

**Detailed**

**Specification**

Name of work :- ...

## 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 :

(i)	Length and breadth	10mm
(ii)	thickness of earthwork Sq. Mt. sub-base, bases. surfacing, and structural members	high, depth or 5mm
(iii)		Areas 0.01 Sq. Metre
(iv)	0.01 Cubic Metre	Cubic contents

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 up to and including 100 meters shall be measured in units of 50 meters, exceeding 100 meters but not exceeding 1 KM, in units of 100 meters, and exceeding 1 Km, in units of 500 meters. The half and greater than half of the units shall be reckoned as one and less than half of the units ignored. In this regard, the source of the 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 COURSE :

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 number of undulation permitted in any 300 m length exceeding in mm				Maximum permissible variation from specified camber profile template mm
1	2	3	4	5	6	7	8
1	Earth sub-grade	36	30	--	--	--	15
2	Granular i 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 :

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

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

3. Rectification :Where the surface irregularity of 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 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 l 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 then 2 hours. the surface shall be scarified to a depth of 50mm, supplemented with freshly mixed material as necessary and recomposed to the relevant specification. When this time is more than 2 hour, the full depth of the layer shall be removed from the pavement and replaced with fresh material, to specification. In either case, the area treated shall not be less than 5 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. that top 75mm shall be scarified. reshaped with added material as necessary and re-compacted The area treated at a place shall not be less than 5 meters long and 2 meters wide.

(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 metre 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 :**

- (a) Sand Content (IS : 2720 Part IV)  
Two test per 8000 Cubic metres of soil
- (b) Plasticity Test Each type to be tested (IS : 2720 Part-V)  
Two tests per 8000 Cubic Metres of soil.
- (c) Density test (IS : 2720 Part VII)  
Each soil type to be tested.  
Two tests per 8000 Cubic Metres of soil.
- (d) Moisture Content Test (IS :2720 Part -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 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 subgrade, 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 assing 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
<b>6.3 Fine Sand:</b> 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 20 mm	Percentage passing for single sized aggregates of Nominal size		
	40 mm	20 mm	40 mm		40 mm	20 mm	40 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 bats shall be measured by volume by suitable boxes or as directed.

#### **M-16 Stone:**

16.1 The stone shall be of the specified variety such as Quartzite/ Trap Stone: Quartzite or any other type of good hard stones.

The stones shall be obtained only from the approved quarry and shall be hard, sound, durable and free from defects like cavities, cracks, sand holes, flaws, injurious veins, patches of loose or soft materials etc. and weathered portions and other structural defects or imperfections tending to affect their soundness and strength. The stone with round surface shall not be used. The percentage of water absorption shall not be more than 5% of dry weight, when tested in accordance with I.S. 9134 1974. The minimum crushing strength of the stone shall be 200 kg/ Sq.Cm. unless otherwise

16.2 The samples of the stone to be used shall be got approved before the work is started.

The Khanki facing stone shall be dressed by chisel as specified in the item for Khanki facing in required shape and size. The face of stone shall be so dressed that the bushing on the exposed face shall not project by more than 40 mm. from the general wall surface and on face to be plastered it shall not project by more than 19 mm. nor shall it have depressions more than 10 mm. from the average wall surface

#### **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	8.	20 mm	2.47
2.	8 mm	Kg./Rmt.	9.	22 mm	Kg./Rmt.
3.	10 mm	0.39	10.	25 mm	2.98
4.	12 mm	Kg./Rmt.	11.	28 mm	Kg./Rmt.
5.	14 mm	0.62	12.	32 mm	3.85
6.	16 mm	Kg./Rmt.	13.	36 mm	Kg./Rmt.
7.	18 mm	0.89	14.	40 mm	4.83
		Kg./Rmt.			Kg./Rmt.
		1.21			6.31
		Kg./Rmt.			Kg./Rmt.
		1.58			7.99
		Kg./Rmt.			Kg./Rmt.
		2.00			9.86
		Kg./Rmt.			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 No. 1**

**Providing and laying 37.50 mm thick open graded Bituminous grouting with B.T. aggregate 0.63 Cum/10 Smt (0.50 Cum /10 Smt coarse aggregate & 13 Cum / 10 smt key aggregate )and using asphalt grade 60/70 for mixing at the rate of 1.99 % . ie 19.90 Kg / M.T. of total mix & bitumen for tack coat @ 3.00 Kg / 10 Smt. on B.T. surface including heating the asphalt and aggregate by continuous batching drum mix plant, transporting and spreading Manually and consolidation with Kuba . including providing all materials, equipments, tools and plant, oil, kerosene fire wood labour charge etc comp. using contractors own machinaries , drum mix plant & equipment etc .comp.**

**Scope :-** The work shall consist of construction 37.5 mm thick BSG on a previously prepared base to the requirement of theses 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 run bitumen of VG-30 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 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 to the grading set forth in table below.

Sieve Size	Percent by Weight aggregate
53.0	100

Sieve Size	Percent by Weight aggregate
26.5	75-100
22.4	50-85
13.2	20-40
5.6	5-20
2.8	0-5

### **Proportioning Materials :-**

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, be 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. / M.T. 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°C or less.

#### **Preparation of Base:-**

The base on which B.S.G. 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.

#### **Tack Coats :-**

A tack coat as per Clause 503 shall be applied over the Base as detailed in item description. @ 2.5 Kg. / 10 Sq.Mt. on B.T. surface and 4 Kg. / 10 Sq.Mt. on W.B.M. surface.

