

**Name of Work :- Annual Rate for Asphalt patch work for various road under R&B Division Morbi.**

**SPECIFICATION**

**Item No. 1** Providing and laying bituminous grout base course 37.50 mm thick in one layer and Bitumen(VG-30) for tack coat 2.50 Kg./ 10 Sq.mtr B.T. Stone aggregates as per required gradation with the asphalt of VG-30 grade at the rate of 1.99% i.e. 19.90 Kg./ M.T. by weight by mix including heating and mixing in drum mix plant, transporting the mix spreading the same and consolidation by MORTH specification including cost of all materials, fuel labours, tools and plant etc. using contactors own drum mix plant etc. complete.

**Scope :-**

The work shall consist of construction in a Single course of compacted crushed aggregates premixed with a bituminous binder, to serve as base / binder course, laid immediately after mixing on a base prepared previously in accordance with the requirement of these specifications and in conformity with the lines, grades and cross sections shown on the drawing or as directed by the Engineer.

**Materials :-**

**Bitumen :-**

The Bitumen shall be paving bitumen of viscosity grade VG-30 complying with Indian Standard Specification for Paving Bitumen" IS : 73.

**504.2.2 Coarse Aggregate :-**

The coarse aggregate shall consist of crushed material retained on the 2.36mm 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 aggregate shall be tested for stripping.

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

**Table 500.3 Physical, Requirements for Coarse Aggregates for Bituminous Macadam.**

Property	Test	Specification
Cleanliness	Grain Size Analysis	Max. 5% passing 0.075mm sieve
Particle shape	Flakiness and Elongation Index (Combined)	Max. 30%
Strength	Los Angeles Abrasion Value	Max. 40%
	Aggregate Impact Value	Max. 30%
Durability	Soundness	Max 12%
	Sodium Sulphate	
	Magnesium Sulphate	Max. 18%
Water Absorption	Water Absorption	Max. 2%
Stripping	Coating and stripping of Bitumen Aggregate Mixtures	Minimum retained coating 95%
Water Sensitivity	Retained Tensile Strength	Minimum 80%

**Notes :-**

[1] IS : 2386, Part-1 [2] IS : 2386 Part-1 [the elongation test to be done only on non flaky aggregate in the sample]

[3] IS : 2386 Part-4 [4] IS : 2386 Part-5 [5] IS : 2386 Part-3

[6] IS : 6241 [7] The Water sensitivity test is only to be carried out if the minimum retained coating in the stripping test is less than 95%

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

**504.2.3. Fine Aggregates :-** Fine Aggregates shall consist of crushed or passing 2.36mm 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.

**504.2.4 Aggregate grading and binder content :-**

The Combined aggregate grading for the mixture shall fall within the limits of grading requirement and content of bitumen shall be at the rate of 19.90 Kg./M.T. i.e. 1.99% by weight of total mix.

**504.2.5 Proportioning of Material :-**

The aggregates shall be proportioned and blended to produce a uniform mixture complying with the requirements of following Table. The binder content shall be within a tolerance of  $\pm 0.3\%$  by weight of total mixture when individual specimens are taken for quality control tests in accordance with the provisions of Section 900.

**Table – Composition of Bituminous Course**

Nominal Aggregate Size	25mm	
layer thickness	37.50mm	
IS : Sieve (MM)	Cumulative % by weight of total Aggregate passing	
	Coarse Aggregate	Key Aggregate
40mm	100	-
26.50mm	40-75	-
22.4mm	-	100
13.20mm	0-20	40-75
5.60mm	-	0-20
2.80mm	0-5	0-5
Bitumen content @ by weight of total Mixture	1.99	
Bitumen Grade	VG-30	

**504.3 Construction Operations :-**

**504.3.1 Weather and seasonal limitations :-**

Laying shall be suspended while free standing water is present on the surface to be covered or during rain, fog and dust storms. After rain the bituminous surface, prime or tack coat, shall be blow off with a high pressure air jet to remove excess moisture or the surface left to dry before laying shall start, laying bituminous mixtures shall not be carried out when the air temperature at the surface on which it is to be laid is below 10<sup>0</sup> C or when the wind speed at any temperature exceeds 40 K.M./H at 2 Mt. height unless specifically approved by the Engineer.

**504.3.2. Preparation of the base :-**

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

**504.8. Preparation of Surface :-**

**504.8.1 Scope :-**

This work shall consist of preparing an existing granular or black topped surface bituminous course. The work shall be performed on such widths and lengths as shown on the drawings or as instructed by the Engineer. The existing Surface shall be firm and clean and treated with prime or tack coat as shown on the drawings as otherwise stated in the contract.

#### **~~504.3.3. 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.~~

~~The tack coat shall be applied on 2.50 Kg./10-Sq.mt. for B.T. Surface.~~

#### **503. Tack Coat :-**

##### **503.1. Scope :-**

This work shall consist of the application of a single coat of bitumen VG-30 Grade to an existing bituminous road surface preparatory to the superimposition of a bituminous mix, when specified in the contract or instructed by the engineer.

##### **503.2 Material :-**

###### **503.2.1 Binder :-**

The binder used for tack coat shall be bitumen VG-30 grade complying with IS : 73 or as directed by the Engineer.

##### **503.3 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.

##### **503.4. Construction :-**

###### **503.4.1 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 in narrow strips, shall be sprayed with a pressure hand sprayer or as directed by the Engineer.

###### **503.4.2. 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 otherwise prepared in accordance with the requirements of MORTH Clause – 501.8 & 513 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.

###### **503.4.3 Application of Tack Coat :-**

The application of tack coat shall be at 2.50 Kg./10 Sq.mt. for B.T. Surface directed by the engineer and shall be applied uniformly.

The method of application of the tack coat will depend on the type of equipment to be used size of nozzels, 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.

#### **504.3.4. Preparation and transportation of the Mixture :-**

##### **501.3 Mixing :-**

Premixed bituminous materials, shall be prepared in a Drum Mix Plant of adequate capacity and bituminous Mix shall be prepared in a Drum Mix plant of adequate capacity and capable of yielding a mix of proper and uniform quality with thoroughly coating aggregates. Appropriate mixing temperatures can be found in 500.5 of these specifications, the difference in temperature between the binder and aggregate should at no time exceed 14°C. In order to ensure uniform quality of the mix and belief writing of aggregates, the Continuous Batch Mix Plant shall be calibrated from time to time.

If a Drum mixing plant is to be used for mixing the bituminous mix, the Contractor Must demonstrate by laboratory analysis that the cold feed combined grading is within the grading limits specified for the bituminous bound material. In the case of a designed job mix. The bitumen and filler content shall be derived using this combined grading.

Further details shall be available in the Manual for Construction and Supervision of Bituminous Works.

#### **501.4. Transporting :-**

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

#### **504.3.5. Spreading :-**

Bituminous materials shall be spread, leveled and tamped by manually. The material shall be spread, raked and leveled with suitable by hand tools by experienced staff and compacted to the satisfactions of the Engineer.

Bituminous material with temperature greater than 145<sup>0</sup> C shall not be laid or deposited on bridge deck water proofing systems, unless precautions against heat damage have been approved by the Engineer.

