

**RECOMMENDED PRACTICE  
FOR  
BITUMINOUS PENETRATION  
MACADAM  
(FULL GROUT)**



**THE INDIAN ROADS CONGRESS**



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Published by  
**THE INDIAN ROADS CONGRESS,**  
Jamnagar House, Shahjahan Road,  
New Delhi-110 011  
**1992**

Price : Rs. 40/-  
(Plus Packing & Postage)

IRC: 20-1966

First Published : July, 1966  
Reprinted : January, 1973  
Reprinted : April, 1978  
Reprinted : March, 1992  
Reprinted : March, 2002  
Reprinted : August, 2005  
Reprinted : June, 2009

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Printed at Abhinav Prints, Delhi-110041  
(500 Copies)

# RECOMMENDED PRACTICE FOR BITUMINOUS PENETRATION MACADAM (FULL GROUT)

## 1. INTRODUCTION

The Recommended Practice for Bituminous Penetration Macadam (Full Grout) prepared by the Bituminous Pavements Committee of the Indian Roads Congress was approved by the Executive Committee of the Indian Roads Congress at their meeting held on the 30th September 1964 and was later approved for publication as Recommended Practice by the Council of the Indian Roads Congress at their meeting held at Jaipur on the 28th November 1964. Some comments received later on were considered by the Bituminous Pavements Committee at their meeting held on the 29th April 1966 and some minor changes were made.

This Recommended Practice is intended to indicate what is considered to be a good practice under average conditions. It is realised that in certain localities, there will be special conditions which may necessitate modifications of the clauses laid down in this Recommended Practice.

Provisions made in this Recommended Practice shall apply unless modified by special provisions to take into account unusual conditions.

## 2. DESCRIPTION

Bituminous penetration macadam shall consist of the construction of one or more courses of compacted crushed aggregates bonded and keyed by alternate applications of bituminous materials and filling aggregate (key aggregates) and the applications of a seal coat, when specified. Thickness of an individual course shall not exceed 75 mm.

### 3. MATERIALS

#### 3.1. Bituminous Materials

The bituminous materials shall conform to the requirements as specified and provided for in the proposal and satisfy the related specifications issued by the Indian Standards Institution (vide ISI Standards 73, 215, 217 and 454). The grades of binder to be used would depend upon the climatic conditions. The suggested binders are straight-run bitumen 80/100, 60/70, 30/40; road tar grade RT-4/RT-5 or approved cutbacks.

#### 3.2. Aggregate

##### 3.2.1. General requirements

The aggregate shall consist of crushed stone, crushed slag, crushed gravel (shingle) or other stones, as specified, and shall have clean, strong, durable and fairly cubical fragments free from dis-integrated pieces, salt, alkali, vegetable matter, dust and adherent coatings.

##### 3.2.2. Physical requirements

The aggregate shall satisfy the following physical requirements:

Los Angeles Abrasion Value.	Max. 40
Aggregate Impact Value	Max. 30
For slag, weight shall not be less than 1120 kg per m <sup>3</sup>	
Soundness	
Loss with sodium sulphate for five cycles	— max. 12 per cent
Flakiness Index	— max. 25 per cent
Stripping	— max. 25 per cent

Where all these conditions cannot be satisfied, it is left to Engineer-in-charge to allow reasonable tolerances.

##### 3.2.3. Sizes

The size of the coarse aggregate and the key aggregate shall depend upon the intended thickness of the bituminous penetration macadam (vide Tables 1 and 3).

3.2.4. The coarse aggregate shall conform to the grading specified in Table 1.

TABLE 1

Per cent passing, sieve No.	Compacted thickness	
	50 mm	75 mm
63 mm	—	100
50 mm	100	—
38 mm	—	35-70
25 mm	35-70	—
19 mm	—	0-15
12 mm	0-15	—
9 mm	—	—
4.75 mm	—	—
2.36 mm	0-5	0-5

The coarse aggregate shall be spread in the quantity given in Table 2 by means of approved aggregate spreaders or by approved manual means.

TABLE 2

Compacted thickness	Quantity
50 mm	0.60 m <sup>3</sup> per 10 m <sup>2</sup>
75 mm	0.90 m <sup>3</sup> per 10 m <sup>2</sup>

### 3.2.5. Key aggregate

Key aggregate shall conform to the grading specified in Table 3.

TABLE 3

Per cent passing, sieve No.	Compacted thickness	
	50 mm	75 mm
38 mm	—	—
25 mm	—	100
19 mm	100	35-70
12 mm	35-70	—
9 mm	—	0-15
4.75 mm	0-15	—
2.36 mm	0-5	0-5

The key aggregate shall be spread at the rate specified in Table 4.

TABLE 4

Compacted thickness	Quantity
	Cu. metre per 10 m <sup>2</sup>
50 mm	0.15
75 mm	0.18

### 3.2.6. Seal coat

Materials required are given in Table 5.

