates to coarse aggregates	Quantity of water per 5 Kg. of cement max.
Ordinary	Liter	One Cubic meter = 1000 liters		Liter
M100	1:3:6	300	General 1:2 for fine agg. To coarse agg. By volumes but subject to a upper limit of 1 : 1 ½ & a lower limit of 1:3	34
M150	1:2:4	220		32
M200	1:1 ½ : 3	160		30
M250	1:1:2	100		27

Note :- The proportion of the aggregates shall be adjusted from upper limit to lower limit progressively as the grading of the fine aggregates becomes finer & the maximum size of coarse aggregates becomes larger.

Example : For an average grading of fine aggregates (that is zone II or IS 383-1963) the proportions shall be 1 : 1 ½ 1:2 and 1:3 for maximum size of aggregates 10mm, 20mm and 40mm respectively (after carrying out sieve analysis).

Note : 2 A mix leaner than M100 (1:3:6) may be used for non structural parts, if provided in the contract, in such case grading of aggregates shall be by volume. Other requirement for mixing and placing & curing shall be the same.

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

Sr. No.	Item of Construction	Maximum nominal size of coarse aggregates
1.	R.C.C. Well curbs, R.C.C. well staining and R.C.C. piles	40mm
2.	R.C.C. well staining	63mm
3.	Well cap or pile cap, solid type piers, abutment and wing walls and other pier caps	40mm
4.	R.C.C. work in cross girders, deck slab, wearing course, kerb, light post, blast walls, approach slab, etc. and hollow type piers, abutments, wing walls, and their pier cap	20mm
5.	R.C.C. bearings	20mm
6.	For any other items of construction not covered by Item 1 to 4.	As specified on the drawing or as desired by the Engineer in charge in case it is not specified on drawing.

For heavily reinforced concrete members as in the case of ribs of main beams nominal maximum size of aggregate shall be usually be restricted to 5mm less than the minimum cover to the reinforcement which is the smaller.

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

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

8. Cement shall be stored above the ground level in perfectly dry and watertight sheds. Wherever bulk storage containers are used, their capacity should be sufficient to cater to the requirements at site and should be cleaned at least one every 3 to 4 months. The aggregates shall be stored in such a way as to prevent admixture of foreign materials different sizes of the fine or coarse aggregates shall be stored in separate stock piles sufficiently removed from each other to prevent inter mixing of the materials.

9. The water for mixing shall be potable water to satisfaction of the Engineer in charge. The quality of water shall be just sufficient to produce a dense concrete of required workability for the job.
10. For all work concrete shall be mixed in a mechanical mixer which along with other accessories shall be kept in first class working condition and so maintained throughout the construction. Mixing shall be continued till materials are uniformly distributed and uniform color of the entire mass is obtained and each individual particle of the coarse aggregates show complete coating of mortar containing its proportionate amount of cement. In no case shall the mixing be done for less than 2 minutes after all ingredients have been put into the mixer.
11. When hand mixing is permitted by the Engineer in charge for small jobs or for certain other reasons. It shall be done on a smooth watertight platform large enough to allow efficient turning over of the ingredient of concrete before and after adding water. Mixing platform shall be so arranged that no foreign material shall be mixed with concrete nor does the mixing water flow out. Cement in required numbers of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregates, which shall also be spread in layers of uniform thickness on the mixing platform. Dry coarse and fine aggregates and cement shall then be mixed thoroughly by turning over to get a mixture of uniform color, enough water shall then be gradually added thoroughly by 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.
12. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before putting in new batch. Unless otherwise agreed to by the Engineer in charge, the first batch of concrete from the mixer shall contain only two thirds of normal quantity of coarse aggregates. Mixing plant shall be thoroughly cleaned before changing from one type cement to another.
13. The method of transporting and placing concrete shall be approved by the Engineer in charge. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes place. All formwork and reinforcement contained in it shall be cleaned and made free from standing water, dust, snow or ice immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the Engineer in charge has been obtained.
14. If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer in charge. Concreting being given it shall proceed continuously over the area between construction joints. Fresh concrete shall not be laced against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly design agitators, operating continuously. When this time shall be within 2 hours of the addition of cement to the mix and within 30 minutes of its discharge from the agitator. Except where otherwise depth of not more than 45 minutes when internal vibrators are used and not exceeding 0.30 meter in all other cases.
15. Unless otherwise agreed to by the Engineer in charge concrete shall not be dropped into place from a height exceeding 2 meters. When trucking or chutes are used they shall be kept clean and used in such a way as to avoid segregation. When concreting has to resumed on 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 ratios as in the concrete mix itself. This 13mm layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened all laitance shall be removed by scrubbing the wall surface with wire or bristly brushed, 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 corner and close spots.
16. All concrete shall be compacted to produce a dense homogenous mass with the assistance of vibrators unless otherwise permitted by the Engineer in charge for exceptional cases such as concrete 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.
17. Immediately after compaction, concrete shall be protected against harmful effect of weather including rains, running water, shocks, vibration, traffic, rapid temperature changes, frost and driving

