# 515. MASTIC ASPHALT

## 515.1. Scope

This work shall consist of constructing a single layer of mastic asphalt wearing course for road pavements and bridge decks.

Mastic asphalt is an intimate homogeneous mixture of selected well-graded aggregates, filler and bitumen in such proportions as to yield a plastic and voidless mass, which when applied hot can be trowelled and floated to form a very dense impermeable surfacing.

## 515.2. Materials

515.2.1. Binder: Subject to the approval of the Engineer, the binder shall be a paving grade bitumen meeting the requirements given in Table 500-29.

515.2.2. Coarse aggregate : The coarse aggregate shall consist of crushed stone, crushed gravel/shingle or other stones. They shall be clean, hard, durable, of fairly cubical shape, uncoated and free from soft, organic or other deleterious substances. They shall satisfy the physical

TABLE 500-29. REQUIREMENTS FOR PHYSICAL PROPERTIES OF BINDER

| Property | | Test method | Requirement |
|---|---|---|---|
| Penetration at 25$^{O}$C | | IS 1203 | 15 ± 5* |
| Softening point, $^{O}$C | | IS 1205 | 65 ± 10 |
| Loss on heating for 5h at 163$^{O}$C, % by mass | Max. | IS 1212 | 2.0 |
| Solubility in trichloroethylene, % by mass | Min. | IS 1216 | 9.5 |
| Ash (mineral matter), % by mass | Max. | IS 1217 | 1.0 |

* In cold climatic regions (temperature ≤10°C), a softer penetration grade of 30/40 may be used.

requirements given in Table 500-3.

The percentage and grading of the coarse aggregate to be incorporated in the mastic asphalt depending upon the thickness of the finished course shall be as specified in Table 500-30.

TABLE 500-30. GRADE AND THICKNESS OF MASTIC ASPHALT PAVING, AND GRADING OF COARSE AGGREGATE

| Application | Thickness range (mm) | Nominal size of coarse aggregate (mm) | Coarse aggregate content, % by mass of total mix |
|---|---|---|---|
| Roads and carriageways | 25 -50 | 13 | 40 ± 10 |
| Heavily stressed areas i.e. junctions and toll plazas | 40 – 50 | 13 | 45 ± 10 |

| Nominal size of coarse aggregate IS Sieve (mm) | 13 mm |
|---|---|
| | Cumulative % passing by weight |
| 19 | 100 |
| 13.2 | 88 – 96 |
| 2.36 | 0 – 5 |

Fine aggregate : The fine aggregate shall be the fraction passing the 2.36 mm and retained on the 0.075 mm sieve consisting of crusher run screening, natural sand or a mixture of both. These shall be clean, hard, durable, uncoated, dry and free from soft or flaky pieces and organic or other deleterious substances.

Filler : The filler shall be limestone powder passing the 0.075 mm sieve and shall have a calcium carbonate content of not less than 80 percent by weight when determined in accordance with IS: 1514.

The grading of the fine aggregate inclusive of filler shall be as given in Table 500-31.

TABLE 500-31. GRADING OF FINE AGGREGATE (INCLUSIVE OF FILLER)

| I.S. Sieve | Percentage by weight of aggregate |
|---|---|
| Passing 2.36 mm but retained on 0.600 mm | 0 - 25 |
| Passing 0.600 mm but retained on 0.212 mm | 10 - 30 |
| Passing 0.212 mm but retained on 0.075 mm | 10 - 30 |
| Passing 0.075 | 30 - 55 |

515.3. Mix Design

515.3.1. Hardness number: The mastic asphalt shall have a hardness number at the time of manufacture of 60 to 80 at 25°C prior to the addition of coarse aggregate and 10 to 20 at 25°C at the time of laying after the addition of coarse aggregate.

The hardness number shall be determined in accordance with the method specified in IS: 1195-1978.

515.3.2. Binder content: The binder content shall be so fixed as to achieve the requirements of the mixture specified in Clause 515.3.1. and shall be in the range of 14 to 17 per cent by weight of total mixture as indicated in Table 500-32.

TABLE 500-32. COMPOSITION OF MASTIC ASPHALT BLOCKS WITHOUT COARSE AGGREGATE

| IS Sieve | Percentage by weight of mastic asphalt | |
|---|---|---|
| | Minimum | Maximum |
| Passing 2.36 mm but retained on 0.600 mm | 0 | 22 |
| Passing 0.600 mm but retained on 0.212 mm | 4 | 30 |
| Passing 0.212 mm but retained on 0.075 mm | 8 | 18 |
| Passing 0.075 mm | 25 | 45 |
| Bitumen Content | 14 | 17 |

515.3.3. Job mix formula: The Contractor shall inform the Engineer in writing at least 1 month before the start of the work of the job mix formula proposed to be used by him for the work, indicating the source and location of all materials, proportions of all materials such as binder and aggregates, single definite percentage passing each sieve for the mixed aggregate and results of the tests recommended in the various Tables and Clauses of this Specification.

