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Indian Standard

METHODS OF TESTS FOR PREFORMED FILLERS FOR EXPANSION JOINTS IN CONCRETE PAVING AND STRUCTURAL CONSTRUCTION

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METHODS OF TESTS FOR PREFORMED FILLERS FOR EXPANSION JOINTS IN CONCRETE PAVING AND STRUCTURAL CONSTRUCTION

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Indian Standard

METHODS OF TESTS FOR PREFORMED FILLERS FOR EXPANSION JOINTS IN CONCRETE PAVING AND STRUCTURAL CONSTRUCTION

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 28 February 1983, after the draft finalized by the Building Construction Practices Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Hitherto, methods of tests to assess the qualitative requirements of bitumen impregnated preformed fillers for expansion joints were included in IS : 1838-1961*. To unify the test methods to be used for other types of preformed fillers made from cork, rubber, PVC, epoxy, etc, it has been decided to modify and cover these methods in a separate Indian Standard. Though some of the methods may not be considered suitable for testing preformed fillers made from PVC, rubber, etc, it has been decided by the Committee to modify these methods in future to suit all types of fillers as and when it becomes necessary.

0.2.1 In this standard, the procedure for determining the dimensions accurately has been added, procedure for calculating water absorption has been modified to assess it in terms of volume, and procedure for determining the density included. Further, modification to the method for calculating the percentage of recovery is being actively considered by the committee and will be added as and when final recommendations are made available.

0.3 In the formulation of this standard due weightage has been given to the standards and practices prevailing in different countries.

0.4 In reporting the results of a test or analysis made in accordance with this standard, if the final value observed or calculated is to be rounded off it shall be done in accordance with IS : 2-1960†.

*Specification for preformed fillers for expansion joints in concrete non-extruding and resilient type (bitumen impregnated fibre).

†Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard covers the methods for carrying out the following tests on preformed expansion joints fillers:

a) Dimension
b) Recovery and compression
c) Extrusion
d) Water absorption
e) Density
f) Penetration of recovered bitumen
g) Bitumen content
h) Weathering

2. PREPARATION OF THE TEST SPECIMEN

2.1 Five specimens for test shall be cut from each sample. Each test specimen shall be freshly and squarely cut using a metal plate 100 × 100 mm as a cutting template. The metal template shall be machined from 6 mm plate to fit the extrusion mould described in **5**, within + 0, − 0·01 mm in length and in width.

3. DETERMINATION OF DIMENSIONS

3.1 Object — To determine the length, width and thickness of preformed expansion joint fillers.

3.2 Measurement of Length and Width

3.2.1 *Apparatus* — A steel tape capable of measuring to the nearest 1 mm.

3.2.2 *Procedure* — The fillers shall be laid on a flat surface so as to fully expose the width without distortion. The width shall be measured in at least three places spaced equally along its length. During measurement, the tape shall be placed as nearly as possible at right angle to the edge of the filler.

3.2.3 *Report* — The average of all the measurements shall be reported.

3.3 Measurement of Thickness

3.3.1 *Apparatus* — A micrometer or any other instrument capable of measuring to an accuracy of 0·01 mm.

3.3.2 *Procedure* — The thickness of the test specimen (*see* **2**) shall be measured at four scattered points.

3.3.3 *Report* — The average of all the observations shall be reported.

4. DETERMINATION OF RECOVERY AND COMPRESSION

4.1 Object — To determine the following properties of preformed fillers:

a) Percentage of recovery,
b) Resistance to compression, and
c) Loss in bitumen.

4.2 Apparatus — A typical mounting for the test is shown in Fig. 1. Place the test specimen on a flat metal plate and centre a 110 × 110 × 12 mm metal plate ground to have plane parallel faces on the top surface of the specimen. Use a simple *U* shape bridge to support a dial gauge or other suitable measuring device reading to 0·02 mm above the centre of specimen. Place a hollow metal load transfer cylinder with slots for inserting the *U* shape bridge and an opening for reading the measuring device between the moving head of the testing machine and the plate covering the specimen. Mount a spherical bearing block between the upper end of the cylinder and the moving head of the testing machine. Centre accurately both the hollow metal cylinder or other device and the spherical bearing block in order that the load shall be applied uniformly to the test specimen.

4.3 Procedure — When the specimen has been mounted as in **4.2** and is subjected to only the pressure of the dead weight of 110 × 110 × 12 mm metal plate, determine its thickness by means of the measuring device. When the load transferring apparatus and spherical bearing block are placed on the test specimen some compression may result. Consider this reduction in thickness as part of the 50 percent reduction in thickness to be applied.

4.3.1 *Recovery* — For the determination of the percentage of recovery, the test specimen shall be compressed to 50 percent of its thickness before the test by single application of load. The load shall be immediately released after application. The thickness of the specimen shall be measured at the end of ten minutes after release of the load. Should the specimen show a recovery of less than 70 percent of its thickness before the test, the test shall be repeated as specified in **4.2**.