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

18. Formwork shall include all temporary or permanent forms required for forming the concrete together with all temporary construction required for their support. Formwork shall however be divided into following two distinct categories.

1. Shuttering i.e. formwork required for forming the concrete
2. Scaffolding i.e. formwork required for supporting shuttering.

Forms for shuttering shall be constructed only in metal suitably line. Forms for scaffolding shall be constructed of metal or timber. Both shuttering and scaffolding shall be of substantial rigid construction and shuttering shall be true to shape and dimension shown on the drawings. All bolts and rivets shall be countersunk and well ground to provide a smooth plane surface.

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

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

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

22. The Engineer in charge shall be informed in advance by the contractor of his intentions to strike any formwork. While fixing the time for removal of formwork due consideration shall be given to local condition, character of the structure, the weather and other conditions that influence the setting of concrete and of the materials used in the mix. Where field operations are controlled by the strength tests of concrete the removal of the load supporting or soffit forms may commence when concrete has attained strength equal to at least twice the stress to which the concrete will be subjected at the time of striking props including the effect of any further addition of loads. When field operations are not controlled by strength tests of concrete the vertical forms of beams, columns and wall may be removed after 2 days. The props of slabs and beams may be removed after 14 and 21 days respectively. All

formwork shall be removed without causing any damage to the concrete. Centering shall be gradually and uniformly lowered in such a manner as to permit the concrete to take stress due to its own weight uniformly and gradually. Where internal metal ties are permitted they or their removable parts shall be extracted without causing any damage to the concrete and remaining holes filled with mortar. No permanent embedded metal part shall have less than 25mm cover to the finished concrete surface. Where it is intended to refused the formwork, it shall be cleaned and made good to the satisfaction of the Engineer in charge.

23. Immediately after the removal of forms all exposed bars or bolts passing through the cement concrete members and used for 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 fins caused by form joints all cavities produced by the removal of the form ties and all other holes and depressions, honeycomb spots, broken edges or corners and other defects shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry as consistency as is possible to sue. Considerable pressure shall be applied in filling and pointing to ensure through filling in all voids. Surface which have been pointed shall be kept moist for periods of twenty four hours. If rock pockets / honeycombs in the opinion of the Engineer in charge are of such an extent or character as to affect the strength of the structure materially or to endanger the lime of the steel reinforcement he may declare the concrete defective and required the removal and replacement of the portion of the structure affected.

24. In the case of reinforcement work workability shall be such that the concrete surrounds and properly grips all reinforcement. The degree of consistency which shall depend upon the nature of work and methods of vibration of concrete shall be determined by regular slumps tests. Following slump shall be adopted for different type of works.