**Table 500.5 Manufacturing and Rolling Temperatures**

<b>Penetration</b>	<b>Bitumen Mixing [C]</b>	<b>Aggregate Mixing [C]</b>	<b>Mixed Material [C]</b>	<b>Rolling [C]</b>	<b>Laying [C]</b>
35	106-170	160-175	170 Maximum	100 Maximum	130 Maximum
65	150-165	150-170	165 Maximum	90 Maximum	125 Maximum
90	140-160	140-165	155 Maximum	80 Maximum	115 Maximum

#### **504.3.6. ~~Rolling :-~~**

~~Compaction shall be carried out in accordance with the provisions of MORTH Clauses 501.6 and 501.7 as below.~~

#### **501.6 Compaction :-**

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

Compaction of bituminous materials shall commence as soon as possible after laying. Compaction shall be substantially completed before the temperature falls below the minimum rolling temperatures stated in the relevant part of these Specification. Rolling of the longitudinal joints shall be done immediately behind the paving operation.

After this rolling shall commence at the edges and progress towards the center longitudinally except that on super elevated and unidirectional compared portion, it shall progress from the lower to the upper edge parallel to the center line of the pavement. Rolling shall continue until all roller marks have been removed from the surface. All deficiencies in the surface after laying shall be made good by the attendants behind the paver before initial rolling its commenced. The initial or breakdown rolling shall be done with 8-10 tonnes dead weight smooth wheeled roller. The immediate rolling shall be done with vibratory roller. The finish rolling shall be done with 6 to 8 tonnes smooth wheeled tandem rollers.

Where compaction is to be determined by density of the requirements to prove the performance of rollers shall apply in order to demonstrate that the specified density can be achieved. In such cases the contractor shall nominate the plant and the method by which he intends to achieve the specified level of compaction and finish at

temperatures above the minimum specified rolling temperature. Laying trials shall then demonstrate the acceptability of the plant and method used.

Bituminous materials shall be rolled in a longitudinal direction with the driven rolls nearest the paver. The rollers shall first compact material adjacent to joints and then work from the lower to the upper side of the layer, overlapping on successive passes by at least one-third of the width of the rear roller in the case of a pneumatic tyred roller, at least nominal width of 300mm.

In Portions with super elevated and un-directional camber, after the edge has been roller, the roller shall progress from the lower to the upper edge.

Roller should move at a speed of not more than 5 K.M. / H. The roller shall not be permitted to stand on pavement which has not been fully compacted and necessary precautions shall be taken to prevent dropping of oil, grease, petrol or other foreign matter on the pavement 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.

#### **501.7. Joints :-**

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

[1] By beating the joints with an approved joint heater when the adjacent width is being laid but without cutting back or coating with binder. The heater shall raise the temperature of the full depth of material to within the specified range of minimum rolling temperature and maximum temperature at any stage for the material for a width not less than 75mm. The contractor shall have equipment available for use in the event of a heater break down to form joints by method [iii].

[2] By using two or more pavers operating in each other, where this is practicable, and in sufficient proximity for adjacent widths to be fully compacted by continuous rolling.

[3] By cutting back the exposed joint for a distance equal to the specified layer thickness, to a vertical face discarding all loosened material and coating the vertical face completely with 60/70 penetration grade hot bitumen or cold applied bitumen or polymer modified adhesive bitumen tape with a minimum thickness of 2mm before the adjacent width is laid.

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

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 MORTH clause -903.

#### **Surface Finish and Quality Control :**

The surface finish of the completed construction shall conform to the requirements of Clause-902 of MORTH Specification. All materials and workmanship shall comply with the provisions set out in Section-900 of MORTH Specification.

#### **Arrangements for Traffic :**

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

**Measurement for Payment :-**

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

Department will be free to get some loaded dumpers test checked at other weigh 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 pro-rate basis depending upon the area reduced or exceeded respectively.

Weight of mix materials will be done in presence of responsible person, not less than the rank of Supervisor of Department and the measurements shall be recorded by the Deputy Executive Engineer or Assistant Engineer or Additional Assistant Engineer, if so authorized. Record of each dumper will be mentioned separately in bond and numbered register which will be maintained by the Department representatives and signed by the contractor. Proper gate pass system shall be established for the vehicle coming to the plant site and going from the site. The location of K.M. hectometer and meter in which individual dumpers are unloaded shall be recorded carefully.

**Rate for premixed bituminous materials :-**

The unit rate for premixed bituminous material shall be payment in full for carrying out the required operation including full compensation for, but not limited to :

1. Making arrangements for traffic to clause-112 except for initial treatment to verge, shoulders and construction of diversions.
2. Preparation of the surface to revive the materials.
3. 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.
4. Mixing transporting, laying and compacting the mix as specified.
5. All labour, tools equipment, plant including installation of hot mix plant, power supply units and all machinery incidental to complete the work to these specification.
6. Carrying out the work in part widths of the road where directed.
7. Carrying out all tests for control of quality, and
8. The rate shall cover the provision of bitumen at the rate specified in the contract.
9. The rate for premixed material are to include for all wastage in cutting of joints etc.
10. 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.
11. The cost of all plant and laying trials as specified to prove the mixing and laying methods is deemed, to be included in the contractor's rates for the materials.

**Item No. 2 Providing & Laying 37.50 mm. thick B.M. with B.T. Aggregate as per MORT&H specification & Bitumen(VG-30) for tack coat @ 2.5Kg./ 10 Smt. & Bitumin (VG-30) for mixing @ 34.00Kg/M.T. i.e. 3.40 % of total weight of mix including heating the aggregate & asphalt in continuous batching drum mix plant and spreading the same and consolidation with vibratory roller including providing all materials equipments, tools & plants, fire wood, oil, kerosene, labour charges etc. complete using contractor's own machinery drum mix plant etc. complete.**

#### **504.1. Scope**

This work shall consist of construction in a single course having 50mm to 100mm thickness or in multiple courses of 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.

#### **504.2. Materials**

**504.2.1. Bitumen:** The bitumen shall be paving bitumen of Penetration Grade complying with Indian Standard Specifications for "Paving Bitumen" IS:73, and of the penetration indicated in Table 500-4.

**504.2.2. 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.

**504.2.3. 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%
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.

**504.2.4. 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.

**504.2.5. 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.

### 504.3. Construction Operations

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

**TABLE 500-4. 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
19	-	90-100
13.2	35-64	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	3.3-3.5
Bitumen grade	35 to 90	60 to 70

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.

**504.3.2. 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.

**504.3.3. 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.

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

### 504.3.5. Spreading :-

Bituminous materials shall be spread, leveled and tamped by manually. The material shall be spread, raked and leveled with suitable by hand tools by



experienced staff and compacted to the satisfactions of the Engineer. The temperature of mix at the time of laying shall be in the range 121-163 C.

