


GOVERNMENT OF GUJARAT

ROAD & BUILDING DEPARTMENT

DETAILED ITEM WISE TECHNICAL SPECIFICATION

Name of Work - *Work of Widening, Strengthening and Resurfacing of various road as and when required or in emergency under R&B Division, Vav-Tharad, Dist.-Vav-Tharad(Annual Rate Basis)*


Deputy Executive Engineer
R & B Sub Division
Tharad


Executive Engineer
District R & B Division
Vav-Tharad

Work of Widening, Strengthening and Resurfacing of various road as and when required or in emergency under R&B Division, Vav-Tharad, Dist.-Vav-Tharad(Annual Rate Basis)

GENERAL TECHNICAL SPECIFICATIONS

1. General :-

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

(i)	Length and breadth	10 mm
(ii)	height, depth or thickness of earthwork, sub-base. bases, surfacing and structural members	05 mm
(iii)	areas	0.01 Sq.Mtrs.
(iv)	cubic contents	0.01 Cubic Mtr.

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

2. Measurements of lead for materials.

Where lead is specified in the contract, the same shall be deemed to mean as described hereunder.

Lead shall be determined on the shortest practicable route and the one actually taken and decision of the engineer -in charge in this regard shall be taken as final. Distances up to and including 100 metres shall be measured in units of 50 metres. exceeding 100 metres but exceeding 1km. in units of 100 metres, and exceeding 1km.in units of 500 metres. The half and greater than half of the units shall be reckoned as one and less than half of the units ignored. in this regard, the source of the materials shall be divided into suitable blocks and for each block and for each block the distance from the centre of the block to the centre of placing pertaining to that block shall be taken as the lead distance.

3. Surface Regularity of sub grade & pavement Courses :-

The surface regularity of completed wearing surface in the longitudinal and transverse directions shall be within the tolerances in Table below. The longitudinal profile shall be checked with a 3 metre long straight edge, at the middle of each traffic lane along a line paralleled to the centre of the road. The transverse profile shall be checked with a set of three camber boards at intervals of ten (10) metres.

PERMITTED TOLERANCES OF SURFACE REGULARITY FOR PAVEMENT COURSES

Sr No	Type of Construction	Longitudinal Profile with 3 metre straightedge					Cross Profile
		Maximum Permissible undulation mm	Maximum number of undulation permitted in any 300m. length exceeding in mm.				Maximum permissible variation from specified profile camber template—mm
			18	12	10	6	
1	2	3	4	5	6	7	8
1	Earth Sub grade	36	30	-	-	-	15
2	Granular/lime / Cement Stabilised Sub-base.	23	-	30	-	-	12
3	Water Bound Macadam with nominal size metal (20-50) mm	18	-	-	30	-	8
4	Semi-Dense Carpet @	15	-	-	-	20	6

Note.

1. These are for machine laid surface. If laid manually, tolerance up to 50 percent above these values in this column may be permitted. However this relaxation does not apply to the value of maximum undulation for longitudinal and cross profiles mentioned in columns 3 and 8 the table.

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

3 Rectification :Where the surface irregularity fall outside the specified tolerances, the contractor shall be liable to rectify in the manner described below and to the satisfaction of the Engineer-in-charge at his own cost.

(i) **Subgrade** : Where the surface is high, it shall be trimmed and suitably compacted. Where the same is low. The deficiency be corrected by adding fresh materials. The degree of compacted and the type of materials to be used shall conform to the specified requirement.

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

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

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

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

(v) **Bituminous Constructions** : For bituminous constructions, for wearing course, where the surface is high or low, the full depth of the layer shall be removed and replaced with fresh materials and compacted to specification. In all cases where the removal and replacement of a bituminous layer is involved, the area treated shall be less than 5 metres long and less than 1 lane wide.