	Type of work	Slumps	
		Where vibrator are used	Where vibrator are not used
(i)	Mass concrete in RCC foundations, fotting and retaining walls.	10mm to 25mm	80 mm
(ii)	Beams, slab and columns simply reinforced.	25mm to 40 mm	100mm to 120 mm
(iii)	Thin RCC section or section with congested	40mm to 50mm	125mm to 150mm

25. Works strength test shall be made in accordance with IS 516. Each test shall be conducted on ten specimens five of which shall be tested at seven days and the remaining five at 28 days. The sample of concrete shall be taken on each day of concreting and cubes shall be made at the rate of one for every 5 Cu.M. of concrete or a part thereof. However if concreting done in a day is less than t15 Cu.M. the minimum number of cubes can be reduced to 6 with the specific permission of the Engineer in charge. Similar works test shall be carried out whenever the quality and grading of materials is charges irrespective of the quantity concrete proud. The number of specimens may be suitably increased as deemed necessary by the Engineer in charge, when procedure of tests given above reveal a poor quality of concrete and in other special cases.

26. The average strength of the group of cubes cast for each day shall not be less than the specified work cub strength 20 percent of the cubes cast for each day may have values less than the specified strength, provided the lowest value is not less than 85 percent of the specific strength.

27. R.C.C. work shall have exposed concrete surfaces. Centering design and its erection shall approved by the Engineer in charge. One carpenter with helper will invariably be kept present throughout the period of concreting. Movement of labour and other persons shall be totally prohibited over reinforcement laid in position. For access to different parts, suitable mobile platforms shall 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. Concreting of important structural members shall always be done in the presence and under the supervision of departmental person not below the rank of Assistant Engineer / Addl. Asst. Engineer, Overseer or as instructed by the Engineer in charge. After removal work checks that concrete produced is of good quality. Plastering shall not be allowed to the expressed faces of concrete.

## **28 Tremix process ( Vaccume dewatering service ) on cement concrete road surface :**

Providing extra labour charges for tremix (vacuum dewatering service) process on C. C. road surface by using vacuum dewatering pump, floater surface vibrator making groves on surface as instruction incl. leveling etc. complete.

### **28.1. Working Method :**

#### **Concrete Placing**

Concrete can be placed & distributed by transit mixer, or also sufficient man power is required it is important to distributed the concrete evenly & as near the final level as possible.

### **28.2 Poker Vibration :**

As a first step, concrete is vibrated with as immersion vibrator in order to remove, entrapped air & voids & make the concrete homogeneous. Please ensure that the areas close to channels & stop ends carefully vibrated. Do not distributed the concrete with the poker vibration along with the surface vibration.

### **28.3. Surface Vibration :**

Surface Vibration should always start as soon as there is enough concrete in front of surface vibrator. Two passes with surface vibrator are required. During the first pass, concrete must be distributed evenly in front of surface vibrator. There should be a roll of concrete of about 10-20 mm in front of leading beam along the entire length of the vibrator. When the concrete has been placed and vibrated to a length of the vibrator. When the concrete has been placed and vibrated to a length of about 5 mm. the second pass is carried out. The machine should be pulled at a speed of maximum 1 mtr. / min and without interruption 'avoid finings' on the surface Keep the surface of the channel. Clean from concrete.

### **28.4. Vacuum Processing :**

Please the filter pads as soon as the sufficient concrete surface is vibrated. Please note that the vacuum dewatering process must start within 30 minutes front the time of starting concrete pouring. Filter pads are placed in such away that there is at least 100 mm fresh concrete visible around the filter pads on all four sides. Filter should be overlapped with each other by at least 250 mm. (all filter are marked with black line to ensure proper overlapping).

The recesses or other obstacles within the area to be vacuum processed must be covered & sealed using polythene sheet before the filter pads are placed. If the obstacles are flush with the surface level or above. Filter pad must be found.

The rolled top cover is placed centrally on the filter pads. It is rolled out in such a way that it covers all filter pads & exposed concrete on the sides of the filter pads. Please note that the exposed concrete will ensure perfect sealing of the cover from the top.

Connect the central pipe of the top cover to the suction hose which in turn is connected to the vacuum pumps. When the pump is started vacuum will be created between the top cover & filter pads. Excess water will be taken in to the vacuum pump tank & discharged. Normal suction cycle is 1-1.5 min. per 10 mm of concrete thickness, Guidelines for selecting dewatering time (a) normal condition are shown in the following table.

