

**SPECIFICATIONS FOR MIX SEAL
SURFACING (MSS)
CLOSE-GRADED PREMIX SURFACING (CGPS)**



**INDIAN ROADS CONGRESS
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SPECIFICATIONS FOR MIX SEAL SURFACING (MSS) CLOSE-GRADED PREMIX SURFACING (CGPS)

1. INTRODUCTION

1.1 The Flexible Pavement Committee of the Indian Roads Congress in its meeting held on 1st August, 2003 decided to prepare a draft on recommended practice of Mix Seal Surfacing under the title "Development of New Documents, Priority and Programmes." A Sub-group consisting of S/Shri R.S. Shukla and S.K. Nirmal was constituted for preparing the document. Accordingly S/Shri R.S. Shukla and S.K. Nirmal prepared the draft for the consideration of the Committee. This draft was circulated to the members of the newly formed Flexible Pavement Committee as decided in the meeting held on 22nd April, 2006. Subsequently, based on the discussions in the second meeting held on 9th August, 2006, the Committee approved the draft and authorized Shri S.K. Nirmal to send the final draft incorporating comments of members to IRC. The draft document was considered in the Highways Specifications and Standards Committee on 26th May, 2007 and approved. The draft was approved by the IRC Council on 18th August, 2007 subject to certain modifications, keeping in view the comments of members and approval by the Convenor, Highways Specifications & Standards Committee.

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2. SCOPE

2.1 These Specifications deal with the details of mixing, laying and control of 20 mm thick Mix Seal Surfacing for use as a wearing course on a well prepared granular/bituminous base suitable to receive Mix Seal Surfacing/ Close Graded Premix Surfacing. These Specifications are preferred for low volume traffic (upto 10 msa).

2.2 The work shall consist of the preparation, laying and compaction of a close graded premix surfacing material of 20 mm thickness composed of graded aggregates premixed with bituminous binder on a previously prepared base/surface in accordance with the requirements of these specifications, to serve as a wearing course.

2.3 The close-graded premix surfacing shall be of two types namely, Type A and Type B conforming to the grading requirements given in Table 3 as specified in the contract documents. Type-A grading may be used for high rainfall area and Type-B grading may be used for low rainfall area (upto 150 cm per year).

3. MATERIALS

3.1 Binder

The binder for Mix Seal Surfacing shall conform to the requirements, as specified by Bureau of Indian Standards for viscosity graded paving bitumen (IS:73) or modified bitumen as per IRC:SP:53- "Guidelines for Selection of Grade of Viscosity Graded Paving Bitumen and Modified Bitumen" which are given in Table 1, 2A and 2B.

For tack coat, rapid setting cationic bituminous emulsion conforming to IS:8887 is generally preferred. However, IRC:16 may be referred in this regard.

3.2 Aggregates

The aggregates shall consist of crushed stone, crushed gravel (shingles) or other stones, as specified. The aggregates shall have clean, strong, durable and fairly cubical pieces free from disintegrated rock, organic and other deleterious matter and adherent coatings. The aggregates shall preferably be hydrophobic and of low water absorption. In case, the aggregates available are of hydrophilic nature, they shall be suitably doped with anti-stripping agents etc. before use.

3.2.1 Physical requirements: The aggregates shall satisfy the following physical requirements.

- (i) Aggregate Impact value – Maximum 30%
- (ii) Los Angeles Abrasion value – Maximum 40%

- (iii) Soundness
Loss with Sodium Sulphate for 5 cycles - Maximum 12%
Loss with Magnesium Sulphate, 5 cycles – Maximum 18%
- (iv) Flakines Index - Maximum 25%
- (v) Adhesion percent retained coating- Minimum 95%
- (vi) Water absorption - Maximum 1%

Note: The aggregates may satisfy the requirement of either of the test at (i) or (ii) above.

3.2.2 Grading of aggregates: The aggregates for the Mix Seal Surfacing shall conform to the grading given in Table 3, as specified in the contract.

