IS : 4332 (Part X) - 1969
(Reaffirmed 1995)

Indian Standard

METHODS OF TEST FOR STABILIZED SOILS

PART X TEST FOR SOIL-BITUMINOUS MIXTURES

UDC 624·131·3 :624·138·232·2

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 1

Price Rs 5·00

January 1971

Indian Standard

METHODS OF TEST FOR STABILIZED SOILS

PART X TEST FOR SOIL-BITUMINOUS MIXTURES

Soil Engineering Sectional Committee, BDC 23

Chairman

PROF S. R. MEHRA

Manak, Old Adhikari Lodge, Ranikhet, Uttar Pradesh

Members	*Representing*
DR ALAM SINGH	University of Jodhpur, Jodhpur
SHRI B. B. L. BHATNAGAR	Land Reclamation, Irrigation & Power Research Institute, Amritsar
SHRI K. C. CHANDIOK	All India Instruments Manufacturers & Dealers Association, Bombay
SHRI VED PRAKASH (*Alternate*)	
SHRI K. N. DADINA	In personal capacity (*P-820, New Alipore, Calcutta 53*)
SHRI A. G. DASTIDAR	Cementation Co Ltd, Bombay
SHRI J. DATT	Concrete Association of India, Bombay
SHRI T. M. MENON (*Alternate*)	
SHRI R. L. DEWAN	Bihar Institute of Hydraulic & Allied Research, Khagaul, Patna
PROF DINESH MOHAN	Central Building Research Institute (CSIR), Roorkee
SHRI D. R. NARAHARI (*Alternate*)	
DIRECTOR, CENTRAL SOIL MECHANICS RESEARCH STATION	Central Water & Power Commission, New Delhi
DIRECTOR (DAMS II) (*Alternate*)	
PROF R. N. DOGRA	Indian Institute of Technology, New Delhi
EXECUTIVE ENGINEER (SOIL MECHANICS AND RESEARCH DIVISION)	Concrete and Soil Research Laboratory, Public Works Department, Government of Tamil Nadu
SHRI B. N. GUPTA	Irrigation Research Institute, Roorkee
SHRI S. N. GUPTA	Central Board of Irrigation & Power, New Delhi
DR JAGDISH NARAIN	University of Roorkee, Roorkee
SHRI K. R. JAIN	National Buildings Organisation, New Delhi
SHRI B. S. BHATTI (*Alternate*)	
JOINT DIRECTOR RESEARCH (FE), RDSO	Railway Board (Ministry of Railways)
DEPUTY DIRECTOR, RESEARCH SOIL MECHANICS, RDSO (*Alternate*)	
SHRI S. S. JOSHI	Engineer-in-Chief's Branch, Army Headquarters
SHRI S. VARADARAJA (*Alternate*)	

(*Continued on page* 2)

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 1

(*Continued from page* 1)

Members	*Representing*
SHRI G. KUECKELMANN	Rodio Foundation Engineering Ltd; *and* Hazarat & Co, Bombay
SHRI A. H. DIVANJI (*Alternate*)	
SHRI O. P. MALHOTRA	Public Works Department, Government of Punjab
SHRI C. B. PATEL	M. N. Dastur & Co (Private) Ltd, Calcutta
SHRI PRITAM SINGH	Indian National Society of Soil Mechanics & Foundation Engineering, New Delhi
REPRESENTATIVE	Public Works (Special Roads) Directorate, Government of West Bengal
RESEARCH OFFICER	Building and Roads Research Laboratory, Public Works Department, Government of Punjab
RESEARCH OFFICER	Engineering Research Department, Hyderabad
SHRI S. N. SINHA	Roads Wing (Ministry of Transport & Shipping)
SHRI A. S. BISHNOI (*Alternate*)	
SHRI C. G. SWAMINATHAN	Institution of Engineers (India), Calcutta
DR H. L. UPPAL	Central Road Research Institute (CSIR), New Delhi
SHRI H. G. VERMA	Public Works Department, Government of Uttar Pradesh
SHRI D. C. CHATURVEDI (*Alternate*)	
SHRI R. NAGARAJAN, Director (Civ Engg)	Director General, ISI (*Ex-officio Member*)