TABLE 5

Material	Size	Quantity required for 10 m <sup>2</sup>
Chipping	9 mm passing 12 mm and retained on 6 mm square mesh sieve	0.09 to 0.11 m <sup>3</sup>
Binder		
I. Straight-run bitumen*		9.8 to 12 kg
or		
II. Road tar of suitable grade**		

## 4. CONSTRUCTION METHODS

### 4.1. Weather and Seasonal Limitations

No bituminous penetration macadam shall be constructed when the atmospheric temperature is below 16°C, or when the pavement is damp, or the weather is foggy or rainy or during dust storm.

### 4.2. Equipment

All equipment necessary for the proper construction of the work shall be on the side of the work in good condition.

\*Grade 175/225 is suggested for use in very cold regions and 80/100 for use in warm climates.

\*\* Grade R.T. 2 is suggested for use in hilly and R.T. 3 for use in plains.



### 4.3. Preparation of Base

The underlying course on which bituminous penetration macadam is to be laid shall be prepared, shaped and conditioned to a uniform grade and section as specified. Any depressions or potholes should be properly made up and thoroughly compacted sufficiently in advance. Any priming, if needed, may be applied in accordance with the I.R.C. Tentative Specification for Priming of Base Course with Bituminous Primers.

### 4.4. Spreading and Compacting Coarse Aggregate

4.4.1. The coarse aggregate shall be spread (with suitable edge protections) and hand packed to a uniform depth and true to alignment profile and grade. A testing template cut to the camber of the finished pavement shall be used to obtain uniformity of the surface.

The spreading shall be carried no further in advance of the rolling and penetrating operations that can be completed in one average day's work. Segregated aggregate or aggregate mixed with earth or other foreign substances shall be removed and replaced with graded aggregate.

### 4.4.2. Rolling

The aggregate shall be dry rolled with a ten-ton road roller until compacted and keyed. The rolling shall begin at the sides, overlapping the shoulder at least 30 cm and shall proceed to the centre. In the case of superelevated curves, lapping should be approximately  $1/3$  of the width of the rear wheel on each trip. After the edges have been rolled, the rolling shall progress from the inside to the outside of the curve.

After the initial rolling, the surface shall be checked with a crown template and a 3-metre straight edge. The surface shall not vary more than 12 mm from the template or straight edge. All surface irregularities exceeding the above limit shall be corrected by removing or adding aggregates as required.

Each course shall be uniformly compacted, the rolling shall stop before the voids are closed to such an extent as to prevent free and uniform penetration of the bitumen and key aggregate.

### 4.5. Application of Bituminous Material

After the coarse aggregate has been rolled and checked, the bituminous binder shall be applied at a temperature appropriate to

the type and grade of the binder. The rate of application for different thicknesses is specified in Table 6.

TABLE 6

Compacted thickness	Binder	Quantity in
		Kg per 10 m <sup>2</sup>
50 mm	(i) Straight-run bitumen	50
	(ii) Road tar RT-4/RT-5	60-65
75 mm	(i) Straight-run bitumen	68
	(ii) Road tar RT-4/RT-5	82-88

Before applying the binder, the aggregate shall be surface dry for its entire depth.

The bituminous material shall preferably be applied by a pressure distributor uniformly over the surface at the specified rate. Over small areas, where the use of a spray bar is impracticable, the material shall be applied by the nozzle attachment. Only when permitted, pouring pots may be used according to the directions of the Engineer-in-charge.

#### 4.6. Application of Key Aggregate

Immediately after the first penetration of bitumen, the key aggregate shall be spread uniformly over the surface by means of an approved mechanical spreader or by approved manual methods, rolled, dragged with drag-broom to accomplish uniform distribution and roiled again. Key aggregate shall be added where needed, and rolling and brooming shall continue until the key aggregates are locked in the surface. The surface shall be maintained true to grade and cross-section.

#### 4.7. Seal Coat

Seal coat shall be applied before opening the road to traffic. The binder, heated to the requisite temperature, should be applied to the clean surface. The chippings shall then be spread and rolled.

#### 4.8. Finishing

The finished surface shall be uniform and conform to the lines, grades and typical cross-sections shown in the specifications. The same should be checked as per methods laid down in the "Handbook of Quality Control for Construction of Roads and Runways"—IRC Special Publication: 11-1977. The maximum permissible undulation on the longitudinal profile is 12 mm and also the number of undulations of 10 mm or more should not exceed 30 in a length of 300 metre. The maximum permissible variation in the cross-profile is 8 mm.

#### 5. OPENING TO TRAFFIC

The finished surface shall be opened to traffic preferably 24 hours after rolling the bituminous macadam but if, in special circumstances, the road is required to be opened to traffic earlier, it may be done provided the speed of vehicles is restricted to 15 km per hour.

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