3.3 Proportioning of Materials

The total quantity of aggregates used for type A or B, shall be 0.27 cu m per 10 square metre area for a carpet thickness of 20 mm. The quantity of binder for premixing shall be 22.0 kg and 19.0 kg per 10 square metre for Type A and Type B surfacing respectively.

3.4 Tack Coat

The binder used for tack coat shall be either suitable low viscosity paving bitumen of VG -10 grade conforming to IS:73 or Cationic Bitumen Emulsion RS-1 conforming to IS:8887/ASTM D2397. The use of cutback bitumen RC - 70 (in cold climate) as per IS:217 shall be restricted only for sites where atmospheric temperature at the time of application reaches below 0°C or for emergency applications. The rate of application of tack coat shall be as per Table 4. The quantity of cutback, when used as tack coat will be same as that of emulsion.

4. CONSTRUCTION METHODS

4.1 Weather and Seasonal Limitations

Mix seal surfacing shall not be laid or placed during rainy weather or when the sub grade or base is damp or when the atmospheric temperature in the shade is 10 °C or less.

Table 1: Viscosity Graded (VG) Bitumen and their General Applications

Viscosity Grade (VG)	General Applications
VG – 40	Used in highly stressed areas such as those at interactions, near toll booths and truck parking lots in lieu of old 30/40 penetration grade.
VG – 30	Used for paving in most parts of India in lieu of 60/70 penetration grade bitumen.
VG – 20	Used in cold climate, high altitude regions of North India
VG – 10	Used for spraying and other applications in lieu of 80/100 penetration grade

Table 2A: Selection Criteria for Viscosity-Graded (VG) Paving Bitumen Based on Climatic Conditions

Highest Daily Mean Air Temperature °C			
Lowest Daily Mean Air Temperature, °C	Less than 20°C	20°C to 30°C	More than 30°C
– 10°C or Higher	VG - 10	VG - 20	VG - 30
Lower than –10°C	VG - 10	VG - 10	VG - 20

Table 2B. Selection Criteria for Grade of Modified Bitumen

Highest Daily Mean Air Temperature, °C			
Lowest Daily Mean Air Temperature, °C	Less than 20°C	20°C to 30°C	More than 30°C
Grade of Modified Bitumen			
– 10°C or Higher	PMB/NRMB 120 CRMB 50	PMB/NRMB 70 CRMB 55	PMB/NRMB 40 CRMB 60
Lower than –10°C	PMB/NRMB 120 CRMB 50	PMB/NRMB 120 CRMB 50	PMB/NRMB 70 CRMB 55

PMB = Polymer Modified Bitumen

NRMB= Natural Rubber Modified Bitumen

CRMB= Crumb Rubber Modified Bitumen

Table 3: Aggregate Grading for Mix Seal Surfacing

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

Table 4: Rate of Application of Tack Coat

SI. No.	Type of Surface	Rate of Spray (Emulsion) (kg/m ²)	Rate of Spray (Bitumen - VG-10) (kg/m ²)
(i)	Bituminous surface	0.20 to 0.30	0.30 to 0.40
(ii)	Granular Surface treated with primer	0.25 to 0.30	0.35 to 0.40

4.2 Equipment

All equipment used for the proper construction of mix seal surfacing shall be available at site of the work and shall be in good working condition.

4.3 Arrangement for Traffic

Adequate provision for the movement of traffic shall be made in accordance with IRC:SP:55, as far as possible, so as not to interfere with the smooth construction operation on the road.

4.4 Preparation of Course

The course on which Mix Seal Surfacing is to be laid shall be prepared, reshaped and conditioned to a uniform grade and profile. Any depressions or pot holes shall be properly filled and compacted in advance. The surface of the underlying course shall be thoroughly swept clean and made free from cow dung, dust and foreign material. A prime coat shall be applied if the course is granular.