Secretary
SHRI G. RAMAN
Deputy Director (Civ Engg), ISI

Soil Testing Procedures and Equipment Subcommittee, BDC 23 : 3

Convener	
DR H. L. UPPAL	Central Road Research Institute (CSIR), New Delhi
Members	
DR ALAM SINGH	University of Jodhpur, Jodhpur
SHRI T. N. BHARGAVA	Roads Wing (Ministry of Transport & Shipping)
SHRI A. S. BISHNOI (*Alternate*)	
SHRI R. L. DEWAN	Bihar Institute of Hydraulic & Allied Research, Khagaul, Patna
DIRECTOR, CENTRAL SOIL MECHANICS & RESEARCH STATION	Central Water & Power Commission, New Delhi
DIRECTOR (DAMS II) (*Alternate*)	
SHRI H. K. GUHA	Geologists Syndicate Private Ltd, Calcutta
SHRI N. N. BHATTACHARYYA (*Alternate*)	
SHRI S. S. JOSHI	Engineer-in-Chief's Branch, Army Headquarters
SHRI MAHABIR PRASAD	Public Works Department, Government of Uttar Pradesh
SHRI O. P. MALHOTRA	Buildings and Road Research Laboratory, Chandigarh
DR I. S. UPPAL (*Alternate*)	
SHRI D. R. NARAHARI	Central Building Research Institute (CSIR), Roorkee
SHRI G. S. JAIN (*Alternate*)	
SHRI H. C. VERMA	Associated Instrument Manufacturers (India) Private Limited, New Delhi
SHRI M. N. BALIGA (*Alternate*)	

Indian Standard

METHODS OF TEST FOR STABILIZED SOILS

PART X TEST FOR SOIL-BITUMINOUS MIXTURES

0. FOREWORD

0.1 This Indian Standard (Part X) was adopted by the Indian Standards Institution on 2 December 1969, after the draft finalized by the Soil Engineering Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Soil stabilization is the alteration of any property of a soil to improve its engineering performance. There are several methods of stabilization and these may be broadly on the basis of treatment given to the soil (for example, dewatering and compaction), process involved (for example, thermal and electrical), and on additives employed (for example, asphalt and cement). The choice of a particular method depends on the characteristics of the problem on hand. For studying in the laboratory, the methods and effects of stabilization, certain standard methods of test for the evaluation of properties of stabilized soils and their analysis are required. The required standards on methods of test for stabilized soils are to be published in parts and this part [IS : 4332 (Part X)-1969] lays down the method for the determination of water absorption, expansion, and extrusion characteristics of compacted soil or soil aggregate moistures containing liquid bituminous material.

0.3 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country. This has been met by basing the standard on ASTM D915-61 ' Standard method of testing soil bituminous mixtures ', published by the American Society for Testing and Materials, USA.

0.4 In reporting the result 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*.

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

1. SCOPE

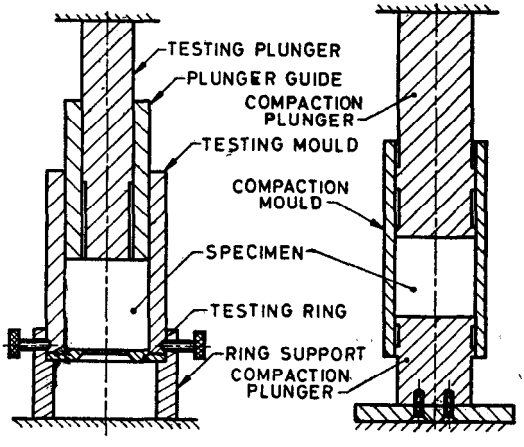
1.1 This standard (Part X) covers the determination of water absorption, expansion, and extrusion characteristics of compacted soil or soil-aggregate mixtures containing liquid bituminous material. The method is intended for determining the effects of water on these mixtures. It may also be employed to determine the same characteristics for untreated soil or soil-aggregate mixtures. The results are not intended for use in formulæ to determine pavement thickness, nor to predict relative-field performance of different bituminous materials as stabilization admixtures.