### **Preparation and 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 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 tile 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 B.S.G. 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 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.S.G. 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. 2**

**Providing and laying 37.50 mm thick open graded Bituminous grouting with B.T. aggregate 0.63 Cum/10 Smt (0.50 Cum /10 Smt coarse aggregate & 13 Cum / 10 smt key aggregate ) and using asphalt grade VG 30 for mixing at the rate of 1.99 % . ie 19.90 Kg / M.T. of total mix & bitumen for tack coat @ 3.00 Kg / 10 Smt. on B.T. surface including heating the asphalt and aggregate by continuous batching drum mix plant, transporting and spreading the same by paver finisher and consolidation with vibratory roller . including providing all materials, equipments, tools and plant, oil, kerosene fire wood labour charge etc comp. using contractors own machineries , drum mix plant & equipment and paver finisher etc .comp.**

**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 run bitumen of VG-30 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 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 or 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

Sieve Size	Percent by Weight aggregate
26.5	75-100
22.4	50-85
13.2	20-40
5.6	5-20
2.8	0-5

### **Proportioning Materials :-**

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, be 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. / M.T. 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°C or less.

#### **Preparation of Base:-**

The base on which B.S.G. 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.

#### **Tack Coats :-**

A tack coat as per Clause 503 shall be applied over the Base as detailed in item description. @ 2.5 Kg. / 10 Sq.Mt. on B.T. surface and 4 Kg. / 10 Sq.Mt. on W.B.M. surface.

### **Preparation and 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 as such as laid down in Appendix A

(F) 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.

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

(H) 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

(I) 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.

(J) 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
- j). The machine shall have hydraulically extendable screed for appropriate width requirement.
- k). The screed shall temping 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.
- l). The paver shall be equipped with necessary control mechanism so as to ensure that the finished surface is free from surface blemishes.
- m). The paver shall be fitted with an electronic sensing device for automatic leveling and profile control within the specified tolerances.
- n). The screen shall have the internal heating arrangement.
- o). 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.

- p). 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 tile 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 B.S.G. 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 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.S.G. work shall be payment in full for carrying out the required operations including full compensations for :-

- (vii) Making arrangement for traffic to clause 112 except for initial treatment to verge shoulders and constructions of diversions.
- (viii) Preparation of base except for laying of profile corrective course but including filling of potholes
- (ix) 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.
- (x) 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.
- (xi) Carrying out the work in part widths of the road where directed.
- (xii) Carrying out all tests for control of quality

**Item No. 3**

**Providing and laying 37.50 mm thick compacted Bituminous Macadam using stone chips 0.66 Cum/ 1 M.T. mix as per gradation & using asphalt grade VG 30 for tack coat 3.00 Kg /10 smt on B.T. surface & for mixing 35 Kg / M.T.(i.e. 3.50 % of mix) including heating the asphalt and aggregate by continuous batching drum mix plant, transporting th mix material and spreading the same Manually and consolidation with Kuba . including cost of fuel ,hire charges, fire wood , kerosens, labour charge etc & with contractors own machinaries , drum mix plant & equipment etc .comp.**

**504. BITUMINOUS MACADAM**

**Scope**

This work shall consist of construction in a single course having 37.50 mm compacted crushed aggregates premixed with a bituminous binder on a previously prepared base to the requirements of these Specifications. Bituminous macadam is more open graded than the dense graded bituminous materials described in Clauses 507, 508 and 509.

## Materials

**Bitumen:** The bitumen shall be paving bitumen of VG-30 Grade complying with Indian Standard Specifications for "Paving Bitumen" IS:73.

**Coarse aggregates:** The coarse aggregates shall consist of crushed rock, crushed gravel or other hard material retained on the 2.36 mm sieve. They shall be clean, hard, durable, of cubical shape, free from dust and soft or friable matter, organic or other deleterious matter. Where the Contractor's selected source of aggregates have poor affinity for bitumen, as a condition for the approval of that source, the bitumen shall be treated with approved anti-stripping agents, as per the manufacturer's recommendations, without additional payment. Before approval of the source, the aggregates shall be tested for stripping.

The aggregates shall satisfy the physical requirements set forth in Table 500-3.

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

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

**TABLE 500-3. PHYSICAL REQUIREMENTS FOR COARSE AGGREGATES FOR BITUMINOUS MACADAM**

Property	Test	Specification
Cleanliness	Grain size analysis <sup>1</sup>	Max 5% passing 0.075mm sieve
Particle shape	Flakiness and Elongation Index (Combined) <sup>2</sup>	Max 30%
Strength*	Los Angeles Abrasion Value <sup>3</sup>	Max 40%
	Aggregate Impact Value <sup>3</sup>	Max 30%
Durability	Soundness: <sup>4</sup>	
	Sodium Sulphate	Max 12%
	Magnesium Sulphate	Max 18%
Water Absorption	Water absorption <sup>5</sup>	Max 2%

Property	Test	Specification
Stripping	Coaling and Stripping of Bitumen Aggregate Mixtures <sup>6</sup>	Minimum retained coating 95%
Water Sensitivity <sup>7</sup>	Retained Tensile Strength	Min80%

Notes : 1. IS : 2386 Part 1 4. IS : 2386 Part 5  
2. IS : 2386 Part 1 5. IS : 2386 Part 3  
(the elongation test to be done only on non-flaky aggregates in the sample)  
3. IS: 2386 Part 4\* 6. IS: 6241  
7. The water sensitivity test is only required if the minimum retained coating in the stripping test is less than 95%.