4. Quality control tests during Construction :

The materials supplied and the works carried out by the contractor shall conform to the enclosed relevant specification. For ensuring the requisite quality of construction, the materials and works shall be subjected to quality control tests, as described here in after, by the Engineer- in charge. Test procedures for the various quality control tests are indicated in the respective sections mentioned, the test shall be carried out as per the prevalent accepted Engineering practice to the directed of the Engineer-in-charges.

5. Test on Earthwork for Embankment Construction.

5.1 Borrow Material :

- (a) Sand Content (IS : 2720 Part IV)
Two test per 8000 Cubic Metres of soil.
- (b) Plasticity test (IS : 2720 Part V)
Each type to be tested, Two test per 8000 Cubic Metres of soil.

- (c) Density test (IS : 2720 Part VII)
Each soil type to be tested. Two test per 8000 Cubic Metres of soil.
- (d) Moisture Content test (IS 2720 Part - II)
One test for every 250 Cubic metres of soil.

5.2 Compaction Control :

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

5. Following materials shall conform to the Indian Standards shown "Against Them"

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

7. Barrel thickness of pipes of different class shall be as under :

Sr. No.	Internal Diametre of pipe in mm	Barrel thickness (in mm)		
		NP1	NP2	NP3
1	80	25	25	-
2	100	25	25	-
3	150	25	25	-
4	250	25	25	-
5	300	30	30	-
6	250	32	32	75
7	400	32	32	75
8	450	35	35	75
9	500	-	35	75
10	600	-	40	80
11	700	-	40	80
12	800	-	45	90
13	900	-	50	100
14	1000	-	55	110
15	1100	-	60	115
16	1200	-	65	115

Item No 1	Providing Milling with Cold Milling machine of existing Bituminous surface up to any depth including stacking useful materials with Rolling & Watering on Road side and disposing off remaining stuff any lead as per instruction of engineer in charge.
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Technical Specification for Cold Milling of Existing Bituminous Surface

Item:

Providing milling with Cold Milling Machine of existing bituminous surface up to any depth including stacking useful materials with rolling and watering on roadside and disposing off remaining unserviceable material with all leads and lifts as per instruction of Engineer-in-Charge.

Technical Specification

The work shall consist of milling/removal of existing bituminous layers from road surface using self-propelled Cold Milling Machine of approved make and capacity to the required depth, width, grade, and profile as directed by the Engineer-in-Charge.

Scope of Work

The contractor shall carry out:

- Milling/removal of existing bituminous surface up to required depth.
- Maintaining specified line, level, camber, and profile during milling operation.
- Collection and stacking of reusable milled material (RAP) along roadside or at designated locations.
- Rolling and watering of milled surface wherever instructed.
- Loading, transportation, and disposal of unserviceable materials/debris at approved dumping locations with all leads and lifts.
- Providing barricading, traffic control, safety signs, and necessary precautions during execution.

Method of Execution

1. The existing road surface shall be surveyed jointly before commencement of work to determine milling depth and limits.
2. Milling shall be carried out using a self-propelled Cold Milling Machine equipped with automatic grade and slope control arrangement capable of producing uniform texture and profile.
3. Milling operation shall be executed carefully to avoid damage to underlying pavement layers, structures, utilities, manholes, kerbs, and adjoining surfaces.
4. The milled material suitable for reuse shall be collected, stacked, and protected as directed by the Engineer-in-Charge.
5. Unserviceable materials shall be removed from site and disposed off at approved locations.
6. After milling, the surface shall be cleaned properly using mechanical brooming/air compressor and, where instructed, compacted by rolling and watering to maintain trafficability.
7. Necessary traffic diversion, caution boards, reflective barricades, lighting arrangements, and safety measures shall be provided during the entire operation.

Measurement

The work shall be measured in Square Metres (Sqm.) for specified depth of milling or as otherwise specified in BOQ.