2. APPARATUS

2.1 Mechanical Mixer — capable of producing intimate mixtures of soil, water and bituminous material.

2.2 Compaction Apparatus — as shown in Fig. 1 and 2 consisting of the parts given in **2.2.1** to **2.2.3** (*see* Note).

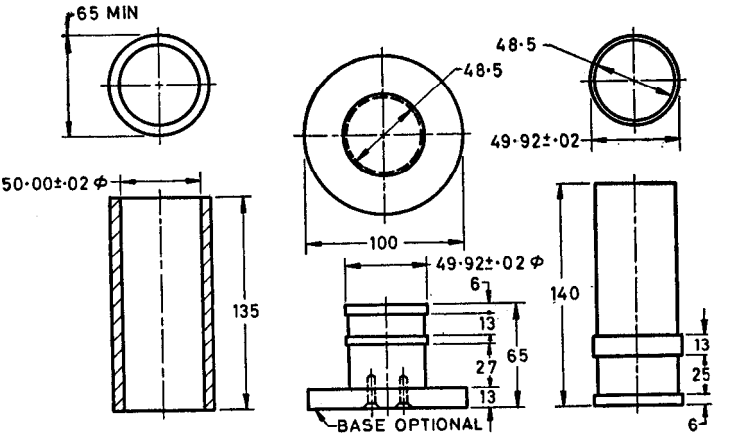
NOTE — The inside diameters of all compaction and extrusion test apparatus and the diameter of the testing end of the test plunger shall be checked periodically to assure adherence to the specified tolerances on dimensions.

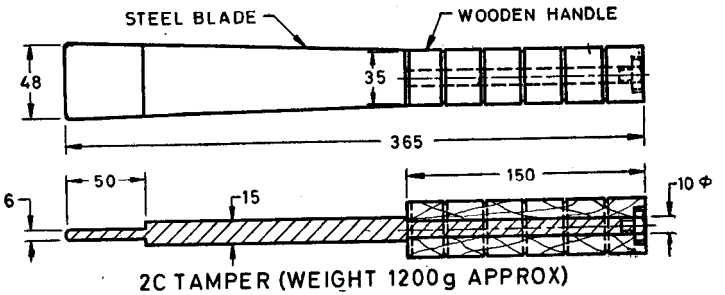


All dimensions in millimetres.

FIG. 1 TESTING ASSEMBLY AND MOULDING ASSEMBLY

2.2.1 *Compaction Mould* (*Fig. 2A*) — A cylindrical hardened steel mould having an inside diameter of 50·00 ± 0·02 mm, a length of 135 mm and an outside diameter of 65 mm or greater. The mould shall be equipped with a suitable device to control the specified drop and to protect the top of the mould during precompaction with the tamper (*see* Note under **2.2**).





All dimensions in millimetres.

FIG. 2 COMPACTION APPARATUS

2.2.2 *Compaction Plungers* (*Fig. 2B*) — One hardened steel plunger having a circular face, 49·92 ± 0·02 mm in diameter and a length of 140 mm and one hardened steel plunger having a diameter of 49·92 ± 0·02 mm and a length of 65 mm (*see* Note under **2.2**).

2.2.3 *Tamper* (*Blade Type*) (*Fig. 2C*) — The tamper shall be made of steel and shall have an overall length of 365 mm. For the upper 150 mm it shall be turned to a steel shank 10 mm in diameter and shall be fitted with a wooden handle 35 mm in outside diameter. The flat blade shall be 215 mm in length and shall be 35 mm in width next to the handle and 48 mm in width at the tamping end. The thickness of the flat blade shall be 15 mm at the handle and for a distance of 165 mm below the handle (*see* Note under **2.2**).

2.2.3.1 The lower 50 mm of the blade shall be 6 mm in thickness, and the tamping edge shall be finished to a rounded edge. The total weight of the tamper shall be approximately 1 200 g.

2.3 Water Absorption Apparatus — A corrosion-resistant-flat-bottom pan approximately 5 cm in depth and a cabinet or moist-room maintained at a temperature between 18°C and 27°C and relative humidity of at least 90 percent.