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

**Aggregate grading and binder content:** When tested in accordance with IS: 2386 Part 1 (wet sieving method), the combined aggregate grading for the particular mixture shall fall within the limits shown in Table 500-4 for the grading specified in the Contract. The type and quantity of bitumen, and appropriate thickness, are also indicated for each mixture type.

**Proportioning of material:** The aggregates shall be proportioned and blended to produce a uniform mixture complying with the requirements of Table 500-4. The binder content shall be within a tolerance of  $\pm 0.3$  per cent by weight of total mixture when individual specimens are taken for quality control tests in accordance with the provisions of Section 900. Asphalt VG-30 @ 35 Kg. / M.T. i.e. 3.50% by weight of total mix shall be used for mixing

## Construction Operations

**Weather and seasonal limitations:** The provisions of Clause 501.5.1 shall apply.

**TABLE 590-4. COMPOSITION OF BITUMINOUS MACADAM**

Mix designation	Grading 1	Grading 2
Nominal aggregate size	40mm 8	19mm
Layer thickness	80-100mm	50-75 mm
IS Sieve (mm)	Cumulative % by weight of total aggregate passing	
45	100	
37.5	90-100	
26.5	75-100	100

Mix designation	Grading 1	Grading 2
Nominal aggregate size	40mm 8	19mm
Layer thickness	80-100mm	50-75 mm
IS Sieve (mm)	Cumulative % by weight of total aggregate passing	
19	-	90-100
13.2	35-61	56-88
4.75	13-22	16-36
2.36	4-19	4-19
0.3	2-10	2-10
0.075	0-8	0-8
Bitumen content, % by weight of total mixture <sup>1</sup>	3.1-3.4	3.4
Bitumen grade	35 to 90	80-100

Notes: 1. Appropriate bitumen contents for conditions in cooler areas of India may be up to 0.5% higher subject to the approval of the Engineer.

**Preparation of the base:** The base on which bituminous macadam is to be laid shall be prepared, shaped and compacted to the required profile in accordance with Clauses 501.8 and 902.3 as appropriate, and a prime coat, shall be applied in accordance with Clause 502 where specified, or as directed by the Engineer.

**Tack coat :** A tack coat in accordance with Clause 503 shall be applied as required by the Contract documents, or as directed by the Engineer. Asphalt VG30 @ 2.50 Kg. / 10 Sq.Mt. shall used for tack coat

**Preparation and transportation of the mixture:** The provisions of Clauses 501.3 and 501.4 shall apply.

**Spreading:** The provisions of Clauses 501.5.3 shall apply.

TABLE 500-5. MANUFACTURING AND ROLLING TEMPERATURES

Bitumen Penetration	Bitumen Mixing (°C)	Aggregate Mixing (°C)	Mixed Material (°C)	Rolling (°C)	Laying(°C)
35	160-170	160-175	170 Maximum	100 Minimum	130 Minimum
65	150-165	150-170	165 Maximum	90 Minimum	125 Minimum
90	140-160	140-165	155 Maximum	80 Minimum	115 Minimum

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

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

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

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

### **Protection of the Layer**

The bituminous macadam shall be covered with either the next pavement course or wearing course, as the case may be, within a maximum of forty-eight hours. If there is to be any delay, the course shall be covered by a seal coat to the requirement of Clause 513 before opening to any traffic. The seal coat in such cases shall be considered incidental to the work and shall not be paid for separately.

### **Arrangements for Traffic**

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

### **Measurement for Payment**

Bituminous macadam shall be measured as finished work by weight in **metric tonnes**.

#### **504.8.Rate**

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

- (i) Making arrangements for traffic to Clause 112 except for initial treatment to verge, shoulders and construction of diversions;
- (ii) Preparation of the surface to receive the material.
- (iii) Providing all materials to be incorporated in the work including arrangement for stock yards, all royalties, fees, rents where necessary and all leads and lifts;
- (iv) Mixing, transporting, laying and compacting the mix, as specified.
- (v) All labour, tools, equipment, plant including installation of hot mix plant, power supply units and all machinery, incidental to complete the work to these Specifications;
- (vi) Carrying out the work in part widths of the road where directed;
- (vii) Carrying out all tests for control of quality; and

- (viii) The rate shall cover the provision of bitumen at the rate specified in the contract, with the provision that the variation in actual percentage of bitumen used will be assessed and the payment adjusted accordingly.
- (ix) The rates for premixed material are to include for all wastage in cutting of joints etc.
- (x) The rates are to include for all necessary testing, mix design, transporting and testing of samples, and cores. If there is not a project specific laboratory, the Contractor must arrange to carry out all necessary testing at an outside Laboratory, approved by the Engineer, and all costs incurred are deemed to be included in the rate quoted for the material.
- (xi) The cost of all plant and laying trials as specified to prove the mixing and lays, methods is deemed to be included in the Contractor's rates for the material.

**Payment shall be made on M.T. basis**

### **503. TACK COAT**

#### **Scope**

This work shall consist of the application of a single coat of low viscosity liquid bituminous material to an existing bituminous road surface preparatory to the superimposition of a bituminous mix, when specified in the Contract or instructed by the Engineer.