**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

**504.3.6. 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.

**MORTH SPECIFICATION 501.6. FOR Compaction**

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

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

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

Bituminous materials shall be rolled in a longitudinal direction, with the driven rolls nearest the paver. The roller shall first compact material adjacent to joints and then work from the lower to the upper side of the layer, overlapping on successive passes by at least one-third of the width of the real roll or, in the case of a pneumatic-tyred roller, at least the nominal width of 300mm

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

Rollers should move at a speed of not more than 5 km per hour. The roller shall not be permitted to stand on pavement which has not been fully compacted, and necessary precautions shall be taken to prevent dropping of oil, grease, petrol or other foreign matter on the pavement 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

#### **501.7. Joints**

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

- (i) by beating the joints with an approved joint heater when the adjacent width is being laid, but without cutting back or coating with binder. The heater shall raise the temperature of the full depth of material, to within the specified range of minimum rolling temperature and maximum temperature at any stage for the material, for a width not less than 75 mm. The Contractor shall have equipment available, for use in the event of a heater breakdown, to form joints by method (iii);
- (ii) by using two or more pavers operating in echelon, where this is practicable, and in sufficient proximity for adjacent widths to be fully compacted by continuous rolling;
- (iii) by cutting back the exposed joint, for a distance equal to the specified layer thickness, to a vertical face, discarding all loosened material and coating the vertical face completely with 60/70 penetration grade hot bitumen, or cold-applied bitumen, or polymer modified adhesive bitumen tape with a minimum thickness of 2 mm, before the adjacent width is laid.

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

#### **504.4. 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.

#### **504.5. 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.

#### **504.6. Arrangements for Traffic**

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

#### **504.7. Measurement for Payment**

Bituminous macadam shall be measured as finished work in cubic metres or by weight in metric tonnes, where used as regulating course, or square metres at the specified thickness as indicated in the Contract or shown on the drawings, or as otherwise directed by the Engineer.

#### **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 in Clause 501.8.8.2. (i) to (xi).

**The unit rate for payment of this item shall be per 1-M.T. basis of complete item**

**Item No. 3 Providing & Laying 20 mm. thick Mix Seal Surfacing using stone chipping & Aggregate as per MORT & H specification & Bitumen(VG-30) for tack coat @ 2.5Kg./ 10 Smt Bitumen Grade VG-30 for mixing @ 50.90Kg/M.T. i.e. 5.09 % of total mix including heating the aggregate & asphalt in continuous batching drum mix plant and spreading the same and consolidation with vibratory roller. including providing all materials equipments, tools & plants, fire wood, oil, kerosenr, labour charges etc. complete using contractor's own machinery drum mix plant etc. complete.**

**SCOPE :-**

This work shall consist of laying and compacting mix seal surfacing in a 20mm single course composed of suitable aggregates premixed with a bituminous binder on a previously prepared base, in accordance with the requirements of these specifications to serve as a wearing course.

**Materials :-**

**Binder :-**

The binder shall be bitumen of a VG-30 grade as directed by the Engineer-in-Charge and satisfying the requirement of IS : 73,217,454.

**Coarse Aggregate :**

The aggregate shall consist of crushed stone of Black Trap only. They shall be clean, strong, durable, of fairly cubical shape and free from disintegrated pieces, organic or other deleterious matter and adherent coating. The aggregates shall preferably be hydrophobic and of low porosity. If hydrophilic aggregates are to be used the bitumen shall preferably be treated with anti-stripping agents of approved quality in suitable dose as per Appendix-5. The aggregates shall satisfy the physical requirements set forth in Table 500-3.

**TABLE 500-3 PHYSICAL REQUIREMENTS OF AGGREGATES FOR MIX SEAL SURFACE**

Property	Test	Specification
Cleanliness	Grain size analysis	Max 5% passing 0.075mm sieve
Particle shape	Flakiness and Elongation Index (Combined) <sup>2</sup>	Max 30%
Strength*	Los Angles Abrasion Value <sup>3</sup> Aggregate Impact Value <sup>3</sup>	Max 40% Max 30%
Durability	Soundness <sup>4</sup> Sodium Sulphate Megnesium Sulphate	Max 12% Max 18%
Water Absorption	Water Absorption <sup>5</sup>	Max 2%
Stripping	Coating and stripping of Bitumen Aggregate Mixtures <sup>6</sup>	Maximum retained coating 95%
Water sensitivity <sup>7</sup>	Retained Tensile Strength	Min. 80%

**Aggregate grading and binder content :-** When tested in accordance with IS : 2386 Part-I (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.

\* 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.

**Fine Aggregate :-**

The Fine aggregate 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.

**Aggregate Gradation :-**

The coarse and fine aggregate shall be so graded or combined as to confirm to the grading set forth in Table 500-10

**Aggregate Gradation for Mix Seal Surfacing :-**

IS Sieve Designation	Cumulative Percent by weight of total passing the sieve
13.2mm	--
11.20mm	100%
5.60mm	52-88%
2.80mm	14-38%
90 Micron	0-5%

**Proportioning of Materials :-**

The total quantity of the aggregates used for mix seal surfacing shall be used to achieve required 20mm compacted thickness.

The quantity of binder used for premixing in terms of straight run bitumen shall be 5.09% by weight of the total mix i.e. 50.90 Kgs. per Tonne of Mix.

Before starting the work, the contractor shall get the job mix formula for the mix, approved by the Engineer-in-Charge.

**Construction Operations :-**

**Weather and Seasonal Limitation :-**

Mix Seal Surfacing shall not be laid during rainy season or when the base course is damp or wet.

**Preparation of base :-**

The base on which mix seal surfacing is to be laid shall be prepared shaped and conditioned of the specified lines; grade and cross sections in accordance with M.O.S.T. Specification, as directed by the Engineer-in-Charge. The surface shall be thoroughly swept and scrubbed, dean and free of dust and foreign matter.

**Tack Coat :-**

This work shall consist of the applicant of a single coat of bitumen VG-30 Grade to an existing bituminous road surface preparatory to the superimposition of a bituminous mix, when specified in the contract or instructed by the engineer.

**Preparation and transportation of Mix :**

Mix Seal Surfacing mix shall be prepared in a drum mix plant of adequate capacity and capable to yield a mix of proper and uniform quality with thoroughly coated aggregate. The Plant shall be Drum Mix type. The Plant shall have co-ordinated set of essential units capable of production uniform mix within the job mix formula such a as laid down in appendix – A.

- (a) In case of drum mix plant, the cold feed system shall have variable speed belt conveyors/ or other suitable devices for regulating the accurate proportioning of aggregate to an even flood flow automatically from a Control Operation Control Cabin.

- (b) **Bitumen Control Unit :**  
Capable measuring metering and spraying required quantity of bitumen at specified temperature with automatic synchronization of bitumen and aggregate feed.
- (c) **Filler System :**  
A fine 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 capacity with self heating arrangement and temperature control device. The boiler should be fitted with temperature indicating instruments.

The temperature of binder at the time of mixing shall be in the range of 160-177 C. and of aggregates in the range of 155-163 C provided also that at no time shall be the difference in temperature between the aggregates and the binder exceed 14 C.

Mixing shall be thorough 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 mix plant to the point of use in suitable vehicles. The vehicles employed for transport, shall be clean and covered over the transit if so directed by the Engineer-in-Charge.

#### **504.3.5. Spreading :-**

Bituminous materials shall be spread, leveled and tamped by manually. The material shall be spread, raked and leveled with suitable by hand tools by experienced staff and compacted to the satisfactions of the Engineer. The temperature of mix at the time of laying shall be in the range 121-163 C.

#### **ROLLING :**

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

The roller wheels shall be kept damp to prevent the mix from 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 on super, elevated portions, it shall progress from the lower to upper edge parallel to the fresh material with rear or mixed wheel loading 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.

#### **Opening to Traffic :-**

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

#### **Surfacing Finish & Quality Control for Work :-**

The surface finish of construction shall conform to the requirement of MORT&H Specification table 900-1. Control on the quality of material and works shall be exercised by the Engineer-in-Charge in accordance with MORT&H Specification.