2.4 Extrusion Test Assembly — The extrusion test assembly shall be as shown in Fig. 3 and shall consist of the parts given in **2.4.1** to **2.4.5** (*see* Note under **2.2**).

2.4.1 *Testing Mould* (*Fig. 3A*) — A cylindrical hardened steel mould having an inside diameter of 51·8 ± 0·2 mm at the large end, tapered to an inside diameter of 50·50 ±0·02 mm at a point 57·5 mm from the bottom continuing at a diameter of 50·50 ± 0·02 mm to the bottom for a total length of 115 mm and having an outside diameter of 75 mm (*see* Note under **2.2**).

2.4.2 *Testing Plunger* (*Fig. 3B*) — A cylindrical hardened steel plunger having a diameter of 28·60 ± 0·02 mm on the testing end for a distance of 50 mm and then a diameter of 32·0 ± 0·1 mm for a distance of 100 mm for an overall length of 150 mm (*see* Note under **2.2**).

2.4.3 *Plunger Guide* (*Fig. 3C*) — A cylindrical steel guide or sleeve having an outside diameter of 50·2 ± 0·1 mm, an inside diameter of 32·4 ± 0·1 mm and a length of 100 mm (*see* Note under **2.2**).

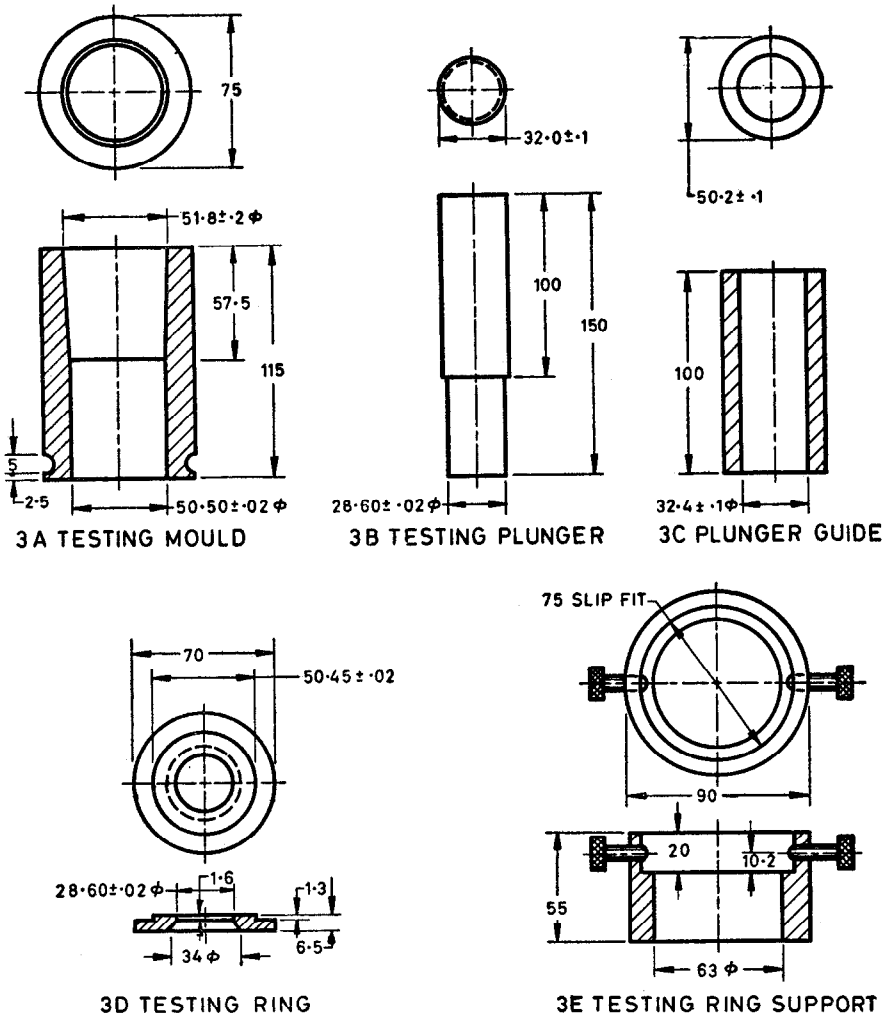
2.4.4 *Testing Ring* (*Fig. 3D*) — A hardened tool steel annular plate, 6·5 mm in thickness having a circular opening with a diameter of 28·60 ± 0·02 mm. The cutting edges of the aperture shall be 1·6 mm in thickness and the aperture shall be tapered outward from the cutting edge at an angle of approximately 30 deg with the vertical. It shall be fitted with a seat 50·45 ± 0·02 mm in diameter and 1·3 mm in height (*see* Note under **2.2**).