515.4. Construction Operations

515.4.1. Weather and seasonal limitations: The provisions of Clause 501.5.1 shall apply, except that laying shall not be carried out when the air temperature at the surface on which the Mastic Asphalt is to be laid is below 10°C.

515.4.2. Preparation of the base: The base on which mastic asphalt is to be laid shall be prepared, shaped and conditioned to the profile required, in accordance with Clause 501 or 902 as appropriate or as directed by the Engineer. In the case of a cement concrete base, the surface shall be thoroughly power brushed clean and free of dust and other deleterious matter. Under no circumstances shall mastic asphalt be spread on a base containing a binder, which might soften under high application temperatures. If such material exists, the same shall be cut out and repaired before the mastic asphalt is laid.

515.4.3. Tack coat: A tack coat in accordance with Clause 503 shall be applied on the base or as directed by the Engineer.

515.4.4. Preparation of mastic asphalt: Penetration of mastic asphalt consists of two stages. The first stage shall be mixing of filler and fine aggregates and then heating the mixture to a temperature of 170°C to 210°C. Required quantity of bitumen shall be heated to 170°C to 180°C and added to the heated aggregated. They shall be mixed and cooked in an approved type of mechanically agitated mastic cooker for some time till the materials are thoroughly mixed. Initially the filler alone is to be heated in the cooker for an hour and then half the quantity of binder is added. After heating and mixing for some time, the fine aggregates and the balance of binder are to be added and further cooked for about one hour. The second stage is incorporation of coarse aggregates and cooking the mixture for a total period of 3 hours. During cooking and mixing, care shall be taken to ensure that the contents in the cooker are at no time heated to a temperature exceeding 210°C.

Where the material is not required for immediate use it shall be cast into blocks consisting of filler, fine aggregates and binder, but without the addition of coarse aggregate, weighing about 25 K-gs each. Before use, these blocks shall be reheated to a temperature of not less than 175°C and not more than 210°C, thoroughly incorporated with the requisite quantity of coarse aggregates and mixed continuously. Mixing shall be continued until laying operations are completed so as to maintain the coarse aggregates in suspension. At no stage during the process of mixing shall the temperature exceed 210°C.

The mastic asphalt blocks (without coarse aggregate) shall show on analysis a composition within the limits as given in Table 500-32.

The mixture shall be transported to the laying site in a towed mixer transporter having arrangement for stirring and keeping the mixture hot during transportation.

515.4.5. Spreading : The mastic asphalt shall be laid, normally in one coat, at a temperature between 175°C and 210°C and spread uniformly by hand using wooden floats or by machine on the prepared and regulated surface. The thickness of the mastic asphalt and the percentage of added coarse aggregate shall be in accordance with Table 500-30 or as specified by the Engineer. Where necessary, battens of the requisite dimensions should be employed. Any blow holes that appear in the surface shall be punctured while the material is hot, and the surface made good by further floating.

515.4.6. Joints : All construction joints shall be properly and truly made. These joints shall be made by warming existing mastic asphalt by the application of an excess quantity of the hot mastic asphalt mixture which afterwards shall be trimmed to leave it flush with the surfaces on either side.

515.4.7. Surface finish : The mastic asphalt surface can have poor skid resistance after floating; in order to provide resistance to skidding, the mastic asphalt after spreading, while still hot and in a plastic condition, shall be covered with a layer of stone aggregate. This aggregate shall be 13.2 mm size (passing the 19.0 mm sieve and retained on the 9.5 mm sieve) or 9.5mm size (passing the 13.2 mm sieve and retained on the 6.7 mm sieve) subject to the approval of the Engineer. Hard stone chips, complying with the quality requirements of Table 500-17, shall be precoated with bitumen at the rate of 2 ± 0.4% of S-65 penetration grade. The addition of 2% of filler complying with Table 500-9 may be required to enable this quantity of binder to be held without draining. The chips shall then be applied at the rate of 0.005 cu. m. per 10 sq. m. and rolled or otherwise pressed into the surface of the mastic layer when the temperature of the mastic asphalt is not less than 100°C

515.5. Opening to Traffic : Traffic may be allowed after completion of the work when the mastic asphalt temperature at the mid-depth of the completed layer has cooled to the daytime maximum ambient temperature.

515.6. 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.

The surface of the mastic asphalt, tested with a straight edge 3.0m long, placed parallel to the centre line of the carriageway, shall have no depression greater than 7mm. The same limit shall also apply to the transverse profile when tested with a camber template.

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

515.8. Measurement for Payment : Mastic asphalt shall be measured as finished work in square metres at a specified thickness, or by weight in tonnes as stated in the Contract.

515.9. Rate : The contract unit rate for mastic asphalt shall be payment in fall for carrying out the required operations including full compensation for all components listed under Clause 501.8.8.2. (i) to (ix).