**Surface Levels :**

The levels of the subgrade and different pavement courses as constructed, shall not vary from those calculated with reference to the longitudinal and cross-profile of the road shown on the drawings or as directed by the engineer beyond the tolerances mentioned in Table 900-1.

**TABLE 900-1. TOLERANCES IN SURFACE LEVELS**

1	Subgrade	+ 20mm - 25mm
2	Sub-base + 10mm (a) Flexible Pavement (b) Concrete Pavement (Dry lean concrete or Rolled concrete)	-20mm + 6mm -10mm
3	Base – Course for flexible pavement (a) Bituminous Course  (b) Other than bituminous (i) Machine laid (ii) Manually laid	+ 6 mm - 6 mm + 10mm - 10mm +15mm -15mm
4	Wearing Course for flexible pavement (a) Machine laid  (b) Manually laid	+ 6mm - 6mm +10mm -10mm
5	Cement Concrete pavement	+ 5mm -6mm*

**Arrangement for Traffic :**

The provision of MOST specification shall apply as regards that flow of traffic during construction.

**Passage of Traffic along a part of the Existing Carriageway under Improvement :**

For widening / strengthening existing carriageway where part width of the existing carriageway is proposed to be used for passage of traffic, treated shoulders shall be provided on the side on which work is not in progress. The treatment to the shoulder shall consist of providing at least 150mm thick granular base course covered with bituminous surface dressing in a width of at least 1.5m. and the surface shall be maintained throughout the period during which traffic uses the same to the satisfaction of the Engineer. The continuous length in which such work shall be carried out, would be limited normally to 500m. at a place. However, where work is allowed by the Engineer in longer stretches passing places at least 20m. long with additional paved width of 2.5m. shall be provided at every 0.5 Km. interval.

In case of widening existing two lane to four lane, the additional two lanes would be constructed first and the traffic diverted to it and only thereafter the required treatment to the existing carriageway would be carried out. However, in case where on the request of the contractor, work on existing two-lane carriageway is allowed by the Engineer with traffic using part of the existing carriageway, stipulations as in para above shall apply.

After obtaining permission of the Engineer, the treated shoulder shall be dismantled, the debris disposed of the area cleared as per the direction of the Engineer.

**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 weight 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 periodically got calibrated, verified and satisfied 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 filed, the reduction in or addition to payment shall have to be considered respectively.

Weight of mix materials will be done in presence of responsible person, not less than the rank of supervisor of department and the measurement shall be recorded by the Deputy Executive Engineer or Assistant Engineer or Addl. Asstt. Engineer. If so authorized, Record of each dumper will be maintained separately in bound and numbered register, which will be maintained by the departmental representative 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.

**RATE :-**

The contract unit rate for mix seal surfacing shall be paid in full for carrying out the required operations including full compensation for all components.

- (i) Making arrangements for traffic as per above details except for initial treatment to verge, shoulders and construction of diversion.
- (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 leads and lift.
- (iv) All labour, tools, equipment, plant including installation of Drum mix plant, power supply units and all machineries, incidental to complete the work to the specifications.
- (v) Carrying out the work in part width of the road where directed.
- (vi) Carrying out all tests for control of quality.

**Item No. 4 Providing, graded machine crushed black stone aggregate, wet mix macadam (WMM) including mixing the Material with water in mechanical mix (pug mill) or by manual JCB including loading weighting on way bridge etc. complete.**

#### **406.1. Scope**

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

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

#### **406.2. Materials**

##### **406.2.1. Aggregates**

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

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

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

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

\*\* To determine this combined proportion, the flaky stone from a representative sample should first be separated out. Flakiness index is weight of flaky stone metal divided by weight of stone sample. Only the elongated particles be separated out from the remaining (non-flaky) stone metal. Elongation index is



weight of elongated particles divided by total non-flaky particles. The value of flakiness index and elongation index so found are added up.

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

**406.2.1.2. Grading requirements** : The aggregates shall conform to the grading given in Table 400-11.

**TABLE 400-11. GRADING REQUIREMENTS OF AGGREGATES FOR WET MIX MACADAM**

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

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

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

### **406.3. Construction Operations**

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

**406.3.2. Provision of lateral confinement of aggregates:** While constructing wet mix macadam, arrangement shall be made for the lateral confinement of wet mix. This shall be done by laying materials in adjoining shoulders along with that of wet mix macadam layer and following the sequence of operations described in Clause 407.4.1.

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

Optimum moisture for mixing shall be determined in accordance with IS:2720 (Part-8) after replacing the aggregate fraction retained on 22.4 mm sieve with material of 4.75 mm to 22.4 mm size. While adding water, due allowance should be made for evaporation losses. However, at the time of compaction, water in the wet mix should not

vary from the optimum value by more than agreed limits. The mixed material should be uniformly wet and no segregation should be permitted.

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

The mix may be spread either by a paver finisher or motor grader. For portions where mechanical means cannot be used, manual means as approved by the Engineer shall be used. The motor grader, shall be capable of spreading the material uniformly all over the surface. Its blade shall have hydraulic control suitable for initial adjustments and maintaining the same so as to achieve the specified slope and grade.

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

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

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

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

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

In portions in camber, rolling should begin at the edge with the roller running forward and backward until the edges have been firmly compacted. The roller shall then progress gradually towards the centre parallel to the centre line of the road uniformly

overlapping each of the preceding track by at least one-third width until the entire surface has been rolled.

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

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

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

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

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

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

#### **406.4. Opening to Traffic**

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

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

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

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

#### **406.6. Rectification of Surface Irregularity**

Where the surface irregularity of the wet mix macadam course exceeds the permissible tolerances or where the course is otherwise defective due to subgrade soil getting mixed with the aggregates, the full thickness of the layer shall be scarified over the affected area, reshaped with added premixed material or removed and replaced with fresh premixed material as applicable and recompacted in accordance with Clause 406.3.

The area treated in the aforesaid manner shall not be less than 5 m long and 2 m wide. In no case shall depressions be filled up with unmixed and ungraded material or fines.

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

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

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

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

#### **406.9. Rates**

The Contract unit rate for wet mix macadam shall be .payment in full for carrying out the required operations including full compensation for all components listed in Clause 401.8. which is re-printed here under ::

- (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.

**Unit rate for payement of this item shall be per -1Cum. basis of complete item**

**Item No. 5** Providing and laying bituminous grout base course 37.50 mm thick in one layer and Bitumen(VG-30) for tack coat 2.50 Kg./ 10 Sq.mtr B.T. Stone aggregates as per required gradation with the asphalt of VG-30 grade at the rate of 1.99% i.e. 19.90 Kg./ M.T. weight by mix including heating and mixing in drum mix plant, transporting the mix spreading the same by paver finisher and consolidation by MORTH specification including cost of all materials, fuel labours, tools and plant etc. using contactors own drum mix plant etc. complete.

**Scope :-**

The work shall consist of construction in a Single course of compacted crushed aggregates premixed with a bituminous binder, to serve as base / binder course, laid immediately after mixing on a base prepared previously in accordance with the requirement of these specifications and in conformity with the lines, grades and cross sections shown on the drawing or as directed by the Engineer.

**Materials :-**

**Bitumen :-**

The Bitumen shall be paving bitumen of viscosity grade VG-30 complying with Indian Standard Specification for Paving Bitumen" IS : 73.