2.4.5 *Testing Ring Support* (*Fig. 3E*) — A testing ring support of the type shown in Fig. 3E, or equivalent, adequate to support other parts of the extrusion test assembly.

2.5 Testing Machine — A loading device of at least 4 500 kg capacity, capable of applying load through a uniform motion of the testing head at a rate of 25 mm/min. It shall be fitted with a device for continuously measuring the applied load. It may be equipped with a maximum load indicator.

2.6 Drying Oven — capable of maintaining a temperature of 60 ± 3°C.

2.7 Measuring Device — accurately calibrated and equipped to determine heights and diameters of test specimens to the nearest 0·2 mm.



All dimensions in millimetres.

FIG. 3 EXTRUSION TEST APPARATUS

2.8 Moisture Content Determination Apparatus — conforming to the requirements of IS : 4332 (Part II)-1967*.

*Methods of test for stabilized soils: Part II Determination of moisture content of stabilized soil mixtures.

2.9 Balances — Two, one having a capacity of 2 000 g or more and sensitive to 0·5 g or less, the other having a capacity of 500 g or more and sensitive to 0·05 g or less.

2.10 Sieves — 4·75-mm IS Sieve and 2·00-mm IS Sieve as prescribed in IS : 460-1962*.

2.11 Containers — metal containers with tight-fitting lids for storing and ' aging ' mixtures.

2.12 Miscellaneous Equipment — mixing pans, thermometers, etc.

3. MATERIALS

3.1 Bituminous Material — The bituminous material shall be emulsified asphalt, cut-back or other liquid asphalt or tar, the type and grade to be as specified in accordance with relevant Indian Standards.

4. PREPARATION OF SOIL

4.1 Pulverize the air-dry soil in such a manner as to separate the soil particles without reducing the particle size and screen through a 4·75-mm IS Sieve. Record the percentage retained on the 4·75-mm IS Sieve. Screen the soil passing the 4·75-mm IS Sieve through the 2·00-mm IS Sieve and if soil binder aggregations are retained on the 2·00-mm IS Sieve, further pulverize them to pass the 2·00-mm IS Sieve. Combine and intimately mix the material passing the 4·75-mm IS Sieve and retained on the 2·00-mm IS Sieve with the material passing the 2·00-mm IS Sieve. Store the soil thus prepared in tightly closed containers. Conduct the water absorption, expansion and extrusion tests on the total material passing the 4·75-mm IS Sieve.

5. MOISTURE CONTENT AND DRY WEIGHT OF SOIL

5.1 Determine the moisture content w, of the air-dried soil by testing 100 g of the prepared soil in the moisture content determination apparatus in accordance with IS : 4332 (Part II)-1967†.

5.2 Determine the calculated weight of dry soil in the air-dry soil to be used in the water-absorption, expansion and extrusion tests as follows:

$$W_d = \frac{100\,W}{100 + w}$$

where

W_d = Calculated weight of dry soil in g,

W = weight of air-dry soil in g, and

w = determined moisture content in percent (*see* **5.1**).

*Specification for test sieves (*revised*).

†Methods of test for stabilized soils: Part II Determination of moisture content of stabilized soil mixtures.

6. PREPARATION OF SOIL-STABILIZER MIXTURE

6.1 Tar and Liquid Asphalt

6.1.1 If the addition of water is required, weigh out the air-dried soil, prepared as prescribed in **4.1**, in 1 000 g portions (calculated on the dry soil basis) to provide sufficient mix material for the required number of test specimens. Place the weighed quantity of soil in the bowl of the mechanical mixer and add the specified amount of water, based upon the calculated dry weight of the soil and with due allowance for the determined moisture present, and roughly distribute it by cutting and stirring the mixture with a stiff knife. Start the mixer and continue mixing for a total mixing period of 5 min stopping when necessary to clean the sides of the mixing bowl and blade. Time spent in scraping the blade and sides of mixing bowl shall not be included in the mixing time. Place the soil-water mixture in a tightly closed metal container and allow to stand for a period of 16 to 24 hours.