Rate Includes

The rate shall include:

- Deployment of cold milling machine, operators, fuel, and machinery.
 - Cutting, milling, and removal of bituminous layers.
 - Loading, unloading, stacking, rolling, watering, and cleaning.
 - Transportation and disposal of unserviceable materials.
 - All labour, tools, plants, consumables, safety arrangements, barricading, and incidental charges complete.
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Relevant Specifications

The work shall be carried out in accordance with:

- Ministry of Road Transport & Highways (MoRTH) Specifications.
- IRC Guidelines and relevant clauses.
- Instructions of Engineer-in-Charge.

- Item No 2** Providing and laying 50 mm thick Bituminous Macadam (BM) with B.T. aggregate as per M.O.R.T. & H. specification and using emulsion RS-1 as per IS 8887: for tack coat @ 2.50 KG. / 10 Sq.m. with mechanical sprayer and Bulk asphalt VG-30 for mixing @ 34.00 KG. / M.T. i.e. 3.40 % of total weight of mix including heating and mixing the aggregate and asphalt in continuous of drum mix plant and hot laid process spreading the same by paver finisher and consolidation with roller as per M.O.R.T. & H specification to achieve desired density, including providing all materials equipments, tools and plants, fire wood, oil, kerosene, labour charges etc. complete using contractor's own machinery drum mix plant and paver finisher etc. complete..

504.1. 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.

504.2. Materials

504.2.1. Bitumen: The bitumen shall be paving bitumen of suitable viscosity grade VG-30 as per IS: 73. The actual grade of bitumen to be used shall be decided by the Engineer appropriate to the region, traffic, rainfall and other environmental conditions. Guidelines on selection of the grade of bitumen are given in Appendix - 4.

Viscosity Grade (VG) Bitumen Specification as per IS 73 : 2013

Characteristics	VG-10	VG-20	VG-30	VG-40
Absolute Viscosity 60°C, poises, min	800	1600	2400	3200
Kinematic Viscosity 135°C CSI, min	250	300	350	400
Flashpoint, C, min	220	220	220	220
Solubility in trichloroethylene, %min	99.0	99.0	99.0	99.0
Penetration at 25°C	80-100	60-80	50-70	40-60
Softening point, C min	40	45	47	50
Test on residue from thin film oven test / RTFOT				
(A) Viscosity ratio at 60°C, max	4.0	4.0	4.0	4.0
(B) Ductility at 25°C, cm, min after thin film oven test	75	50	40	25

504.2.2. Aggregates

504.2.2.1. The aggregates shall consist of crushed stone, crushed gravel/single or other stones. They shall be clean, strong, durable of fairly cubical shape and free from disintegrated pieces, organic or other deleterious matter and adherent coating. If crushed shingle/gravel is used, not less than 90 percent by weight of the gravel/shingle pieces retained on 4.75 mm sieve shall have at least two fractured faces. 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
BITUMINOUS MACADAM

Sr. No.	Test	Test Method	Requirement
1	Loas Angles Abrasion Value	IS-2386 Part-4	40 Percent Maximum
2	Aggregates Impact Value*	IS-2386 Part-4	30 Percent Maximum
3	Flakiness and Elongation ** Indices (Total) Coating and AASHOTOT-182	IS-2386 Part-I	30 Percent Maximum Minimum retained coating 95 percent.
4	Stripping of bitumen aggregate mixture soundness	IS-2386 Part-5	12 Percent Maximum
5	i) Loss with sodium sulphate 5-cycles ii) Loss with magnesium sulphate 5-cycles.		18 Percent Maximum
6	Water absorption	IS-2386 Part-3	2- Percent Maximum

*Aggregates may satisfy requirements for either of the two tests.

Note : If crushed slag is used, Clause 404.2.3 shall apply.

504.2.2. The aggregate for bituminous macadam shall conform to one of the two grading in Table 500-4, depending on the compacted thickness; the actual grading shall be as specified in the Contract.