Thickness in		Dewatering Time (min.)
MM	Inch	
50	2	7
100	4	15
125	6	20
150	8	30
200	10	40

Please note that dewatering time largely depends upon ambient conditions viz. Temperature, humidity, etc. During the course of dewatering. The concrete surface gradually hardens & can be felt from the top of the top cover. The extent of hardness achieved by the concrete decides when to stop dewatering process.

When the vacuum processing is over the cover is rolled up to 100 mm so that the sides of the filter pads are visible. This will remove the water that may have remained on the concrete surface. Filter pads & in the section hose. After about 30 seconds, the top cover is rolled completely & vacuum pump is switched off simultaneously. The suction hose & the top cover pipe are disconnected. Do not run the pump while the ball valve is open as likely that small aggregate are sucked in to the pump due to vacuum. The entire process is repeated on the next concrete panel.

After first patch in any / given panel is dewatered, care should be taken while piecing filter pad on the concrete surface next to the dewatered concrete. First filter pad should start from the edges of last filter pad of the previously dewatered concrete. The remaining filter pads then shall be placed as explained above.

While repeating dewatering process subsequently, in order that top cover should get proper sealing against the side already vacuum processed, it should be rolled out at least 300 mm over the vacuum dewatered area. Before spreading the top cover on the dewatered area, it is essential to give one pass of skim floater (with disc.) along the edges of the dewatered concrete. The concrete surface will become wet as some will come on the top surface. This will provide the necessary sealing. Subsequently roll out top cover completely. Check that there are no wrinkles on the top cover.

#### 28.5. Floating :

The first finishing operation is floating where floating disc is used. Only the that can not be reached by skim floater are floated by hand. Care should be taken while floating. Near channels & edges. The skim floater is run over the channel up to disc center in order to avoid unevenness at the joint. All four sides of dewatered panel must be floated first central area is to be floated later. Any corrections, if required are to be this stage with the concrete collected at the time of raking only. Never use any cement paste.

Mixture of cement & sand or fresh for patchwork. Such material will pool off will leave black patches after the concrete floor is brought to use

Normally two passes with disc with the skim floater operating at higher speed are sufficient for the skid free surfaces. This pass of skim floater should be given, perpendicular to the previous pass. Please note that the floating operation brings up certain amount of water to the surface. This moisture helps in carrying out finishing operation.

#### 28.6. Trowel ling

Trowel ling is carried out with the same machine running on trowel ling blades. Normally, two pass of trowel ling blades are required for the smooth surface finish. However, the number of passes can be decided depending upon the surface finish required. The first trowel ling operation can start after the about 30 minutes after the final floating operation & surface is sufficiently dry. This pass is to be made using low speed & minimum blade angle. Please also use the lower speed when trowel ling near the channels, from edges obstacles etc. Blade angle & the speed can be increased for subsequent passes to achieve smoother surface finish.

28.7. Curing : Concrete has to be protected from rapid drying which may result in cracking. Curing can be done by ponding, covering with plastic sheet or gunny bags. In any method, the surface should be always kept wet with water. Curing can also be done by application of curing compound. Curing must be done for at-least 7 days.

### Intermixing of Topping

**First Pass :** You can start the work when Topping has darkened because of the moisture from the under using concrete. The Topping material is worked with care into concrete surface with a skim floater equipped with a disc.

### Intermixing of Topping

**Second Pass :** Check the surface flatness with straight edge and work the topping material into concrete as the first time.

### **Power trowel ling**

**First Pass :** The first trowel ling is carried out as a normal power – trowel ling.

At the time of final power – trowel ling, surplus concrete must be off from the rails and stop ends.

There must not be damage at the rails when the floor is finished

29. In reinforced concrete the volume occupied by reinforcement shall not be deducted. The slab shall be measured as running continuously through and the beam as the portion below the slab.