4.3.2 Subject the test specimen three applications of load sufficient to compress it to 50 percent of its thickness before the test. Apply the load without shock and at such a rate that the specimen shall be compressed approximately 1·0 mm per minute. After the first and second applications release the load immediately, and permit the specimen to recover for 30 minutes before the load is again applied. After the third application release the load immediately and permit the specimen to recover for one

hours; then measure the thickness again. Remove the load transferring apparatus and spherical bearing block from the test specimen during recovery periods between compressions and following the third application of load.

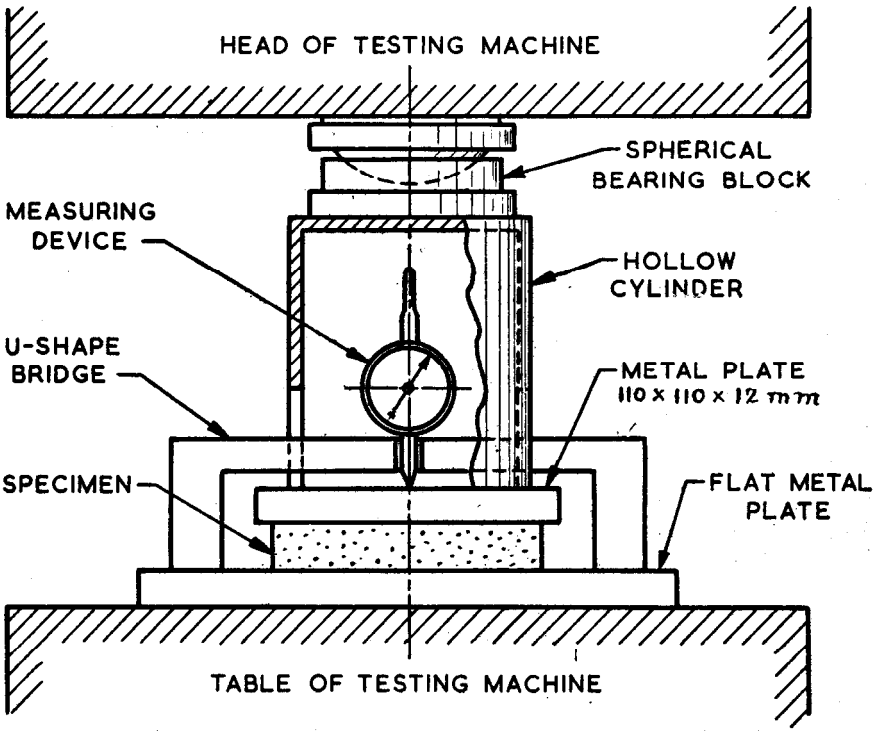

FIG. 1 TYPICAL MOUNTING OF SPECIMEN FOR RECOVERY AND COMPRESSION TESTS

4.4 CALCULATION

4.4.1 *Percentage of Recovery* — Calculate the percentage of recovery as follows:

$$\text{Recovery, percent} = \frac{t_1}{t_0} \times 100$$

where

t_1 = thickness of the specimen after test (mm), and

t_0 = thickness of the specimen before test (mm).

4.4.2 *Resistance to Compression* — Calculate the resistance to compression as follows:

$$\text{Compression, kgf/mm}^2 \text{ (or N/mm}^2\text{)} = \frac{W}{A}$$

where

W = total maximum load required for the first application (*see* **4.3.1**), kgf(or N); and

A = area of the plate, mm².

5. DETERMINATION OF EXTRUSION

5.1 Object — To determine the amount of extrusion of the free edge of the preformed fillers.

5.2 Apparatus — Place the test specimen in a suitable steel mould so constructed as to confine the lateral movement of the specimen under compression to one side only. Interior dimensions of the mould shall be 100 × 100 mm with permissible variations of length and width of ± 0·5 mm. Mould sides shall be of such a height as to extend at least 10 mm above the test specimen. Cover the specimen with a 1·2 mm metal plate ground to have plane parallel faces and machined to fit snugly, but without binding, within the three restraining sides of the steel mould. Use a simple *U*-shaped bridge to support above the centre of the specimen a dial or other suitable measuring device reading to 0·02 mm. Place upon the plate a metal cylinder or other device for transferring the load from the moving head of the testing machine around the measuring apparatus to the plate covering the specimen. Mount a spherical bearing block between the upper end of the cylinder and the moving head of the testing machine.

5.3 Procedure — When the specimen has been mounted as described in **5.2** and is subjected only to the pressure of the dead weight of the 100 × 100 × 1·2 mm metal plate, determine its thickness by means of the measuring device. When the load-transferring apparatus and spherical bearing block are placed on the test specimen, some compression may result. Consider this reduction in thickness as part of the 50 percent reduction in thickness to be applied.