6.1.2 Place the aged soil-water mixture or air-dried soil in 1 000 g portions (calculated on the dry soil basis) in the bowl of the mechanical mixer. Add the specified amount of bituminous materials into a depression previously made in the prepared soil-water mixture and roughly stir into the mixture by means of a stiff knife. Attach the bowl containing the mixture to the mixer, start the mixer, and continue mixing for a total mixing period of 5 min, stopping when necessary to clean the sides of the mixing bowl and blade. Extra mixing may be performed by hand, if necessary for an additional 5 min per period, using a rubber-tipped pestle. Place the soil bituminous mixture in a tightly closed container and allow to stand for a period of 4 hours. Form the mixture into specimens the same day the mix is prepared.

6.2 Emulsified Asphalt — Weigh out the air-dried soil prepared as described in **4.1** in 1 000 g portions (calculated on the dry soil basis) to provide sufficient mix material for the required number of test specimens. Place the weighed quantity of soil in the bowl of the mechanical mixer, start the machine at slow speed and add the specified amount of water to the moving mass. Continue mixing for a total elapsed period of 5 min, stopping when necessary to clean the sides of the mixing bowl and blade. Time spent in scraping the blade and sides of mixing bowl shall not be included in the mixing time. Add the specified amount of emulsified asphalt to the wetted soil and continue mixing for a minimum of 5 min or a maximum of 10 min so as to produce a mixture having a visual homogeneity. Place the completed mixture in the tared shallow pans and allow it to air dry to the specified moisture content, with frequent stirring so as to prevent crusting (*see* Note).

NOTE — With certain soils that have a tendency toward formation of hard clods during drying, special precautions are at times necessary to improve the handling characteristics and uniformity of the mixture during compaction. In such cases, as

soon as the consistency of the mixture will permit, it shall be cut with a spatula into dice-like sections having approximately 12 to 15 mm edges. These diced cubes shall be stirred occasionally during drying. When the cubes shall have dried to just below the plastic limit consistency of the soil they shall be placed in the bowl of the mechanical mixer and mixed until a discrete, uniform, granular mass is obtained. This worked mass shall be placed in tared shallow pans and allowed to continue to air-dry while stirring with a spatula at intervals to the specified moisture content.

6.3 Moisture Content of Mixture — Determine the moisture content *w* of the aged soil-bituminous mixture as a percentage of the dry soil weight in accordance with IS : 4332 (Part II)-1967*.

6.3.1 If the percentage of moisture does not vary from the specified moisture content by more than 0·15, form the soil-bituminous mixture into specimens as described in **7.** If the moisture content does not fall within this allowable tolerance, discard the mixture and prepare a new mixture.

7. PREPARATION OF SPECIMENS

7.1 Three specimens shall be prepared for each test result desired, making each test result the average of three readings. Each of the three readings shall be recorded.

7.2 Portions of the soil-bituminous mixture, each sufficient to form specimen 50 mm diameter by 50 $\pm$ 1·2 mm in height shall be weighed and formed into specimens as described in **7.2.1** to **7.2.3.**

7.2.1 Insert the short compaction plunger approximately 25 mm into the bottom of the compaction mould suitably supported to maintain its position during initial compaction. Place the weighed mixture in the compaction mould.

7.2.2 Obtain initial compaction by 25 blows with the tamper. Allow the tamper to fall freely from a height of 150 mm above the bottom of the specimen being formed and rotate it between application of the blows. Then insert the long compaction plunger into the top of the compaction mould, remove the support for the mould and place the entire assembly (*see* Fig. 1) in the testing machine.