504.2.3. Proportioning of materials: The bitumen content for premixing shall be 3.4 percent by weight of the total mix except when otherwise directed by the Engineer.

TABLE 500 - 4
COMPOSITION OF BITUMINOUS MACADAM

Mix designation Nominal aggregate size layer thickness	Grading1 40 mm 80-100 mm	Grading2 19 mm 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	35-61	56-88
4.75	13-22	16-36
2.36	4-19	4-19
0.3	2-10	2-10
0.075	0-8	0-8
Bitumen content, % by weight	3.1-3.4	3.40%
Bitumen grade	35to90	VG-30

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.

The maximum compacted thickness of a layer shall be 50 mm.

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

504.2.4. Variation in proportioning of material: The Contractor shall have the responsibility for ensuring proper proportioning of materials and producing a uniform mix. A variation in binder content ± 0.3 per cent by weight of total mix shall, however, be permissible for individual specimens taken for quality control tests vide Section 900.

504.3. Construction Operations

504.3.1. Weather and seasonal limitations: The work of laying shall not be taken up during rainy or foggy weather or when the base course is damp or wet, or during dust storm or when the atmospheric temperature in shade is 100C or less.

504.3.2. Preparation and transport of mix: Bituminous macadam 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 coated aggregates.

Drum mix plant shall be of suitable capacity preferably of drum mix type. Total system for crushing of stone aggregates and feeding of aggregate fractions in required proportions to achieve the desired mix, deployed by the Contractor must be capable of meeting the overall specification requirements under stringent quality control. The plant shall have the following essential features:

A - General

- (a) The plant shall have coordinated set of essential units capable of producing uniform mix as per the job mix formula.
- (b) Cold aggregate feed system with minimum 4 bins having belt conveyor arrangement for initial proportioning of aggregates from each bin in the required quantities.
In order to have free flow of fines from the bin, it is advisable to have vibrator fitted on bin to intermittently shake it.
- (c) Belt conveyers below each bin should have variable speed drive motors. There should be electronic load sensor on the main conveyor for measuring the flow of aggregates.
- (d) Dryer unit with burner capable of heating the aggregate to the required temperature without any visible unburnt fuel or carbon residue on the aggregate and reducing the moisture content of the aggregate to the specified minimum.
- (e) The plant shall be fitted with suitable type of thermometric instruments at appropriate places so as to indicate or record/register the temperature of heated aggregate, bitumen and mix.

- (f) Bitumen supply unit capable of heating, measuring/metering and spraying of bitumen at specified temperature with automatic synchronisation of bitumen and aggregate feed in the required proportion.
- (g) A filler system suitable to receive bagged or bulk supply of filler material and its incorporation to the mix in the correct quantity wherever required.
- (h) A suitable built-in dust control system for the dryer to contain/recycle permissible fines into the mix. It should be capable of preventing the exhaust of fine dust into atmosphere for environmental control wherever so specified by the Engineer.
- (i) The plant should have centralised control panel/cabin capable of presetting, controlling / synchronizing all operations starting from feeding of cold aggregates to the discharge of the drum mix to ensure proper quality of mix. It should have indicators for any malfunctioning in the operation.

Every drum mix plant should be equipped with siren or horn so that the operator may use the same before starting the plant every time in the interest of safety of staff.

B - For Batch Type Plant

- (i) Gradation control unit having minimum four deck vibratory screens for accurate sizing of hot aggregate and storing them in separate bins. This unit should be fully covered to reduce the maintenance cost and for better environmental condition.
- (ii) Proper arrangement for accurate weighing of each size of hot aggregate from the control panel before mixing.
- (iii) Paddle mixer unit shall be capable of producing a homogeneous mix with uniform coating of all particles of the mineral aggregate with binder.