30. All necessary labours, materials, equipment etc for sampling preparing test cubes, curing etc. comp. shall be provided by the contractor. Testing of the materials and concrete may be arranged by the Engineer in charge in an approved laboratory at the cost of contractor

31 The payment shall be made on Cu.M. basis for the finished work.

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

### **Item No. 29**

### **Providing TMT Bar FE 500D reinforcement for R.C.C. work including bending, binding and placing in position complete upto floor two level**

**The work include P & L. in position / HYSD / Mild Steel / Thermo – Mechanically Treated bar of the following grade.**

Grade Designation	Bar Type Conforming to governing IS specification	Characteristic strength Fy MPa	Elastic Modulus GPa
S 415 & 500 D	IS 1786 High yield strength deformed bar	415 & 500	200
S 240	IS 432 Part II	240	

### **TMT Bar**

**415 /500 D TMT Bar shall conform to min 415/500 MPa yield strength. Tensile strength of min 500 MPa and elongation percentage min 32. The chemical composition of bars shall be as below:-**

	<b>Max</b>
Carbon	0.25
Sulphur	0.05
Phosphorus	0.05
Sulphur & Phosphorus	0.01

1. All steel shall be procured from original producers, no re-rolled steel shall be incorporated in the work. Only new steel bars shall delivered to the site, Every bar shall be inspected before assembling in the work and defective brittle or brunt bar shall be discarded Cracked ends of bars hall be discarded.
2. The work shall consist of furnishing and placing reinforcement of the shape and dimensions shown on the drawings or as directed by the Engineer in charge.



3. Steel shall be clean and free from loose rust and loose mill scale at the time of fixing in position and subsequent concreting. Steel shall apply treatment of anticorrosive with powder of polymer base material before use.
4. Reinforcing steel conform accurately to the dimensions given in Bar bending schedules shown on relevant drawings. Bars shall be bent cold to the specified shape and dimensions or as directed by the Engineer in charge using a proper bar bender operated by hand or power to attain proper radius of bends. Bars shall not be bent or straightened in a manner that will injure the material. Bars bent during transport or handling shall be straightened before being used on work they shall be not heated to facilitate bending. Unless otherwise specified a 'U' type hook at the end of each bar shall invariably provided. The radius of the bend shall not be less than twice the diameter of the round bar and the length of the straight part of the bar beyond the end of the curve shall be at least four times the diameter of the round bar. In the case of bars which are not round and in the case of deformed bars ten diameter shall be taken as the diameter of circle having an equivalent effective area. The hooks shall be suitably encased to prevent any splitting of the concrete.
5. All reinforcement bars shall be accurately placed in exact position shown on the drawings and shall be securely held in position during placing of concrete by annealed binding wire not less than 1 mm in size and conforming to IS: 280 and by using stay blocks or metal chairs, spacers, metal hangers supporting wires or other approved device at sufficiently close intervals. Bars will not be allowed to sag between supports nor displaced during concreting or any other operation of the work. All devices used for positioning shall be of non corrodible material wooden and metal supports will not extent to the surface of concrete except where shown on the drawings, placing bars on layers of freshly laid concrete laid concrete as the work progresses for adjusting bar spacing will not be allowed pieces of broken stone or brick and wooden blocks shall not be used layers of bars shall be separated by spacer bars precast mortar blocks or other approved devices. Reinforcement after being placed in position shall be maintained in a clean condition until completely embedded in concrete. Special care shall be exercised to prevent any displacement of reinforcement in concrete already placed. To protect reinforcement from corrosion concrete cover shall be provided as indicated on the drawings. All bars protruding from concrete and to which other bars are to be spliced and which are likely to be exposed for an indefinite period shall be protected by a thick coat of neat cement grout.
6. Bars crossing each other where required, shall be secured by binding wire (annealed) of size not less than 1 mm and conforming to IS:280, in such a manner that they do not slip over each other at the time of fixing and concreting.
7. As far as possible bars of full length shall be used. In case this is not possible overlapping of bars shall be done as directed by the Engineer in charge when practicable overlapping bars shall not touch each other but be kept apart of 25 mm or 1.25 times the maximum size of the coarse aggregate whichever is greater by concrete between them where not feasible overlapping bars shall be bound with annealed steel wire, not less than 1 mm thickness twisted tight. The overlaps shall be staggered for different bars and located at points along the span where neither shear nor bending moment is a normal.
8. Whenever indicated on the drawings or desired by the Engineer-in-charge bar shall be jointed by couplings which shall have a cross-section sufficient to transmit the full stresses of bars. The ends of the bars that are jointed by couplings shall be upset for a sufficient length so that the effective cross-section at the base of threads is not less than the normal cross-section of the bar. Threads shall be standard white wash threads steel for coupling shall conform to IS :226
9. When permitted or specified on the drawings joints of reinforcement bars shall be butt welded so as to transmit their full stresses welded joints shall preferably be located at points where steel not be subject to more than 75 percent of the maximum permissible stresses and welds so staggered that at any one section not more than 20 percent of the rods are welded metal and conforms to any or all other special provisions for the work will be accepted suitable means shall be provided for holding the bars securely in position during welding. It must be ensured that no voids are left in welding and when welding is done in 2 or 3 stages, previous scale, rust, grease, paint and other foreign matter before welding shall conform to IS 814 welded pieces of reinforcement shall be tested specimen shall be taken from the actual site and their number and frequency of tests shall be as directed by the Engineer – in – charge.
10. Reinforcement shall be measured in length excluding overlaps, separately for different diameters as actually used in the work, where welding or coupling is resorted in place of lap-joints such joints shall be measured for payment as the equivalent length of over-lap as per design requirement, From the length so measured the weight of reinforcement shall be calculated in tones on the same basis of IS : 1732. Length