7.2.3 Obtain final compaction by compressing the specimen at a constant rate of 25 mm/min until a total load of about 2 725 ($\pm$ 25) kg is indicated. Maintain this load for 2 min. Remove the specimen from the mould, mark the top of the specimen as tamped and weigh and measure the specimen for average height and diameter. The average height of the specimen shall be 50 $\pm$ 1·2 mm. Any specimens not conforming to the specified tolerance shall be discarded.

*Methods of test for stabilized soils: Part II Determination of moisture content of stabilized soil mixtures.

7.3 Calculate the density as follows, expressed on the basis of the calculated weight of dry soil in the specimen, and assuming that no change has occurred in the composition of the mixture during compaction:

$$W_d = \frac{100\ W_s}{100 + w + B} \text{ and } \gamma_d = \frac{W_d}{V}$$

where

W_d = calculated weight of dry soil in specimen in g,

W_s = weight of specimen in g,

w = percentage by weight of moisture in mixture moulded into specimens (**6.3**),

B = percentage by weight of bituminous material in mixture expressed as a percentage of dry soil weight,

γ_d = density of dry soil in g/cm^3, and

V = volume of specimen in cm^3.

8. CURING OF SPECIMENS

8.1 Unless otherwise specified, specimens containing emulsified asphalt shall be tested in the cured state. Prior to testing for moisture absorption, expansion and extrusion value, the specimen shall be cured as specified in **8.1.1** to **8.1.3.**

8.1.1 Cure the soil-emulsified asphalt specimens in an oven maintained at 60 ± 3°C until 80 to 90 percent (unless otherwise specified) of the moisture at the time of moulding has been removed. This point shall be determined on a control specimen chosen from each group of three specimens. At the completion of the curing period, record the weight, average height and diameter of each specimen.

8.1.2 Place the control specimen, after removal from the curing oven in a desiccator for at least 30 min (to reach laboratory temperature) and then weigh. Remove all other specimens at the same time and place in a desiccator arrangement similar to that used for the control specimen, to insure the same degree of drying.

8.1.3 The curing of specimens shall be conducted only during times when the laboratory is in operation. At times when control checks cannot be carried out remove all specimens from the oven and place in a sealed container in order to retard further loss in weight.

8.2 Soil-asphalt and soil-tar specimens shall be tested in the uncured state, in the cured state or both, as specified. If tests on cured specimens of soil-asphalt and soil-tar are required, prior to testing for moisture absorption, expansion and extrusion value, the specimens shall be cured as specified in **8.2.1** to **8.2.3.**

8.2.1 Cure the specimens to constant weight in an oven maintained at 60 $\pm$ 3°C. Constant weight of a specimen for this purpose shall be defined as that weight at which the loss in weight during a 6 h period in the oven is 0·3 g or less. From each set of three specimens choose a control specimen for use in determining when constant weight has been obtained.

8.2.2 Place all specimens in an oven maintained at 60 $\pm$ 3°C for an initial curing period of 40 to 42 h after which remove all specimens from the oven, place in a desiccator for at least 30 min to reach laboratory room temperature, and weigh the control specimens. Again place all specimens in the oven and, after an interval of 6 h remove, cool to room temperature in a desiccator and weigh the control specimens. Make further weight readings, after 6 h periods in the oven, until the control specimens have been dried to constant weight as defined in **8.2.1.** After initial curing period when the last weight readings to be made on a given day have been made, remove all the specimens from the oven and place in a desiccator until the start to the next working day.

8.2.3 When a control specimen has been dried to constant weight, as defined in **8.2.1**, remove all specimens represented by that control specimen from the desiccator and record the weight average height, and diameter of each specimen.

9. PROCEDURE FOR WATER ABSORPTION AND EXPANSION TESTS

9.1 The water absorption test shall be performed in an absorption cabinet or moist room maintained at a temperature between 18°C and 27°C and a relative humidity of at least 90 percent. Place the bottom of the specimen as tamped, downward in the water absorption test.

9.2 Place the specimens directly on the bottom of a flat-bottom pan, and adjust the height of distilled water in the pan to and maintain at a height of 25 mm above the bottom of the specimens. After seven days remove the specimens from the absorption cabinet or moist room and remove the free moisture from the surface by quick blotting. Record the weights and average diameters of the bottom of the specimens.