C - For Continuous Type Plant

- (i) Gradation control unit having vibratory screens for accurate sizing of hot aggregate and storing them in separate bins. This unit should be fully covered to reduce the maintenance cost and for better environmental condition.
- (ii) There should be appropriate arrangement for regulating and volumetric control of the flow of hot aggregate, from each bin to achieve the required proportioning.
- (iii) Paddle mixer unit shall be capable of producing a homogeneous mix with uniform coating of all particles of the mineral aggregate with binder.

D - For Drum Mix Plant

- (i) It is a prerequisite that only properly screened and graded materials are fed to the bins. If required, a vibratory screening unit shall be installed at the plant site to ensure the same.

A primary 4-deck vibratory screening unit shall be installed before the multiple bin cold feed system for screening the aggregates and grading the same.

- (ii) Belt conveyers below each bin should have variable speed drive motors. There should be electronic load sensor on the main conveyer for measuring the flow of aggregate.
- (iii) There should be arrangement to measure moisture content of the aggregate(s) so that moisture correction may be applied for working out requirements of binder and filler.

The temperature of binder at the time of mixing shall be in the range of 1500C -to 1630 C and that of the aggregate in the range of 1550C - 1630C provided that the difference in temperature between the binder and aggregate at no time exceeds 140C.

Mixing shall be thorough to ensure that a homogeneous mixture is obtained in which all particles of the aggregates are coated uniformly, and the discharge temperature of mix shall be between 1300C to 1600C.

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

> 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.

> MATERIALS :

For scarifying and re-laying the granular surface : The materials used shall be coarse aggregates salvaged from scarification of the existing granular base course supplemented by fresh coarse aggregates and screenings so that aggregates and screening thus supplemented correspond to Clause 404.

For patching potholes and sealing cracks : Where the existing surface to be overlaid is bituminous, any existing potholes and cracks shall be repaired and sealed in accordance with Clauses 3004.2 and 3004.3 or as directed by the Engineer.

For Profile Corrective Course : A profile corrective course for correcting the existing pavement profile shall be laid to varying thickness as shown on the Drawings, or as indicated in the Contract Documents. The profile corrective course shall be laid to tolerances and densities as specified for wearing course if a single layer, or base course, if it is to be covered with a wearing course layer.

Profile corrective course and its application : The type of material for use as a profile corrective course shall be as shown on the drawing or as directed by the Engineer. Where it is to be laid as part of the

overlay/strengthening course, the profile corrective course material shall be of the same specification as that of the overlay/strengthening course. However, if provided as a separate layer, it may be of the same specification and details given in the contract drawings.

Surface Levels :

The levels of the sub grade 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.	Sub-Grade	+ 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	+6mm -6mm +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

> TACK COAT :

Scope :

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

> Materials :

The binder used for tack coat at the rate of 2.5 kg/10 sq.m. shall be bitumen emulsion complying with IS:8887 of a type and grade as specified in the Section 500.

Contract or as directed by the Engineer. The use of cut back bitumen as per IS:217 shall be restricted only for sites at sub-zero temperatures or for emergency applications as directed by the Engineer.

> Weather and Seasonal Limitations :

Bituminous 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 10oC. Where the tack coat consists of emulsion, the surface shall be slightly damp, but not wet. Where the tack coat is of cut back bitumen, the surface shall be dry.

> CONSTRUCTION :

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

Preparation of base : The surface on which the tack coat is to be applied shall be clean and free from dust, dirt, and any extraneous material, and be otherwise prepared in accordance with the requirements of Clauses 501 and 902 as appropriate. Immediately before the application of the tack coat, the surface shall be swept clean with a mechanical broom, and high pressure air jet, or by other means as directed by the Engineer.

Application of tack coat : The application of tack coat shall be at the rate of 2.5 kg/10 sq.m. and shall be applied uniformly.