#### **Materials**

**Binder:** The binder used for tack coat shall be bitumen emulsion complying with IS 8887 of a type and grade as specified in the Contract or as directed by the Engineer. The use of cutback bitumen, as per IS 217 shall be restricted only for sites at sub-zero for emergency applications as directed by the Engineer.

#### **Weather and Seasonal Limitations**

Bituminous material shall not be applied to a wet surface or during a dust storm or when the weather is foggy, rainy or windy or when the temperature in the shade is less than 10°C. Where the tack coat consists of emulsion, the surface shall be slightly damp, but not wet. Where the tack coat is of cutback bitumen, the surface shall be dry.

#### **Construction**

**Equipment:** The tack coat distributor shall be a self-propelled or towed bitumen pressure sprayer, equipped for spraying the material uniformly at a specified rate. Hand spraying of small areas, inaccessible to the distributor, or in narrow strips, shall be sprayed with a pressure hand sprayer, or as directed by the Engineer.



**Preparation of base:** The surface on which the tack coat is to be applied shall be clean and free from dust, dirt, and any extraneous material, and be otherwise prepared in accordance with the requirements of Clauses 501.8 and 902 as appropriate. Immediately before the application of the tack coat, the surface shall be swept clean with a mechanical broom, and high pressure air jet, or by other means as directed by the Engineer.

**Application of tack coat:** The application of tack coat shall be at the rate specified in the Contract, and shall be applied uniformly. If rate of application of Tack Coat is not specified in the contract then it shall be at the rate specified in Table 500-2.

The normal range of spraying

**TABLE 500-2. RATE OF APPLICATION OF TACK COAT**

Type of Surface	Quantity of liquid bituminous material in Kg per sq. m. area
i) Normal bituminous surfaces	0.20 to 0.25
ii) Dry and hungry bituminous surfaces	0.25 to 0.30
iii) Granular surfaces treated with primer	0.25 to 0.30
iv) Non bituminous surfaces	
a) Granular base (not primed)	0.35 to 0.40
b) Cement concrete pavement	0.30 to 0.35

temperature for a bituminous emulsion shall be 20°C to 70°C and for a cutback, 50°C to 80°C if RC-70/MC-70 is used. Where a geosynthetic is proposed for use, the provisions of Clauses 703.3.2 and 703.4.4 shall apply. The method of application of the tack coat will depend on the type of equipment to be used, size of nozzles, pressure at the spray bar, and speed of forward movement. The Contractor shall demonstrate at a spraying trial, that the equipment and method to be used is capable of producing a uniform spray, within the tolerances specified.

Where the material to receive an overlay is a freshly laid bituminous layer, that has not been subjected to traffic, or contaminated by dust, a tack coat is not mandatory where the overlay is completed within two days.

**Curing of tack coat:** The tack coat shall be left to cure until all the volatiles have evaporated before any subsequent construction is started. No plant or

vehicles shall be allowed on the tack coat other than those essential for the construction.

### **Quality Control of Work**

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

### **Arrangements for Traffic**

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

#### **Item No. 4**

**Providing and laying 37.50 mm thick compacted Bituminous Macadam using stone chips 0.66 Cum/ 1 M.T. mix as per gradation & using asphalt grade VG 30 for tack coat 3.00 Kg /10 smt on B.T. surface & for mixing 35 Kg / M.T.(i.e. 3.50 % of mix) including heating the asphalt and aggregate by continuous batching drum mix plant, transporting th mix material and spreading the same Manually and consolidation with Kuba . including cost of fuel ,hire charges, fire wood , kerosens, labour charge etc & with contractors own machinaries , drum mix plant & equipment etc .comp.**

### **504. BITUMINOUS MACADAM**

#### **Scope**

This work shall consist of construction in a single course having 37.50 mm compacted crushed aggregates premixed with a bituminous binder on a previously prepared base to the requirements of these Specifications. Bituminous macadam is more open graded than the dense graded bituminous materials described in Clauses 507, 508 and 509.

#### **Materials**

**Bitumen:** The bitumen shall be paving bitumen of VG-30 Grade complying with Indian Standard Specifications for "Paving Bitumen" IS:73.

**Coarse aggregates:** The coarse aggregates shall consist of crushed rock, crushed gravel or other hard material retained on the 2.36 mm sieve. They shall be clean, hard, durable, of cubical shape, free from dust and soft or friable matter, organic or other deleterious matter. Where the Contractor's selected source of aggregates have poor affinity for bitumen, as a condition for the approval of that source, the bitumen shall be treated with approved anti-stripping agents, as per the manufacturer's recommendations, without additional payment. Before approval of the source, the aggregates shall be tested for stripping.

The aggregates shall satisfy the physical requirements set forth in Table 500-3.

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

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

**TABLE 500-3. PHYSICAL REQUIREMENTS FOR COARSE AGGREGATES FOR BITUMINOUS MACADAM**

Property	Test	Specification
Cleanliness	Grain size analysis <sup>1</sup>	Max 5% passing 0.075mm sieve
Particle shape	Flakiness and Elongation Index (Combined) <sup>2</sup>	Max 30%
Strength*	Los Angeles Abrasion Value <sup>3</sup>	Max 40%
	Aggregate Impact Value <sup>3</sup>	Max 30%
Durability	Soundness: <sup>4</sup>	
	Sodium Sulphate	Max 12%
	Magnesium Sulphate	Max 18%
Water Absorption	Water absorption <sup>5</sup>	Max 2%
Property	Test	Specification
Stripping	Coaling and Stripping of Bitumen Aggregate Mixtures <sup>6</sup>	Minimum retained coating 95%
Water Sensitivity <sup>7</sup>	Retained Tensile Strength	Min80%

Notes : 1. IS : 2386 Part 1

4. IS : 2386 Part 5

1. IS : 2386 Part 1

5. IS : 2386 Part 3

(the elongation test to be done only on non-flaky aggregates in the sample)

2. IS: 2386 Part 4\*

6. IS: 6241

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

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

**Aggregate grading and binder content:** When tested in accordance with IS: 2386 Part 1 (wet sieving method), the combined aggregate grading for the particular mixture shall fall within the limits shown in Table 500-4 for the grading specified in the Contract. The type and quantity of bitumen, and appropriate thickness, are also indicated for each mixture type.