**504.2.2 Coarse Aggregate :-**

The coarse aggregate shall consist of crushed material retained on the 2.36mm 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 aggregate shall be tested for stripping.

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

**Table 500.3 Physical, Requirements for Coarse Aggregates for Bituminous Macadam.**

Property	Test	Specification
Cleanliness	Grain Size Analysis	Max. 5% passing 0.075mm sieve
Particle shape	Flakiness and Elongation Index (Combined)	Max. 30%
Strength	Los Angeles Abrasion Value	Max. 40%
	Aggregate Impact Value	Max. 30%
Durability	Soundness	Max 12%
	Sodium Sulphate	
	Magnesium Sulphate	Max. 18%
Water Absorption	Water Absorption	Max. 2%
Stripping	Coating and stripping of Bitumen Aggregate Mixtures	Minimum retained coating 95%
Water Sensitivity	Retained Tensile Strength	Minimum 80%

Notes :-

[1] IS : 2386, Part-1 [2] IS : 2386 Part-1 [the elongation test to be done only on non flaky aggregate in the sample]

[3] IS : 2386 Part-4 [4] IS : 2386 Part-5 [5] IS : 2386 Part-3

[6] IS : 6241 [7] The Water sensitivity test is only to be carried out if the minimum retained coating in the stripping test is less than 95%

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

**504.2.3. Fine Aggregates :-** Fine Aggregates shall consist of crushed or passing 2.36mm 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.

#### **504.2.4 Aggregate grading and binder content :-**

The Combined aggregate grading for the mixture shall fall within the limits of grading requirement and content of bitumen shall be at the rate of 19.90 Kg./M.T. i.e. 1.99% by weight of total mix.

#### **504.2.5 Proportioning of Material :-**

The aggregates shall be proportioned and blended to produce a uniform mixture complying with the requirements of following Table. The binder content shall be within a tolerance of  $\pm 0.3\%$  by weight of total mixture when individual specimens are taken for quality control tests in accordance with the provisions of Section 900.

**Table – Composition of Bituminous Course**

Nominal Aggregate Size	25mm	
layer thickness	37.50mm	
IS : Sieve (MM)	Cumulative % by weight of total Aggregate passing	
	Coarse Aggregate	Key Aggregate
40mm	100	-
26.50mm	40-75	-
22.4mm	-	100
13.20mm	0-20	40-75
5.60mm	-	0-20
2.80mm	0-5	0-5
Bitumen content @ by weight of total Mixture	1.99	
Bitumen Grade	VG-30	

#### **504.3 Construction Operations :-**

##### **504.3.1 Weather and seasonal limitations :-**

Laying shall be suspended while free standing water is present on the surface to be covered or during rain, fog and dust storms. After rain the bituminous surface, prime or tack coat, shall be blow off with a high pressure air jet to remove excess moisture or the surface left to dry before laying shall start, laying bituminous mixtures shall not be carried out when the air temperature at the surface on which it is to be laid is below  $10^{\circ}$  C or when the wind speed at any temperature exceeds 40 K.M./H at 2 Mt. height unless specifically approved by the Engineer.

##### **504.3.2. Preparation of the base :-**

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

#### **504.8. Preparation of Surface :-**

##### **504.8.1 Scope :-**

This work shall consist of preparing an existing granular or black topped surface bituminous course. The work shall be performed on such widths and lengths as shown on the drawings or as instructed by the Engineer. The existing Surface shall be firm and clean and treated with prime or tack coat as shown on the drawings as otherwise stated in the contract.

##### **504.3.3. 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.~~

The tack coat shall be applied on 2.50 Kg./10-Sq.mt. for B.T. Surface.

#### **503. Tack Coat :-**

### **503.1. Scope :-**

This work shall consist of the application of a single coat of bitumen VG-30 Grade to an existing bituminous road surface preparatory to the superimposition of a bituminous mix, when specified in the contract or instructed by the engineer.

### **503.2 Material :-**

#### **503.2.1 Binder :-**

The binder used for tack coat shall be bitumen VG-30 grade complying with IS : 73 or as directed by the Engineer.

### **503.3 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.

### **503.4. Construction :-**

#### **503.4.1 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 in narrow strips, shall be sprayed with a pressure hand sprayer or as directed by the Engineer.

#### **503.4.2. 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 otherwise prepared in accordance with the requirements of MORTH Clause – 501.8 & 513 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.

#### **503.4.3 Application of Tack Coat :-**

The application of tack coat shall be at 2.50 Kg./10 Sq.mt. for B.T. Surface directed by the engineer and shall be applied uniformly.

The method of application of the tack coat will depend on the type of equipment to be used size of nozzels, 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.

### **504.3.4. Preparation and transportation of the Mixture :-**

#### **501.3 Mixing :-**

Premixed bituminous materials, shall be prepared in a Drum Mix Plant of adequate capacity and bituminous Mix shall be prepared in a Drum Mix plant of adequate capacity and capable of yielding a mix of proper and uniform quality with thoroughly coating aggregates. Appropriate mixing temperatures can be found in 500.5 of these specifications, the difference in temperature between the binder and aggregate should at no time exceed 14°C. In order to ensure uniform quality of the mix and belief writing of aggregates, the Continuous Batch Mix Plant shall be calibrated from time to time.

If a Drum mixing plant is to be used for mixing the bituminous mix, the Contractor Must demonstrate by laboratory analysis that the cold feed combined grading is within the grading limits specified for the bituminous bound material. In the case of a designed job mix. The bitumen and filler content shall be derived using this combined grading. Further details shall be available in the Manual for Construction and Supervision of Bituminous Works.

#### **501.4. Transporting :-**

Bituminous materials shall be transported in clean insulated vehicles, and unless otherwise agreed by the Engineer, shall be covered while in transit or awaiting tipping, Subject to the approval of an Engineer, a thin coating of diesel or lubricating oil may be

applied to the interior of the vehicle to prevent sticking and to facilitate discharge of the material.

#### **504.3.5. Spreading :-**

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

The rate of delivery of material to the paver shall be regulated to enable the paver to operate continuously. The travel rate of as paver, and its method of operations shall be adjusted to ensure an even and uniform flow of bituminous materials across the screed, free from dragging, tearing and segregation of the material. in areas with restricted space where a mechanical paver cannot be used, the material shall be spread, raked and leveled with suitable by hand tools by experienced staff and compacted to the satisfactions of the Engineer.

The minimum thickness of material laid in each paver pass shall be in accordance with the minimum values given in the relevant parts of these specifications. When laying binder course or wearing course approaching an expansion joint of a structure, machine laying shall stop 300mm short of the joint. The remainder of the pavement upto the joint and the corresponding area beyond it, shall be laid by hand, and the joint or joint cavity shall be kept clear of surfacing material.

Bituminous material with temperature greater than 145<sup>0</sup> C shall not be laid or deposited on bridge deck water proofing systems, unless precautions against heat damage have been approved by the Engineer.

Hand placing of pre mixed bituminous materials shall only be permitted in the following circumstances.

- [i] For laying regulating course of irregular shape and varying thickness.
- [ii] In confined spaces where it is impracticable for a paver to operate.
- [iii] For foot Ways.
- [iv] At the approaches to expansion joints at bridge viaducts or other structures.
- [v] For laying mastic asphalt in accordance with clause 515 as below.
- [vi] For filling of path holes.
- [vii] Where directed by the Engineer.