shall include hooks at ends wastage and annealed steel wire for binding shall not be measured and cost of these items shall be deemed to be included in the rates for reinforcement.

11. Rates for reinforcement shall include cost of all steels carrying to work site and cutting, bending, placing, binding and fixing in position as shown on the drawings and as directed by the Engineer – in – Charge. It shall also include cost of all devices for keeping reinforcement in approved position cost of joint age as per approved methods and all wastage and spacer bars.

9. Reinforcement shall be measured in length as per Govt Circular No.PDW-10-2017-01-C Dt.15-02-2019 as actually used in the work, where wildlife or coupling is restored to, in place of lap-joints, such joints shall be measured for payment as the, equivalent length of over-lap as per design requirement. From the length so measured the weight of reinforcement shall be calculated in tonnes on the same basis of IS: 1732 even though steel is supplied to the contractor by the Departmental actual weighment. Length shall include hooks at ends. Wastage and annealed steel wire for binding shall not be measured and cost of these items shall be deemed to be included in the rates for reinforcement.

10. Rate for reinforcement shall include cost of cutting, bending, placing, binding and fixing in position The unit of T.M.T. bar for will be measured on Kg.. basis.

### **Item No. 30**

**White washing with lime on wall surfaces (Two coats) to give an even shade including thoroughly brooming the surface to remove all dirt,dust, mortar drops and other foreign matter.**

1.0. Materials:

1.1. The water shall conform to M-I. Cement water proofing shall conform to I.S. 5410-1969.

2.0. Workmanship:

2.1. Scaffolding: The relevant specifications of item No. 55 shall be followed.

2.2. Preparation of surface: The relevant specifications of item No. 18.11 shall be followed except that the word white wash color wash shall be substituted with water proofing cement paint. The surface shall be thoroughly wetted with clean water before cement water proofing paint is applied.

2.3. Preparation of paint: Portland cement shall be prepared by adding paint powder to water and stirring to obtain a thick paste, which shall then be diluted to a brushable consistency. Generally, equal volumes of paint powder and water make a satisfactory paint. In all cases, the manufacture's instructions shall be followed. The paint shall be mixed in such quantities as can be used up within an hour of mixing as otherwise the mixture will set and thickness, affecting flowing and finish. The lids of cement paint drums shall be kept tightly when not in use.

2.4. Application of Paint:

2.4.1. No painting shall be done when the paint is likely to be exposed to a temperature of below 7°C within 48 hours after application.

2.4.2. When weather conditions are such as to cause damage the work shall be carried out "in the shadow" as far as possible. This helps the proper hardening of the paint film by keeping the surface moist for a longer period.