5.4 For the determination of the amount of extrusion, give the specimen one application of a load sufficient to compress it to 50 percent of its thickness before the test. Apply the load without shock and at such a rate that the specimen shall be compressed approximately 1·0 mm per minute. Determine the amount of extrusion in millimetres by measuring the maximum movement of the free edge of the test specimen during the 50 percent compression of the specimen. Measure the extrusion by means of a dial or other suitable device reading to 0·02 mm.

6. DETERMINATION OF WATER ABSORPTION

6.1 Object — To determine the percentage water absorption of preformed fillers.

6.2 Test Specimen — Cut a specimen 100 × 100 mm from the joint material in such a way that all edge are freshly cut.

6.3 Procedure — Dry the specimen at ambient temperature, when not less than 20°C; for 24 hours in a desiccator and in case of lower temperature dry in oven at 20 ± 2°C and weigh to the nearest 0·1 g. Immerse in water maintained at a temperature of 20 ± 2°C in a horizontal position with 25 mm of water over the specimen for 24 hours. Remove the specimen from the water and remove the surface water from all side of the specimen with a blotting paper. Quickly weigh the specimen and calculate the percentage of absorption as follows:

$$\text{Water absorption, percent by volume} = \frac{10\,(W_1 - W_2)}{t}$$

where

W_1 = weight of the test piece after immersion, g;
W_2 = weight of the test piece before immersion, g; and
t = thickness of specimen before test, in mm.

7. DETERMINATION OF DENSITY

7.1 Object — To assess the amount of density of preformed expansion joint fillers.

7.2 Specimen — Cut a test specimen 100 × 100 mm.

7.3 Procedure — Dry the specimen at ambient temperature, when not less than 20°C, for 24 hours in a desiccator and in case of lower ambient temperature dry in oven at 20 ± 2°C and weigh to the nearest 0·1 g. Determine the dimensions of the specimen to the nearest 0·1 mm and calculate the density as follows:

$$\text{density, kg/m}^3 = \frac{\text{weight of the specimen}}{\text{volume of the specimen}}$$

8. DETERMINATION OF PENETRATION OF RECOVERED BITUMEN

8.1 Object — To determine the amount of penetration of the recovered bitumen at 25°C of bitumen impregnated preformed expansion joint fillers.

8.2 Apparatus and Reagents

8.2.1 *Centrifugal Extractor* — Rotarex type.

8.2.2 *Head Resistant Glass Flask*

8.2.3 *Condenser* — Water cooled.

8.2.4 *Benzene*

8.3 Procedure

8.3.1 Weigh a 150 to 200 g sample of the joint filler to the nearest 0·1 g, break up the sample and place it in a centrifugal extractor. Add pure benzene in sufficient quantity to saturate the sample, then allow the sample to soak for 30 minutes to dissolve the bitumen. Extract the bitumen-benzene solution by centrifuging the sample. Add several successive washes of pure benzene to the centrifuge bowl until the extracted solvent is not discoloured and all the bitumen saturant has been removed from the fibre joint filler.

8.3.2 Collect the bitumen-benzene solution and the washings in a 2 litres round-bottom, heat resistant glass flask and distill over on oil-bath, with a water cooled condenser for condensing the benzene vapours. Continue the distillation until the bitumen-benzene solution is concentrated to approximately 200 ml. Stop the distillation at this point, pour the residue into a 300-ml distillation flask and distill at 360°C.

8.3.3 Determine the penetration of the recovered bitumen according to IS : 1203-1978*.

9. DETERMINATION OF BITUMEN CONTENT

9.1 Object — To determine the percentage of bitumen content in the bitumen impregnated preformed expansion joint fillers.

9.2 Procedure — Dry the fibre residue to constant weight, after the extraction of the bitumen in accordance with **8.3.1**. Determine the bitumen content by difference, expressed as a percentage by weight of the original sample.

10. DETERMINATION OF WEATHERING

10.1 Object — To examine the effect of accelerated weathering on the preformed expansion joint fillers.

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*Methods for testing tar and bituminous materials — Determination of penetration (*first revision*).

10.2 Procedure — Expose the test specimen as described in 2, to a temperature of 75 ± 1°C for a period of 7 days. Upon completion of this accelerated ageing immerse the specimen in water at room temperature for 24 hours.

10.2.1 Place the specimen on edge in a suitable container and pour water into the container to a depth of 50 mm (one-half height of the specimen). It shall be necessary to put a weight or simple frame across the exposed edges of the specimen during this test in order to maintain the position of the specimen in the water. Place the container containing the specimen in a freezing chamber for a period long enough to freeze the water into solid ice. Maintain the temperature of the freezing chamber between — 4 to — 6°C. Upon completion of the freezing cycle remove the pan containing the specimen from the freezing chamber and partially immerse in water at a temperature maintained between 18 and 38°C. The first cycle is completed when the ice surrounding the specimen has melted entirely. Repeat this cycle ten times.

10.3 Result

10.3.1 After completion of ten freezing and thawing cycles remove the specimen from the water and allow it to stand in room temperature for 48 hours. Examine the test specimen for evidences of disintegration.

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2