Manual spreading of pre-mixed wearing course material or the addition of such material by hand spreading to the paved area, for adjustment of level shall only be permitted in the following circumstances.

- [1] At the edge of the layers of material and at gullies and manholes.
- [2] At he approaches to expansion joints at bridges, viaducts or other structures.
- [3] As directed by the Engineer.

**Table 500.5 Manufacturing and Rolling Temperatures**

<b>Penetration</b>	<b>Bitumen Mixing [C]</b>	<b>Aggregate Mixing [C]</b>	<b>Mixed Material [C]</b>	<b>Rolling [C]</b>	<b>Laying [C]</b>
35	106-170	160-175	170 Maximum	100 Maximum	130 Maximum
65	150-165	150-170	165 Maximum	90 Maximum	125 Maximum
90	140-160	140-165	155 Maximum	80 Maximum	115 Maximum



#### **~~504.3.6. Rolling :-~~**

~~Compaction shall be carried out in accordance with the provisions of MORTH Clauses 501.6 and 501.7 as below.~~

#### **501.6 Compaction :-**

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

Compaction of bituminous materials shall commence as soon as possible after laying. Compaction shall be substantially completed before the temperature falls below the minimum rolling temperatures stated in the relevant part of these Specifications. Rolling of the longitudinal joints shall be done immediately behind the paving operation.

After this rolling shall commence at the edges and progress towards the center longitudinally except that on super elevated and unidirectional cambered portion, it shall progress from the lower to the upper edge parallel to the center line of the pavement. Rolling shall continue until all roller marks have been removed from the surface. All deficiencies in the surface after laying shall be made good by the attendants behind the paver before initial rolling commences. The initial or breakdown rolling shall be done with 8-10 tonnes dead weight smooth wheeled roller. The immediate rolling shall be done with vibratory roller. The finish rolling shall be done with 6 to 8 tonnes smooth wheeled tandem rollers.

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

Bituminous materials shall be rolled in a longitudinal direction with the driven rolls nearest the paver. The rollers shall first compact material adjacent to joints and then work from the lower to the upper side of the layer, overlapping on successive passes by at least one-third of the width of the rear roller in the case of a pneumatic tyred roller, at least nominal width of 300mm.

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

Roller should move at a speed of not more than 5 K.M. / H. The roller shall not be permitted to stand on pavement which has not been fully compacted and necessary precautions shall be taken to prevent dropping of oil, grease, petrol or other foreign matter on the pavement 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.

#### **501.7. Joints :-**

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

[1] By beating the joints with an approved joint heater when the adjacent width is being laid but without cutting back or coating with binder. The heater shall raise the temperature of the full depth of material to within the specified range of minimum rolling temperature and maximum temperature at any stage for the material for a width not less

than 75mm. The contractor shall have equipment available for use in the event of a heater break down to form joints by method [iii].

[2] By using two or more pavers operating in each lane, where this is practicable, and in sufficient proximity for adjacent widths to be fully compacted by continuous rolling.

[3] By cutting back the exposed joint for a distance equal to the specified layer thickness, to a vertical face discarding all loosened material and coating the vertical face completely with 60/70 penetration grade hot bitumen or cold applied bitumen or polymer modified adhesive bitumen tape with a minimum thickness of 2mm before the adjacent width is laid.

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

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 MORTH clause -903.

#### **Surface Finish and Quality Control :**

The surface finish of the completed construction shall conform to the requirements of Clause-902 of MORTH Specification. All materials and workmanship shall comply with the provisions set out in Section-900 of MORTH Specification.

#### **Arrangements for Traffic :**

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

#### **Measurement for Payment :-**

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

Department will be free to get some loaded dumpers test checked at other weigh 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 pro-rate basis depending upon the area reduced or exceeded respectively.

Weight of mix materials will be done in presence of responsible person, not less than the rank of Supervisor of Department and the measurements shall be recorded by the Deputy Executive Engineer or Assistant Engineer or Additional Assistant Engineer, if so authorized. Record of each dumper will be mentioned separately in bound and numbered register which will be maintained by the Department representatives and signed by the contractor. Proper gate pass system shall be established for the vehicle coming to the plant site and going from the site. The location of K.M. hectometer and meter in which individual dumpers are unloaded shall be recorded carefully.

#### **Rate for premixed bituminous materials :-**

The unit rate for premixed bituminous material shall be payment in full for carrying out the required operation including full compensation for, but not limited to :

1. Making arrangements for traffic to clause-112 except for initial treatment to verge, shoulders and construction of diversions.
2. Preparation of the surface to receive the materials.

3. 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.
4. Mixing transporting, laying and compacting the mix as specified.
5. All labour, tools equipment, plant including installation of hot mix plant, power supply units and all machinery incidental to complete the work to these specification.
6. Carrying out the work in part widths of the road where directed.
7. Carrying out all tests for control of quality, and
8. The rate shall cover the provision of bitumen at the rate specified in the contract.
9. The rate for premixed material are to include for all wastage in cutting of joints etc.
10. 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.
11. The cost of all plant and laying trials as specified to prove the mixing and laying methods is deemed, to be included in the contractor's rates for the materials.

- Item No. 6 Providing & Laying 37.50 mm. thick B.M. with B.T. Aggregate as per MORT&H specification & Bitumen(VG-30) for tack coat @ 2.5Kg./10 Smt. & Bitumin (VG-30) for mixing @ 34.00Kg/M.T. i.e. 3.40 % of total weight of mix including heating the aggregate & asphalt in continuous batching drum mix plant and spreading the same by paver finisher & consolidation with vibratory roller including providing all materials equipments, tools & plants, fire wood, oil, kerosene, labour charges etc. complete using contractor's own machinery drum mix plant & paver finisher etc. complete.**

#### **504.1. Scope**

This work shall consist of construction in a single course having 50mm to 100mm thickness or in multiple courses of 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.

#### **504.2. Materials**

**504.2.1. Bitumen:** The bitumen shall be paving bitumen of Penetration Grade complying with Indian Standard Specifications for "Paving Bitumen" IS:73, and of the penetration indicated in Table 500-4.

**504.2.2. 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.

**504.2.3. 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%
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.

**504.2.4. 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.

**504.2.5. 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.

### 504.3. Construction Operations

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

**TABLE 500-4. 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
19	-	90-100
13.2	35-64	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	3.3-3.5
Bitumen grade	35 to 90	60 to 70

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.

**504.3.2. 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.

**504.3.3. 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.

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

**504.3.5. 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

**504.3.6. 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.

**MORTH SPECIFICATION 501.6. FOR Compaction**

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

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

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

Bituminous materials shall be rolled in a longitudinal direction, with the driven rolls nearest the paver. The roller shall first compact material adjacent to joints and then work from the lower to the upper side of the layer, overlapping on successive passes by at least one-third of the width of the real roll or, in the case of a pneumatic-tyred roller, at least the nominal width of 300mm

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

Rollers should move at a speed of not more than 5 km per hour. The roller shall not be permitted to stand on pavement which has not been fully compacted, and necessary precautions shall be taken to prevent dropping of oil, grease, petrol or other foreign matter on the pavement 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

#### **501.7. Joints**

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

- (i) by beating the joints with an approved joint heater when the adjacent width is being laid, but without cutting back or coating with binder. The heater shall raise the temperature of the full depth of material, to within the specified range of minimum rolling temperature and maximum temperature at any stage for the material, for a width not less than 75 mm. The Contractor shall have equipment available, for use in the event of a heater breakdown, to form joints by method (iii);
- (ii) by using two or more pavers operating in echelon, where this is practicable, and in sufficient proximity for adjacent widths to be fully compacted by continuous rolling;
- (iii) by cutting back the exposed joint, for a distance equal to the specified layer thickness, to a vertical face, discarding all loosened material and coating the vertical face completely with 60/70 penetration grade hot bitumen, or cold-applied bitumen, or polymer modified adhesive bitumen tape with a minimum thickness of 2 mm, before the adjacent width is laid.