2.4.3. To maintain the uniform mixture and to prevent segregation, the paint shall be stirred frequently in the bucket.

2.4.4. For undercoated surfaces, the surfaces shall be treated with minimum two coats of water proof cement paint. Not less than 24 hours shall be allowed between two coats. Next coat shall not be started until the preceding coat has become sufficiently hard to resist marking by the brush being used. In hot dry weather, the preceding coat shall be allowed between two coats. Next coat shall not be started until the preceding coat has become sufficiently hard to resist marking by the brush being used. In hot dry weather, the preceding coat shall be slightly moistened before applying the subsequent coat.

2.4.5. The finished surface shall be even and uniform in shade, without patches, brush marks, paint drops etc.

2.4.6 The cement paint shall be applied with a brush with relatively short stiff hog or fiber bristles. The paint shall be brushed in uniform thickness and shall be free from excessive heavy brush marks. The lamps shall be well brushed out.

2.4.7. Water proof cement paint shall not be applied on surfaces already treated with white wash color wash, distemper dry or oil bound varnishes, paint etc. It shall not be applied on gypsum, wood and metal surfaces.

2.5. Curing: Painted surfaces shall be sprinkled with water two or three times a day. This shall be done between coats and for at least two days following the final coat. The curing shall be started as soon as the paint has hardened so as not to be damaged by the sprinkling of water say about 12 hours after the application.

2.6. Protection measures shall be taken as per item No. 55

3.0. Mode of measurements & payment:

3.1.The relevant specifications of item No. 55 shall be followed.

3.2. The rate shall be for a unit of one sq. meter

**Item - 31**

**Supplying of Vibratory roller 8 - 10 tonnes @ 100 cum per hour with driver including cost of diesel oil etc. including maintenance and equipment etc. complete**

1. **Scope :-** The work shall consist of supplying of Vibratory roller 8 - 10 tonnes for road work or as instructed by engineer in charge at and where required and as directed by engineer in charge.

Vibratory roller 8 - 10 tonnes shall be supply with driver holding valid license including fuel and oil required including all type of maintenance and repairing work if required. Vibratory roller 8 - 10 tonnes shall be with valid and appropriate insurance.

2. Mode of measurement payment: The measurement of work done by Vibratory roller 8 - 10 tonnes shall be measured in our only in working condition as specified.

3. Unit : Unit shall be one hour

**Item - 32**

**Providing excavator on hire base for excavation, loading etc. type of work on road site operation, diesel, oil (L&T type capacity) as directed.**

1. **Scope :-** The work shall consist of supplying of excavator for road work or as instructed by engineer in charge at and where required and as directed by engineer in charge.

excavator shall be supply with driver holding valid license including fuel and oil required including all type of maintenance and repairing work if required excavator shall be with valid and appropriate insurance.

2. Mode of measurement payment: The measurement of work done by excavator shall be measured in our only in working condition as specified.

3. Unit : Unit shall be one hour

**Item - 33**

**Providing loader machine on hire charges with operator, diesel, oil for loading / unloading work on site as directed.**

1. **Scope :-** The work shall consist of supplying of loader for road work or as instructed by engineer in charge at and where required and as directed by engineer in charge.

loader shall be supply with driver holding valid license including fuel and oil required including all type of maintenance and repairing work if required loader shall be with valid and appropriate insurance.

2. Mode of measurement payment: The measurement of work done by loader shall be measured in our only in working condition as specified.

3. Unit : Unit shall be one hour

**Item - 34**

**Providing Truck, Dumper (With diesel & driver). on hire charges with operator,diesel, oil for loading / unloading work on site as directed.**

1. **Scope :-** The work shall consist of supplying of Truck/Dumper for road work or as instructed by engineer in charge at and where required and as directed by engineer in charge.

Truck/Dumper shall be supply with driver holding valid license including fuel and oil required including all type of maintenance and repairing work if required Truck/Dumper shall be with valid and appropriate insurance.

2. Mode of measurement payment: The measurement of work done by Truck/Dumper shall be measured in our only in working condition as specified.

3. Unit : Unit shall be one Day.

**Signature of  
contractor**

**Deputy Executive Engineer  
Panchayat R. & B. Sub Division  
Bhuj-Kachchh**

**Executive Engineer  
Panchayat R. & B. Division  
Bhuj-Kachchh**