**Proportioning of material:** The aggregates shall be proportioned and blended to produce a uniform mixture complying with the requirements of Table 500-4. The binder content shall be within a tolerance of  $\pm 0.3$  per cent by weight of total mixture when individual specimens are taken for quality control tests in accordance with the provisions of Section 900. Asphalt VG-30 @ 35 Kg. / M.T. i.e. 3.50% by weight of total mix shall be used for mixing

### Construction Operations

**Weather and seasonal limitations:** The provisions of Clause 501.5.1 shall apply.

**TABLE 590-4. COMPOSITION OF BITUMINOUS MACADAM**

Mix designation	Grading 1	Grading 2
Nominal aggregate size	40mm 8	19mm
Layer thickness	80-100mm	50-75 mm
IS Sieve (mm)	Cumulative % by weight of total aggregate passing	
45	100	
37.5	90-100	
26.5	75-100	100

Mix designation	Grading 1	Grading 2
Nominal aggregate size	40mm 8	19mm
Layer thickness	80-100mm	50-75 mm
IS Sieve (mm)	Cumulative % by weight of total aggregate passing	
19	-	90-100
13.2	35-61	56-88
4.75	13-22	16-36
2.36	4-19	4-19
0.3	2-10	2-10
0.075	0-8	0-8
Bitumen content, % by weight of total mixture <sup>1</sup>	3.1-3.4	3.4
Bitumen grade	35 to 90	80-100

Notes: 1. Appropriate bitumen contents for conditions in cooler areas of India may be up to 0.5% higher subject to the approval of the Engineer.

**Preparation of the base:** The base on which bituminous macadam is to be laid shall be prepared, shaped and compacted to the required profile in accordance with Clauses 501.8 and 902.3 as appropriate, and a prime coat, shall be applied in accordance with Clause 502 where specified, or as directed by the Engineer.

**Tack coat :** A tack coat in accordance with Clause 503 shall be applied as required by the Contract documents, or as directed by the Engineer. Asphalt VG30 @ 2.50 Kg. / 10 Sq.Mt. shall used for tack coat

**Preparation and transportation of the mixture:** The provisions of Clauses 501.3 and 501.4 shall apply.

**Spreading:** The provisions of Clauses 501.5.3 shall apply.

TABLE 500-5. MANUFACTURING AND ROLLING TEMPERATURES

Bitumen Penetration	Bitumen Mixing (°C)	Aggregate Mixing (°C)	Mixed Material (°C)	Rolling (°C)	Laying(°C)
35	160-170	160-175	170 Maximum	100 Minimum	130 Minimum
65	150-165	150-170	165 Maximum	90 Minimum	125 Minimum
90	140-160	140-165	155 Maximum	80 Minimum	115 Minimum

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

Rolling shall be continued until the specified density is achieved, or where no

density is specified, until there is no further movement under the roller. The required frequency of testing is defined in Clause 903.

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

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

### **Protection of the Layer**

The bituminous macadam shall be covered with either the next pavement course or wearing course, as the case may be, within a maximum of forty-eight hours. If there is to be any delay, the course shall be covered by a seal coat to the requirement of Clause 513 before opening to any traffic. The seal coat in such cases shall be considered incidental to the work and shall not be paid for separately.

### **Arrangements for Traffic**

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

### **Measurement for Payment**

Bituminous macadam shall be measured as finished work by weight in **metric tonnes**,

#### **504.8.Rate**

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

- (xii) Making arrangements for traffic to Clause 112 except for initial treatment to verge, shoulders and construction of diversions;
- (xiii) Preparation of the surface to receive the material.
- (xiv) Providing all materials to be incorporated in the work including arrangement for stock yards, all royalties, fees, rents where necessary and all leads and lifts;
- (xv) Mixing, transporting, laying and compacting the mix, as specified.
- (xvi) All labour, tools, equipment, plant including installation of hot mix plant, power supply units and all machinery, incidental to complete the work to these Specifications;
- (xvii) Carrying out the work in part widths of the road where directed;
- (xviii) Carrying out all tests for control of quality; and

- (xix) The rate shall cover the provision of bitumen at the rate specified in the contract, with the provision that the variation in actual percentage of bitumen used will be assessed and the payment adjusted accordingly.
- (xx) The rates for premixed material are to include for all wastage in cutting of joints etc.
- (xxi) The rates are to include for all necessary testing, mix design, transporting and testing of samples, and cores. If there is not a project specific laboratory, the Contractor must arrange to carry out all necessary testing at an outside Laboratory, approved by the Engineer, and all costs incurred are deemed to be included in the rate quoted for the material.
- (xxii) The cost of all plant and laying trials as specified to prove the mixing and lays, methods is deemed to be included in the Contractor's rates for the material.