> RATE OF APPLICATION OF TACK COAT :

The emulsion asphalt IS 8887 at the rate of 2.5 kg per 10 sq.m. shall be used for tack coat temperature for a bituminous emulsion shall be 20oC to 70oC and for a cutback, 50oC to 80oC IF RC-70/MC-70 IS used. Where geosynthetic IS proposed for use, the provisions of Clauses 703.3.2, and 703.4.4 shall apply. The method of application of the tack coat will depend on the type of equipment to be used, size of nozzles, pressure at the spray bar, and speed of forward movement. The Contractor shall demonstrate at a spraying trial, that the equipment and method to be used is capable of producing a uniform spray, within the tolerances specified.

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

> Curing of tack coat : The tack coat shall be left to cure until all the volatiles have evaporated before any subsequent construction is started. No plant or vehicles shall be allowed on the tack coat other than those essential for the construction.

> Quality Control Work :

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

> Specifications : The rate shall cover the provision of tack coat at 0.25 kg per square meter with the provision that the variation in actual quantity of bitumen used will be assessed and the payment adjusted accordingly.

> Preparation and transport of mix :

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

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

- (a) In case of drum mix plant, the cold feed system shall have variable speed conveyors/ or other suitable devices for regulating the accurate proportion of aggregate in to an even flood flow automatically from a control operation/Control Cabin.
- (b) Bitumen Control Unit :
Capable of measuring/metering and spraying required quantity of bitumen at specified temperature with automatic synchronization of bitumen and aggregate feed.
- (c) Filler System : A fines feeder system suitable to receive bagged or bulk supply of filler materials and its incorporation to the mix in the correct quantity shall be necessary auxiliary.
- (d) Dust Control : A suitable built in Dust Control Equipment for the dryer to contain the exhaust of fine dust in the 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 range of 150 Degree C to 163 degree and that of the aggregate in the range of 155 degree C - 163 degree C provided that the difference in temperature between the binder and aggregate at no time exceeds 14 Degree C. Rate of asphalt of VG-30 grade in mixing is 3.40% per 1 MT of total mix i.e. 34 kg per 1 MT of total mix.

Mixing shall be thorough to ensure that a homogeneous mixture is obtained in which all particles of the aggregates are coated uniformly and the discharge temperature of mix shall be between 130 Degree C to 160 degree C.

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

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

- (a) Loading hoppers and suitable distributing mechanism.

- (b) All drives having hydrostatic drive/control.
- (c) The machine shall have a hydraulically extendable screed the appropriate width requirement.
- (d) The screed shall have tamping and vibrating arrangement for initial compaction to the layer as it is spread without rutting of otherwise marring the surface. It shall have adjustable amplitude and variable frequency.
- (e) The paver shall be equipped with necessary control mechanism so as to ensure that the finished surface is free from surface blemishes.
- (f) The paver shall be fitted with an electronic sensing device for automatic levelling and profile control within the specified tolerances.
- (g) The screed shall have the internal heating arrangement.
- (h) The paver shall be capable of laying either 2.5 to 4.0 m width or 4.0 to 7.0 m width as stipulated in the Contract.
- (i) The paver shall be so designed as to eliminate skidding/slippage of the tyres during operation. However, in restricted locations and in narrow widths where the available plant cannot be operated in the opinion of the Engineer, he may permit manual laying of the mix.

The temperature of the mix at the time of laying shall be in the range of 123 degree C to 160 degree C. In multi-layer construction, the longitudinal joint in one layer shall offset that in the layer below by about 150 mm. However, the joint in the top-most layer shall be at the lane line of the pavement. Longitudinal joints and edges shall be constructed true to the delineating line parallel to the centre line of the road. All joints shall be cut vertical to the full thickness of the previously laid mix and the surface painted with hot bitumen before placing fresh material. Longitudinal and transverse joints shall be offset by at least 250 mm from those in the lower courses and the joint on the top-most layer shall not be allowed to fall within the wheel path. All transverse joints shall be cut vertically to the full thickness of the previously laid mix with asphalt cutter/pavement breaker and surface painted with hot bitumen before placing fresh material. Longitudinal joints shall be preferably hot joints. Cold longitudinal joints shall be properly heated with joint heater to attain a suitable temperature of about 80oC before laying of adjacent material.

