RECOMMENDED PRACTICE FOR SAND-BITUMEN BASE COURSES

THE INDIAN ROADS CONGRESS

1987

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1. INTRODUCTION

This recommended practice was prepared by the Bituminous Pavements Committee (personnel given below) in their meeting held on the 10th December, 1973 :

Sujan Singh	—*Convenor*
C.G. Swaminathan	—*Member-Secretary*

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S. Mumtaz Ali	C.B.L. Mathur
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Later, it was approved by the Specifications and Standards Committee in their meeting held on the 31st January and 1st February, 1974 and then by the Executive Committee in their meeting held on the 1st May, 1974. Finally, it was approved by the Council in their meeting held on the 2nd May, 1974.

2. SCOPE

This recommended practice deals with the basic outlines of providing one or more layers of base courses of sand stabilised with bituminous materials like penetration grade bitumens, cut-back bitumens and other special road oils laid directly over the sandy subgrade or on a prepared base/sub-base of the pavement.

The practice is mainly intended for desert areas such as in Rajasthan or bordering close to it where no other construction material except sand is economically available. A 10 cm thick

base course with a wearing course of 20 mm premix carpet has been found to be satisfactory for carrying normal traffic upto about 150 vehicles per day (vehicles exceeding 3 tonnes loaded weight) and also occasional heavy traffic of upto 1500 vehicles per day.

3. DESIGN CRITERIA

The sand-bitumen mix should be properly designed based on the Hubbard Field Stability Method and satisfy the requirements given below:

Requirements of the Mix

(1) Hubbard Field Stability at 60° C for paving grade bitumen	Minimum 360 kg
(2) Modified Hubbard Field Stability at 25°C for cut-back bitumens	Minimum 540 kg
(3) Per cent voids	Maximum 20 per cent

Note : (a) It is preferable to keep per cent voids on the lower side than the maximum limit as far as possible.

(b) For mixes in which Kankar is incorporated, Modified Hubbard Field Stability Method may be used as a guide with appropriate modification in stability values as desired by the Engineer-in charge.

4. MATERIALS

4.1. Aggregates

4.1.1. **Sand** : The sand should be clean dune or pit sand free from organic and other deleterious materials. No particular gradation is specified except that the percentage passing 75 microns sieve shall be not more than 10 per cent by weight. A typical grading of sand as obtained in Rajasthan is given in the footnote.

4.1.2. **Coarse aggregates for stabilization** : To impart greater stability to the stabilized sand mix, wherever possible and available, coarse aggregates can be incorporated in the mix, up to a

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Footnote :

1. Typical Gradings

I.S. Sieve Size	Per cent passing
600 Microns	100
300 Microns	98-100
150 Microns	60-65
75 Microns	4-5

2. Single sized sands are not normally recommended.

maximum of 25 per cent by weight of the mix. The coarse aggregates should be either gravel or kankar, clean and free from fines and clayey matter, and the size be such that the whole of it should retain on I.S. 4.75 mm sieve with the maximum size not being more than 1/3 the compacted thickness of the layer to be laid.

4.2. Binder

The binder shall be paving bitumen of suitable penetration grade or cut-back bitumen conforming to I.S. 73-1961 "Paving Bitumen "(Revised)" or I.S. 217-1961 "Cutback Bitumen (Revised)".

5. DESIGN OF MIX

5.1. Selection of Type of Bitumen

The selection for the type of bitumen shall depend upon the type of sand available and atmospheric conditions prevailing at the time of execution of the work.

5.2. Proportion of Bitumen

The proportion of bitumen in the mix shall be designed so as to satisfy the requirements of the mix given in para 3.

6. CONSTRUCTION

6.1. Formation

The formation shall be prepared well ahead of laying the mix in the usual manner, to get approximately the required cross slope or superelevation and shall be compacted dry/wet as may be possible. The final finishing of the berms as well as providing the proper cross slope or superelevation shall be done after the sand-bitumen work has been completed. In the case of sandy subgrades, the carriageway shall be marked with planks of depth equal to the proposed loose thickness of the sand-bitumen layer. The subgrade shall have the required camber or superelevation of the finished road surface, and it shall then be sprinkled with water and lightly rolled with suitable rollers until it is well compacted.