**Payment shall be made on M.T. basis**

### **503. TACK COAT**

#### **Scope**

This work shall consist of the application of a single coat of low viscosity liquid bituminous material to an existing bituminous road surface preparatory to the superimposition of a bituminous mix, when specified in the Contract or instructed by the Engineer.

#### **Materials**

**Binder:** The binder used for tack coat shall be bitumen emulsion complying with IS 8887 of a type and grade as specified in the Contract or as directed by the Engineer. The use of cutback bitumen, as per IS 217 shall be restricted only for sites at sub-zero for emergency applications as directed by the Engineer.

#### **Weather and Seasonal Limitations**

Bituminous material shall not be applied to a wet surface or during a dust storm or when the weather is foggy, rainy or windy or when the temperature in the shade is less than 10°C. Where the tack coat consists of emulsion, the surface shall be slightly damp, but not wet. Where the tack coat is of cutback bitumen, the surface shall be dry.

#### **Construction**

**Equipment:** The tack coat distributor shall be a self-propelled or towed bitumen pressure sprayer, equipped for spraying the material uniformly at a specified rate. Hand spraying of small areas, inaccessible to the distributor, or in narrow strips, shall be sprayed with a pressure hand sprayer, or as directed by the Engineer.

**Preparation of base:** The surface on which the tack coat is to be applied shall be clean and free from dust, dirt, and any extraneous material, and be otherwise prepared in accordance with the requirements of Clauses 501.8 and 902 as appropriate. Immediately before the application of the tack coat, the surface shall be swept clean with a mechanical broom, and high pressure air jet, or by other means as directed by the Engineer.

**Application of tack coat:** The application of tack coat shall be at the rate specified in the Contract, and shall be applied uniformly. If rate of application of Tack Coat is not specified in the contract then it shall be at the rate specified in Table 500-2.

The normal range of spraying

**TABLE 500-2. RATE OF APPLICATION OF TACK COAT**

Type of Surface	Quantity of liquid bituminous material in Kg per sq. m. area
v) Normal bituminous surfaces	0.20 to 0.25
vi) Dry and hungry bituminous surfaces	0.25 to 0.30
vii) Granular surfaces treated with primer	0.25 to 0.30
viii) Non bituminous surfaces	
a) Granular base (not primed)	0.35 to 0.40
b) Cement concrete pavement	0.30 to 0.35

temperature for a bituminous emulsion shall be 20°C to 70°C and for a cutback, 50°C to 80°C if RC-70/MC-70 is used. Where a geosynthetic is proposed for use, the provisions of Clauses 703.3.2 and 703.4.4 shall apply. The method of application of the tack coat will depend on the type of equipment to be used, size of nozzles, pressure at the spray bar, and speed of forward movement. The Contractor shall demonstrate at a spraying trial, that the equipment and method to be used is capable of producing a uniform spray, within the tolerances specified.

Where the material to receive an overlay is a freshly laid bituminous layer, that has not been subjected to traffic, or contaminated by dust, a tack coat is not mandatory where the overlay is completed within two days.

**Curing of tack coat:** The tack coat shall be left to cure until all the volatiles have evaporated before any subsequent construction is started. No plant or



vehicles shall be allowed on the tack coat other than those essential for the construction.

### **Quality Control of Work**

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

### **Arrangements for Traffic**

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

### **Item No. 5**

**Providing and laying Bituminous Seal Coat using stone chips 0.18 Cmt / 10 Amt i.e. 0.66 Cmt aggregate and asphalt grade VG 30 for mixing at the rate of 4.50 % weight of total mix including heating the asphalt and aggregate by continuous batching drum mix plant and transporting the mix material & spreading Manually and consolidation with Kuba and flushing sand @ 0.30 Cum / 100 Smt . including cost of fuel ,hire charges, fire wood , kerosens, labour charge etc & with contractors own machinaries & drum mix plant etc .comp.**

## **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.

### **1. MATERIALS:-**

#### **Binder :-**

The binder shall be straight run bitumen of VG-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“.

#### **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.

**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.

**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

**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 0.24 Cu.M. per 10 Sq.Mt. area. 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

**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.

### **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**

#### **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 MORD 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.

#### **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  $150^{\circ}\text{C}$  -  $177^{\circ}\text{C}$  and aggregates in range of  $150^{\circ}\text{C}$  -  $163^{\circ}\text{C}$  provided also that at no time shall the difference in temperature of the aggregates and binder exceed  $14^{\circ}\text{C}$ .

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.

**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. .

**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 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 before the temperature of mix falls below 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 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 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. 6**

**Providing and laying Bituminous Seal Coat using stone chips 0.18 Cmt / 10 Amt i.e. 0.66 Cmt aggregate and asphalt grade VG 30 for mixing at the rate of 4.50 % weight of total mix including heating the asphalt and aggregate by continuous batching drum mix plant and transporting the mix material & spreading the same by paver finisher and consolidation with vibratory roller of 80 KN to 100 KN static weight and flushing sand @ 0.30 Cum / 100 Smt . including cost of fuel ,hire charges, fire wood , kerosens, labour charge etc & with contractors own machinaries & drum mix plant etc .comp.**

### **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:-**

#### **Binder :-**

The binder shall be straight run bitumen of VG-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“.

#### **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 9. Except that the upper limit for water absorption value shall be one percent.

**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.

**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

**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 0.24 Cu.M. per 10 Sq.Mt. area. 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

**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.

**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.

**10. CONSTRUCTION OPERATIONS****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 MORD 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.