> Compaction : After the spreading of mix, rolling shall be done by 80 to 100 kN vibratory roller. Rolling shall start as soon as possible after the material has been spread deploying a set of rollers as the rolling is to be completed in limited time frame. The roller shall move at a speed not more than 5 km/h. Rolling shall be done with care to avoid unduly roughening of the pavement surface.

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

The initial or break-down rolling shall be done with 80-100 kN static weight smooth wheel roller (3 wheels or tandem) as soon as it is possible to roll the mix without cracking the surface or having the mix pick up on the roller wheels. The second or intermediate rolling shall follow the break-down rolling with vibratory roller of 80 to 100 kN static weight or pneumatic tyred roller of 150 to 250 kN weight, with minimum 7 wheels and minimum tyre pressure of 0.7 MPa as closely as possible to the paver and be done while the paving mix is still at a temperature that will result in maximum density. The final rolling shall be done while material is still workable enough for removal of roller marks with 60 - 80 kN tandem roller. During the final rolling, vibratory system shall be switched off. The joints and edges shall be rolled with a 80 to 100 kN static roller.

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

Rolling operations shall be completed in every respect before the temperature of the mix falls below 100°C.

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

> 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 heating 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 specify 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 equipments available, for in the event of heater break down, to form joints by method.
- (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 material and coating the vertical face completely with VG-30 viscosity 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.

> Surface Finish and Quality Control of Work :

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

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

> Arrangement for Traffic :

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

> 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 150 mm thick granular base course covered with bituminous surface dressing in a width of at least 1.5 m 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 500 m at a place. However, where work is allowed by the Engineer in longer stretches passing places at least 20 m long with additional paved width of 2.5 m 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 and the area cleared as per the direction of the Engineer.

> MEASUREMENTS FOR PAYMENT :

The payment shall be made on the metric tonnage (MT) basis of the weight of mix of aggregates and bitumen. For this purpose, the contractor shall have to install a weight bridge of suitable capacity for the purpose of weighment of dumpers at suitable place at his cost as directed. Weight of empty and weight of loaded dumper will be recorded in bound and numbered register on plant site. Department will be free to get some loaded dumpers test checked at other weight bridge. Weigh bridge will be periodically got calibrated and verified from weight and measure authorities.

> RATE

The contract unit rate for the work shall be payment in full for carrying out the required operations including full compensation for:

- (i) Making arrangements for traffic to Clause 112 except for initial treatment to verge, shoulders and construction of diversions;
- (ii) Preparation of base except for laying of profile corrective course but including filling of potholes;
- (iii) Providing all materials to be incorporated in the work including arrangement for stockyards, all royalties, fees, rents where necessary and all leads and lifts; specification for emergency road works
- (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 pan widths of the road where directed,
- (vi) Carrying out all tests for control of quality and
- (vii) The rate shall cover the provision of bitumen at 3.40 percent of weight of total mix, with the provision that the variation of quantity of bitumen will be assessed and the payment adjusted as per the rate of bitumen quoted.

Item No 3 Providing and laying 50.00 mm thick Dense Bituminous macadam (D.B.M) in Single Layers with B.T. aggregate as per M.O.R.T. & H. specification and Bulk asphalt VG-30 for mixing @ 45.00 KG. / M.T.
i.e. 4.5 % of total weight of mix of asphalt weight including heating and mixing the aggregate and asphalt in continuous of drum mix plant and hot laid process spreading the same by paver finisher and consolidation with roller as per M.O.R.T. & H specification to achieve desired density, including providing all materials equipments, tools and plants, fire wood, oil, kerosene, labour charges etc. complete using contractor's own machinery drum mix plant and paver finisher etc. complete.

505 DENSE BITUMINOUS MACADAM

505.1 Scope