4.5 Application of Tack Coat

Paving bitumen, if used for tack coat binder, shall be heated to its appropriate application temperature in bitumen boiler to achieve desired viscosity of less than 2 poise. The normal range of spraying temperature for a bituminous emulsion shall be 20°C to 70°C and for a cutback, 50°C to 80°C if RC-70/MC-70 is used. Tack coat shall be applied uniformly at the rate given in Section 3.4 using bitumen/emulsion sprayer. The tack coat shall be applied just ahead of the spreading of Mix Seal Surfacing.

4.6 Preparation of Premix

Mechanical mixer shall be used for mixing the aggregate and bituminous binder. Improvised mixing drums may be used only when the work is small.

The bituminous material except emulsion shall be heated to the appropriate application temperature in binder tanks, so designed, as to avoid local overheating and ensuring a continuous supply. The aggregates shall be dry and suitably warmed or heated as required before they are passed on to the mixer and mixed with the binder. When they are delivered in the mixer, they shall be at a temperature which is consistent with the requirement of proper mixing and laying.

After about 15 seconds of dry mixing, the hot bituminous material shall be distributed over the aggregates at the rate specified in para 3.3 and at the temperature specified in Table 5. The mixing shall be continued till a homogeneous mixture is obtained where all particles of mineral aggregates are uniformly coated.

The mixture shall be transported from mixing plant to the site in suitable vehicles or wheel barrows. The required temperatures of binder, aggregates and mixed material at discharge from plant with different grades of bitumen/modified bitumen are given in Table 5.

4.7 Spreading

The mix shall be spread immediately after mixing, preferably, by mechanical paver, spreaders and graders. Uneven surface if any shall be corrected while the mix is still hot.

Table 5 : Mixing, Laying and Rolling Temperatures for Mix Seal Surfacing Mixes

Bitumen Viscosity Grade	Bitumen Temp. (°C)	Aggregate Temp. (°C)	Mixed Material Temp. (°C)	Laying Temp. (°C)	*Rolling Temp. (°C)
VG - 40	160-170	160-175	160-170	150 Min	100 Min
VG - 30	150-165	150-170	150-165	140 Min	90 Min
VG - 20	145-165	145-170	145-165	135 Min	85 Min
VG - 10	140-160	140-165	140-160	130 Min	80 Min
Modified Bitumen	165-185	155-175	160 Maximum	130 Minimum	115 Minimum

* Rolling must be completed before the mat cools to these minimum temperatures

4.8 Rolling

As soon as sufficient length of Mix Seal Surfacing has been laid, rolling shall be resorted to by a 8-10 tonne power roller. Rolling shall commence at the edges and progress towards the centre longitudinally except at super elevation. Rolling shall progress from the lower to upper edge parallel to centre line of the carriageway and over lapping uniformly each preceding track until the entire surface has been rolled and all roller marks are eliminated and no more compaction or crushing of aggregates takes place. While rolling, the roller wheel shall be kept damp to prevent picking of the mix.

When the roller has passed once over the entire area, any high spots or depressions shall be corrected by adding or removing the extra mix, while the mix is still hot.

The edges along the longitudinal and transverse joints of Mix Seal Surfacing laid and compacted, shall be cut to its full depth so as to expose a fresh surface which shall be

painted with thin coat of appropriate binder before fresh mix is placed against it.

4.9 Quality Control

Quality Control shall be exercised in all phases of construction as per IRC:SP:11 "Quality Control for the Construction of Roads and Runways".

4.10 Finished Surface

The compacted surface shall be uniform and conform to grade lines and typical cross section indicated on the plan and shall present a satisfactory surface. When tested with a straight edge, the finished surface shall show no variation greater than 6mm under a 3 metre straight edge.

4.11 Opening the Road to Traffic

The road shall be opened to traffic as soon as the mix cools down to ambient temperature. Speed restrictions may be imposed at initial stages to prevent the shift of the mix under fast traffic.

(The official amendments to this document would be published by the IRC in its periodical, 'Indian Highways' which shall be considered as effective and as part of the code/guidelines/manual, etc. from the Date specified therein)