**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  $150^{\circ}\text{C}$  -  $177^{\circ}\text{C}$  and aggregates in range of  $150^{\circ}\text{C}$  -  $163^{\circ}\text{C}$  provided also that at no time shall the difference in temperature of the aggregates and binder exceed  $14^{\circ}\text{C}$ .

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.

**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. .

**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 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 before the temperature of mix falls below 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 rolled to compaction and all the roller marks eliminated.

**11. OPENING TO TRAFFIC**

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

## **12. 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.

## **13. ARRANGEMENT FOR TRAFFIC**

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

## **14. 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.

## **15. 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 and laying Bituminous Seal Coat using stone chips 0.24 Cmt / 10 Amt i.e. 0.66 Cmt aggregate and asphalt grade VG 30 for mixing at the rate of 4.50 % weight of total mix including heating the asphalt and aggregate by continuous batching drum mix plant and transporting the mix material & spreading the same by paver finisher and consolidation with vibratory roller of 80 KN to 100 KN static weight and flushing sand @ 0.30 Cum / 100 Smt . including cost of fuel ,hire charges, fire wood , kerosens, labour charge etc & with contractors own machinaries & drum mix plant etc .comp.**

### **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.

### **3. MATERIALS:-**

#### **Binder :-**

The binder shall be straight run bitumen of VG-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“.

#### **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 16. Except that the upper limit for water absorption value shall be one percent.

**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.

**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

**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 0.24 Cu.M. per 10 Sq.Mt. area. 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

**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.

**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.

**17. CONSTRUCTION OPERATIONS****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 MORD 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.

**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.

**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. .

**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.

**18. OPENING TO TRAFFIC**

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

## **19. 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.

## **20. ARRANGEMENT FOR TRAFFIC**

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

## **21. 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.

## 22. 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. 8

**Providing and laying Asphalt painting on BT Surface with bitumen grade VG-30 at the rate of 5 kg per 10 Sq.M by mechanical sprayer and spreading the stone dust on prepared surface at the rate of 0.30 Cu.M. per 10 Sq.M etc complete and rolling with PTR roler and brushing etc complete**

- 1 . Bitumen shall be procured directly from refinery by the Contractor. The contractor shall make adequate arrangements for storing bulk asphalt at plant site. The Contractor will produce in original the bill of Refinery all the gate passes issued by the refinery and the number of transport tanker. The Contractor will also produce the Test Certificate regarding the grade of asphalt issued by Refinery.
2. On receipt and storage of bitumen, The bitumen shall be got tested in GERI .Laboratory or other Laboratories approved by R. & B Department. The frequency of test shall be as per norms
3. Contractor will establish OR site of work site laboratory in area not less than 25 sq.m. with pucca construction and equipped with instruments to enable to carry out the following tests.
  - Penetration test as per I.S. 1203
  - Softing point test as per I.S. 1204
  - Ductility test as per I.S. 1208
  - Viscosity test as per I.S. 1206
  - Specification Gravity test as for I.S. 1202

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

4. The Registers for use, temperature and other quality requirements of bitumen will be maintained at Plant site. The registers will be printed, as per formats



approved by R.&B. Department and authorised for use by the Engineer-in-charge. The entries in the registers will be made by the departmental representative and signed by the contractor or his authorised representative

#### 5. Frequency of Tests :

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

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

#### Supply of Stone Dust

3. Screenings: Screenings to fill voids in the coarse aggregate shall generally consist of the same material as the coarse aggregate.
- 2 100gm of clean and dry stone dust conforming to following gradation shall be taken:.

**TABLE GRADING REQUIREMENTS OF SCREENING**

Sieve Size	per cent passing
2.36 mm	100
1.18mm	80
600 mic.	75
300 mic.	45

#### Spreading of (Stone Dust)

Spreading of stone dust 0.03 Cum / 10 Sq.Mt after applying asphalt bitumen 5 Kg / 10 Smt on B.T. Surface by machine sprayer. After spreading the dust to dressed uniformly.

#### PTR Roller

Applying the Bitumen paint and spreading the stone dust after rolled in a longitudinal direction by **“PNEUMATIC-TYRED ROLLER”** Rollers should move at a speed of not more than 5 km per hour. Necessary precautions shall be taken to prevent dropping of oil, grease, petrol or other foreign matter on the pavement either when the rollers are operating or standing. The wheels of rollers shall be kept moist with water, and the spray system provided with the machine shall be in good working order, to prevent the mixture from adhering to the

wheels. Only sufficient moisture to prevent adhesion between the wheels of rollers and the mixture should be used. Surplus water shall not be allowed to stand on the partially compacted pavement

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

Measurement shall be made on area basis. Payment shall be made on

**Sq.Mt.** basis for complete items.

The contract unit rate for Asphalt painting 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 and applying asphalt .
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 No: 9**

**Providing and laying, Spreading and compacting graded stone aggregate to wet mix macadam as per MORT&H specification incl. premixing the material with water to O.M.C. 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 achieves 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 arc, used, the compacted depth of a single layer of the sub-base course may be increased to 200 mm upon approval of the Engineer.

##### **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 2.

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 recompact.

**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 recompact 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. 10**

**Providing and laying W.B.M. of M.C. metal of size 45 mm to 90 mm size including 0.27 Cu.M. Stone screening & 0.08 Cu.M. stone dust as filler including spreading, watering & consolidation by vibratory roller 80KN to 100KN static weight. 100 mm thick compacted**

**404. WATER BOUND MACADAM SUB-BASE/BASE****Scope**

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.