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

#### **504.4. 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.

#### **504.5. 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.

#### **504.6. Arrangements for Traffic**

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

#### **504.7. Measurement for Payment**

Bituminous macadam shall be measured as finished work in cubic metres or by weight in metric tonnes, where used as regulating course, or square metres at the specified thickness as indicated in the Contract or shown on the drawings, or as otherwise directed by the Engineer.

#### **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 in Clause 501.8.8.2. (i) to (xi).

**The unit rate for payment of this item shall be per 1-M.T. basis of complete item**

**Item No. 7 Providing & Laying 20 mm. thick Mix Seal Surfacing using stone chipping & Aggregate as per MORT & H specification & Bitumen(VG-30) for tack coat @ 2.5Kg./ 10 Smt Bitumen Grade VG-30 for mixing @ 50.90Kg/M.T. i.e. 5.09 % of total mix including heating the aggregate & asphalt in continuous batching drum mix plant and spreading the same by paver finisher & consolidation with vibratory roller including providing all materials equipments, tools & plants, fire wood, oil, kerosenr, labour charges etc. complete using contractor's own machinery drum mix plant & paver finisher etc. complete.**

**SCOPE :-**

This work shall consist of laying and compacting mix seal surfacing in a 20mm single course composed of suitable aggregates premixed with a bituminous binder on a previously prepared base, in accordance with the requirements of these specifications to serve as a wearing course.

**Materials :-**

**Binder :-**

The binder shall be bitumen of a VG-30 grade as directed by the Engineer-in-Charge and satisfying the requirement of IS : 73,217,454.

**Coarse Aggregate :**

The aggregate shall consist of crushed stone of Black Trap only. They shall be clean, strong, durable, of fairly cubical shape and free from disintegrated pieces, organic or other deleterious matter and adherent coating. The aggregates shall preferably be hydrophobic and of low porosity. If hydrophilic aggregates are to be used the bitumen shall preferably be treated with anti-stripping agents of approved quality in suitable dose as per Appendix-5. The aggregates shall satisfy the physical requirements set forth in Table 500-3.

**TABLE 500-3 PHYSICAL REQUIREMENTS OF AGGREGATES FOR MIX SEAL SURFACE**

Property	Test	Specification
Cleanliness	Grain size analysis	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> Aggregate Impact Value <sup>3</sup>	Max 40% Max 30%
Durability	Soundness <sup>4</sup> Sodium Sulphate Megnesium Sulphate	Max 12% Max 18%
Water Absorption	Water Absorption <sup>5</sup>	Max 2%
Stripping	Coating and stripping of Bitumen Aggregate Mixtures <sup>6</sup>	Maximum retained coating 95%
Water sensitivity <sup>7</sup>	Retained Tensile Strength	Min. 80%

**Aggregate grading and binder content :-** When tested in accordance with IS : 2386 Part-I (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.

\* 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.

#### **Fine Aggregate :-**

The Fine aggregate 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.

#### **Aggregate Gradation :-**

The coarse and fine aggregate shall be so graded or combined as to confirm to the grading set forth in Table 500-10

#### **Aggregate Gradation for Mix Seal Surfacing :-**

IS Sieve Designation	Cumulative Percent by weight of total passing the sieve
13.2mm	--
11.20mm	100%
5.60mm	52-88%
2.80mm	14-38%
90 Micron	0-5%

#### **Proportioning of Materials :-**

The total quantity of the aggregates used for mix seal surfacing shall be used to achieve required 20mm compacted thickness.

The quantity of binder used for premixing in terms of straight run bitumen shall be 5.09% by weight of the total mix i.e. 50.90 Kgs. per Tonne of Mix.

Before starting the work, the contractor shall get the job mix formula for the mix, approved by the Engineer-in-Charge.

#### **Construction Operations :-**

##### **Weather and Seasonal Limitation :-**

Mix Seal Surfacing shall not be laid during rainy season or when the base course is damp or wet.

##### **Preparation of base :-**

The base on which mix seal surfacing is to be laid shall be prepared shaped and conditioned of the specified lines; grade and cross sections in accordance with M.O.S.T. Specification, as directed by the Engineer-in-Charge. The surface shall be thoroughly swept and scrubbed, dean and free of dust and foreign matter.

##### **Tack Coat :-**

This work shall consist of the applicant of a single coat of bitumen VG-30 Grade to an existing bituminous road surface preparatory to the superimposition of a bituminous mix, when specified in the contract or instructed by the engineer.

##### **Preparation and transportation of Mix :**

Mix Seal Surfacing mix shall be prepared in a drum mix plant of adequate capacity and capable to yield a mix of proper and uniform quality with thoroughly coated aggregate. The Plant shall be Drum Mix type. The Plant shall have co-ordinated set of essential units capable of production uniform mix within the job mix formula such a as laid down in appendix – A.

- (a) In case of drum mix plant, the cold feed system shall have variable speed belt conveyors/ or other suitable devices for regulating the accurate proportioning of

aggregate to an even flood flow automatically from a Control Operation Control Cabin.

**(b) Bitumen Control Unit :**

Capable measuring metering and spraying required quantity of bitumen at specified temperature with automatic synchronization of bitumen and aggregate feed.

**(c) Filler System :**

A fine 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 capacity with self heating arrangement and temperature control device. The boiler should be fitted with temperature indicating instruments.**

The temperature of binder at the time of mixing shall be in the range of 160-177 C. and of aggregates in the range of 155-163 C provided also that at no time shall be the difference in temperature between the aggregates and the binder exceed 14 C.

Mixing shall be thorough 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 mix plant to the point of use in suitable vehicles. The vehicles employed for transport, shall be clean and covered over the transit if so directed by the Engineer-in-Charge.

**SPREADING :**

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

Longitudinal joints and edge shall be constructed true to the delineating lines parallel to the centre line of the road. Longitudinal joints shall be off-set by the least 150mm from those in the binder course. All joints shall be cut vertical to the full thickness of the previously laid mix and the surface painted with not bitumen before placing fresh materials.

**ROLLING :**

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

The roller wheels shall be kept damp to prevent the mix from 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 on super, elevated portions, it shall progress from the lower to upper edge parallel to the fresh material with rear or mixed wheel loading 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.

**Opening to Traffic :-**

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

**Surfacing Finish & Quality Control for Work :-**

The surface finish of construction shall conform to the requirement of MORT&H Specification table 900-1. Control on the quality of material and works shall be exercised by the Engineer-in-Charge in accordance with MORT&H Specification.