6.2. Edge Key

Grooves 8 cm wide and 5 cm deep shall be dug at the edges on

either side so as to give a thickened edge. This is essential to give additional strength to the edge.

6.3. Heating of the Materials

6.3.1. Whenever necessary, the binder shall be warmed or heated as the case may be to that temperature pertaining to the grade of bitumen used and as specified. Normally the temperature shall be that at which the viscosity of the binder is 150-300 centistokes for which the normal heating temperature for penetration grade binder is between 150°-165°C and for cutbacks between 80°-120°C.

6.3.2. Sand shall be dry. If necessary and stipulated, the sand and aggregates shall also be warmed and heated to the requisite temperature as specified, such as 135°-163°C when penetration grade bitumen is employed. At least tilting drum type of drier is recommended for this purpose.

6.4. Mixing

The mixing of sand, aggregates and binder shall be done by using a twin shaft paddle type of mixer using the appropriate quantities of aggregates and the binder as per design. The mixing time shall be determined based on a few initial trials. Normally it will be between 1 to 2 minutes. The mix shall be laid immediately thereafter.

6.5. Laying of Mix

The sand-bitumen mix shall be laid directly over the subgrade to a loose thickness of upto 15 cm so as to be compacted to a 10 cm thickness. The material shall be spread uniformly and rolled to the required density. It is to be ensured that uniform density is obtained throughout the depth of the compacted layer.

6.6. Curing

Where cut-back bitumen is used, the mix, after laying should be allowed for curing till such time that initial rolling could be started. The curing period may vary from 1 to 7 days depending upon the type of cut-back used and the prevailing weather conditions at the time of construction. The curing time should be reckoned from the time of preparing the mix to the period when by periodically making a ball out of the aerated mix and applying a light pressure with fingers, the ball crumbles. The smell of the solvent in the cut-back also gives a good indication. Properly cured mix should not give the small of the solvent except in traces.

6.7. Rolling

Where penetration grade bitumens are used, rolling should start as soon as the hot mix is spread and levelled on the sub-base. In the case of cut-backs, initial rolling shall be done at least after twenty four hours after laying. In all cases, the initial rolling shall be done where possible by light pneumatic tyred road roller. The final rolling shall again be done with 8 to 10 tonnes smooth wheel roller and continued till the desired density is achieved, which may be a week where cut-back bitumens are used.

6.8. Opening to Traffic

Traffic may be allowed after 24 hours of completing the final rolling operation. Only light pneumatic tyred vehicles may be permitted initially. Normal traffic may be allowed only after a month. But the final wearing surface should be laid within 3 months.

7. LAYING OF WEARING SURFACE

To provide a running surface and to protect the base from abrasive action of traffic, a wearing course such as a 20 mm thick premix carpet should be laid over the sand bitumen base, as per IRC : 14-1977 "Recommended Practice for 2 cm Thick Bitumen and Tar Carpets". The ruts and undulations that might be formed during the initial use of the sand-bitumen base course should be made good with premix aggregate before laying the wearing surface.

8. CONTROLS

Adequate quality control at every stage of the work is essential and as such a field laboratory must be set up to ensure the following controls :

(1) In no case shall the difference in temperature between the sand/aggregate and binder exceed 14°C.

(2) **Density :** For every 500 square metres or less of compacted surface, one field density test is to be conducted. This density shall not be less than 95 per cent of the laboratory designed density.

(3) **Tests on the mix :** At least one sample for every 50 m^3 of mix or a minimum of two samples per shift should be collected and tested for stability, voids and determination of the binder content.

(4) The finished surface shall be tested with a 3 m straight edge and any irregularities greater than 6 mm rectified.