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.

**Materials**

**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).

**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)	35 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.

**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                                |

**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.



**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

**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.

**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 11.2 mm 5.6 mm 180 micron	100 95-100 15-35 0-10

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

Classification	Size Range	Compacted thickness	Lose 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>

**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.

### **Construction Operations**

**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.

**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 .is taken up. 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.

**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.

**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.

**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.

**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.

**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, form a wave ahead of the wheels of the moving roller.

**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.

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

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

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

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

**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 recompact. In no case shall depressions be filled up with screenings or binding material.

### **Arrangement for Traffic**

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

### **Measurements for payment**

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

### **Rate**

The Contract unit rate for WATER BOUND MACADAM sub-base shall be payment in full for carrying out the required operations including full compensation for :

- (i) malting arrangements for traffic to Clause 112 except for initial treatment to verges, shoulders and construction of diversions;
- (ii) furnishing all materials to be incorporated in the work including all royalties, fees, rents where necessary and all leads and lifts;
- (iii) all labour, tools, equipment and incidentals to complete the work to the Specifications;
- (iv) carrying out the work in part widths of road where directed; and
- (v) carrying out the required test for quality control.

### **Item No. 11**

**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.**

### **404. WATER BOUND MACADAM SUB-BASE/BASE**

#### **Scope**

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.

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.

#### **Materials**

**Coarse aggregates :** Coarse aggregates shall be black trap machine crushed metal. 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).

**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)	35 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.

**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.	63 mm to 45 mm	75 mm	100
		63 mm	90-100
		53 mm	25-75
		45 mm	0-15
		22.4 mm	0-5

Note : The compacted thickness for a layer shall be 75 mm.

**Screenings:** Screenings to fill voids in the coarse aggregate shall generally consist of the same material as the coarse aggregate. 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.

**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 11.2 mm 5.6 mm 180 micron	100 95-100 15-35 0-10

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

Classification	Size Range	Compacted thickness	Lose Qty.	Screenings			
				Stone Screening		Crushable type such as Murrum or Gravel	
				Grading Classification & Size	For. WBM Sub-base/base course (Loose quantity)	Grading Classification & Size	Loose Qty.
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>

**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 murrum or gravel.

### **Construction Operations**

**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 (leveling 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.

**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 .is taken up. 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.

**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.

**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 super elevated portions where the rolling shall proceed from inner edge to the outer, rolling shall begin from the edges gradually progressing towards the centre. First the edge/edges shall be compacted with roller running forward and

backward. The roller shall then move 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.

**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 (he road which could be completed within one day"s operation.

**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 beer thoroughly keyed, well-bonded and firmly set in its full depth and a grout has been formed of screenings. Care shall be taken to sec 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.

**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, form a wave ahead of the wheels of the moving roller.

**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.

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

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

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

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

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 recompact. In no case shall depressions be filled up with screenings or binding material.

#### **Arrangement for Traffic**

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

#### **Measurements for payment**

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

#### **Rate**

The Contract unit rate for WATER BOUND MACADAM sub-base shall be payment in full for carrying out the required operations including full compensation for :

- (i) malting arrangements for traffic to Clause 112 except for initial treatment to verges, shoulders and construction of diversions;
- (ii) furnishing all materials to be incorporated in the work including all royalties, fees, rents where necessary and all leads and lifts;
- (iii) all labour, tools, equipment and incidentals to complete the work to the Specifications;
- (iv) carrying out the work in part widths of road where directed; and
- (v) carrying out the required test for quality control.

## **ITEM - 12**

### **Providing Laying Spreading and Compacting Rubble Of hard stone On site inclu all taxes.**

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

The stones used in apron shall be sound, hard, durable & fairly regularly in shape. Stone 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 level and prepared for the length and width as shown on the drawings size of stone is as large as possible as weight less than 40 kg . The specific gravity of stone as high as possible and it shall be not less than 2.50. To ensure regular and full intended quantity of stone in apron , template cross walls in dry masonry shall be built about of meter wide and to full height of the apron at the intervals of the apron . Within this walls , the stone shall be hand packed .

1.Payment shall be made on CMT bases of chatta . The materials shall be stacked before laying. Preparation of base or laying bedding shall be deemed incidental to the work Nothing shall deducted for voids.

The rate shall include collection of materials, labour & tools to complete the job

### **Item No. 13**

#### **Hire Charges for Dumper including Diesel, Driver and Oil for One Day.....ect, Completed (8 Hrs.)**

- 1 Providing a Tipper minimum 10 tonne capacity with hydraulic .the work as directed by concern sectional officer or Engineer in charge. Tipper minimum 10 tonne capacity with hydraulic with driver & Cabin completely in good & working condition.
- 2 Driver must have a license & Experience of Tipper minimum 10 tonne capacity with hydraulic driving on all type Roads & like as cart track.
- 3 Rates are included with all charges like fuel, oil & all type of taxes etc.
- 4 As per direction of engineer in charge Tipper minimum 10 tonne capacity with hydraulic & driver provided within time limit
- 5 Rates based on hours & No ideal charges can claim by contractor.

**Deputy Executive Engineer**  
**Pan R & B Sub Division**  
**Chanasma**

**Executive Engineer**  
**R & B Sub. Division**  
**Patan.**