**Surface Levels :**

The levels of the subgrade and different pavement courses as constructed, shall not vary from those calculated with reference to the longitudinal and cross-profile of the road shown on the drawings or as directed by the engineer beyond the tolerances mentioned in Table 900-1.

**TABLE 900-1. TOLERANCES IN SURFACE LEVELS**

1	Subgrade	+ 20mm - 25mm
2	Sub-base + 10mm (a) Flexible Pavement (b) Concrete Pavement (Dry lean concrete or Rolled concrete)	-20mm + 6mm -10mm
3	Base – Course for flexible pavement (a) Bituminous Course  (b) Other than bituminous (i) Machine laid (ii) Manually laid	+ 6 mm - 6 mm + 10mm - 10mm +15mm -15mm
4	Wearing Course for flexible pavement (a) Machine laid  (b) Manually laid	+ 6mm - 6mm +10mm -10mm
5	Cement Concrete pavement	+ 5mm -6mm*

**Arrangement for Traffic :**

The provision of MOST specification shall apply as regards that flow of traffic during construction.

**Passage of Traffic along a part of the Existing Carriageway under Improvement :**

For widening / strengthening existing carriageway where part width of the existing carriageway is proposed to be used for passage of traffic, treated shoulders shall be provided on the side on which work is not in progress. The treatment to the shoulder shall consist of providing at least 150mm thick granular base course covered with bituminous surface dressing in a width of at least 1.5m. and the surface shall be maintained throughout the period during which traffic uses the same to the satisfaction of the Engineer. The continuous length in which such work shall be carried out, would be limited normally to 500m. at a place. However, where work is allowed by the Engineer in longer stretches passing places at least 20m. long with additional paved width of 2.5m. shall be provided at every 0.5 Km. interval.

In case of widening existing two lane to four lane, the additional two lanes would be constructed first and the traffic diverted to it and only thereafter the required treatment to the existing carriageway would be carried out. However, in case where on the request of the contractor, work on existing two-lane carriageway is allowed by the Engineer with traffic using part of the existing carriageway, stipulations as in para above shall apply.

After obtaining permission of the Engineer, the treated shoulder shall be dismantled, the debris disposed of the area cleared as per the direction of the Engineer.

**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 weight 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 periodically got calibrated, verified and satisfied 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, the reduction in or addition to payment shall have to be considered respectively.

Weight of mix materials will be done in presence of responsible person, not less than the rank of supervisor of department and the measurement shall be recorded by the Deputy Executive Engineer or Assistant Engineer or Addl. Asstt. Engineer. If so authorized, Record of each dumper will be maintained separately in bound and numbered register, which will be maintained by the departmental representative 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.

**RATE :-**

The contract unit rate for mix seal surfacing shall be paid in full for carrying out the required operations including full compensation for all components.

- (i) Making arrangements for traffic as per above details except for initial treatment to verge, shoulders and construction of diversion.
- (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 leads and lift.
- (iv) All labour, tools, equipment, plant including installation of Drum mix plant, power supply units and all machineries, incidental to complete the work to the specifications.
- (v) Carrying out the work in part width of the road where directed.
- (vi) Carrying out all tests for control of quality.

**Item No. 8 Providing and Laying Asphalt painting on B.T. surface with Bitumen VG-10 graded at rate 5.00 kg /10 SqM by mechanical sprayer in uniform layer and spreading the stone dust on prepared surface at the rate of 0.03 Cum / 10 Sqm and rolling with smooth wheel pneumatic roller.**

**1.0. Materials**

1.1. The road marking paint shall conform to 1. S. 164 1951.

**2.0. Workmanship**

2.1. The letters and figures shall be to the heights and widths as per approved drawings or as directed. These shall be stenciled or drawn in pencil and got approved before painting. They shall be of uniform size and finished neatly. The edges shall be straight or in pleasant Smooth curves.

**3.0. Mode of measurements & payment**

3.1 Letters, figures and similar items etc. stops, commas, hyphens and the like shall, be deemed to be included in the item.

3.2. The rate per cm. height of letter shall hold good irrespective of width of the letters of figures or the thickness of the lettering.

3.3. The rate shall be for a unit, of one sq. metre.

**Item No. 9 Supplying the Bituminous Ready Cold Mix Material with transported to site, Spreading, Ramming/Rolling etc. complete as per MoRTH specification**

**Specification for Ready-to-Use Cold Mix Pothole Repair Material**

This specification covers ready-to-use cold bituminous mix used for direct pothole repairs without heating, generally supplied in bags/drums and suitable for wet and dry conditions.

**Relevant MoRTH Provisions**

MoRTH Clause 3004 – Pothole and patch repairs

MoRTH Clause 518 – Cold Mix using Bitumen Emulsion

IRC:SP:100-2014 – Cold Mix Technology

IRC:82 – Maintenance of Bituminous Roads

IRC:16 – Surface Treatment

**Scope**

Providing and filling potholes using ready-to-use cold bituminous mix consisting of graded aggregates, mineral filler and specially formulated bituminous binder/additives suitable for direct application under wet or dry conditions without heating.

**Material Requirements – Aggregates**

Aggregates shall conform to MoRTH Section 500 and IS:2386.

Los Angeles Abrasion Value: Maximum 40%

Combined Flakiness & Elongation Index: Maximum 35%

Water Absorption: Maximum 2%

Stripping Value: Minimum 95% coating retained

**Material Requirements – Binder**

Modified Bitumen / Polymer Modified Binder / Bitumen Emulsion with additives.

Bitumen shall conform to IS:73.

Bitumen Emulsion shall conform to IS:8887.

PMB/CRMB shall conform to IRC:SP:53.

**Typical Gradation**

13.2 mm sieve – 100% passing

9.5 mm sieve – 80–100% passing

4.75 mm sieve – 40–70% passing

2.36 mm sieve – 20–45% passing

75 micron sieve – 2–8% passing

### **Performance Requirements**

Mix shall be free flowing and workable.

Good adhesion on wet and dry surfaces.

Storage life minimum 3–6 months.

No stripping under rainfall conditions.

Road may be opened immediately after compaction.

### **Construction Methodology**

Clean pothole and remove loose debris.

Remove standing water if excessive.

Pour cold mix directly into pothole.

Slightly overfill and compact using hand rammer/plate compactor/roller.

Open to traffic immediately after compaction.

### **Relevant IS / IRC Codes**

IS:73 – Paving Bitumen

IS:8887 – Bitumen Emulsion

IS:2386 – Aggregate Testing

IS:6241 – Stripping Test

IRC:SP:100 – Cold Mix Technology

IRC:82 – Maintenance of Bituminous Roads

### **Draft Specification Item**

“Providing and laying ready-to-use cold bituminous pothole repair mix composed of graded aggregates and specially modified bituminous binder, suitable for direct application in wet and dry conditions without heating, including cleaning pothole, filling, compacting and finishing complete as per MoRTH Clause 3004 & 518, IRC:SP:100 and direction of Engineer-in-Charge.”

### **Additional Technical Conditions**

Material shall remain workable for minimum 90 days.

No heating or mixing at site shall be permitted.

Material shall be packed in moisture-proof bags.

Contractor shall submit JMF, test reports and shelf life certificate.

Trial patch may be conducted before approval.

**Deputy Executive Engineer**  
**R & B Sub Division**  
**Halvad**

**Deputy Executive Engineer**  
**R & B Sub Division**  
**Morbi**

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