9.3 Calculation of Water Absorption — Calculate water absorption as follows:

$$\text{Water absorption, percent} = \frac{W_2 - W_1}{W_d} \times 100$$

where

W_2 = weight after absorption,

W_1 = weight before absorption, and

W_d = calculated weight of dry soil in specimen.

9.4 Calculation of Expansion — Calculate expansion during absorption as follows:

$$\text{Expansion percent} = \left[\frac{D_2^3}{D_1^3} - 1 \right] 100$$

where

D_2 = average diameter of bottom of specimen after absorption, and

D_1 = diameter before absorption.

10. PROCEDURE FOR EXTRUSION TEST

10.1 The extrusion test shall be performed at room temperature on specimens that have been subjected to the water absorption test.

10.2 Assemble the testing cylinder, testing ring and ring support as shown in Fig. 1. After the specimen has been removed from the absorption cabinet, weighed and measured, place it in the testing mould with the face that was down during the absorption test downward. Insert the specimen into the large end of the testing cylinder until seated against the testing ring, gradually forcing it if necessary, by use of the compaction plunger. Insert the testing plunger and guide into the large end of the testing mould until resting on top of the test specimen.

10.3 Centre the entire test assembly on the platform of the testing machine. Apply load to the test specimen through the testing plunger, which shall move at a constant rate of 25 mm/min. The extrusion value shall be taken as the maximum total load required to cause failure of the test specimen.

11. REPORT

11.1 The following data shall be reported:

a) Details of soil sample;

b) Stabilizer used;

c) Quantity of stabilizer as a percentage of the dry soil weight;

d) Water, if any, added to the soil as a percentage of the dry soil weight;

e) Dimensions of each specimen before and after each test; and

f) Density of the specimens.

11.2 The following data shall also be reported as the average of three determinations:

a) Water absorption during the absorption test,

b) Expansion during the absorption test,

c) Extrusion value after the absorption test, and

d) Additional data as may be specified.

PUBLICATIONS OF INDIAN STANDARDS INSTITUTION

INDIAN STANDARDS

About 6 000 Indian Standards, broadly classified under the following main heads, have been issued so far:

Agriculture & Food
Chemical
Civil Engineering
Consumer Products
Electrotechnical
Mechanical Engineering
Structural & Metals
Textile

Of these, the standards belonging to the Civil Engineering Group fall under the following categories:

Aggregates
Boards and Sheets
Bricks and Blocks
Builder's Hardware
Cement
Concrete Design and Construction
Concrete Testing
Construction Equipment
Doors and Windows
Drawing, Estimation and Measurement
Drawing Office Equipment
Fire Fighting Equipment
Fire Safety
Flexible Coverings
Floor Finish
Flow Measurement
Flow Measuring Instruments
Foundation
Functional Design
Furniture
General Structural Design and Construction
Gypsum Products
Lime
Loading Standards
Manufacture or Processing
Modular Co-ordination
Multi-Purpose River Valley Projects
Packing
Pipes
Planning, Regulation and Control
Plaster, Paint and Allied Finishes
Poles
Pozzolanas
Reinforcement
Roof
Safety in Construction
Sieves and Wire Gauzes
Soil Engineering
Stones
Tar and Bitumen
Tiles
Timber
Timber Design and Construction
Timber Stores
Wall and Ceiling Finish
Waterproofing and Damp-Proofing
Water Supply, Drainage and Sanitation
Water Supply, Sanitation and Drainage Fittings
Wood-Based Materials

OTHER PUBLICATIONS

	Rs
ISI Bulletin (Published Every Month)	
Single Copy	3·00
Annual Subscription	25·00
Annual Reports (from 1948-49 Onwards)	2·00 to 3·00 each

Handbook of ISI Publications, 1970 (Pages viii + 629, Price Rs 12·00) incorporating annotations on all Indian Standards, and also listing ISO Recommendations and Publications of IEC

Available from

INDIAN STANDARDS INSTITUTION

Headquarters

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 1

Telephone 27 01 31 (20 lines) **Telegrams Manaksanstha**

Branch Offices

Telegrams Manaksanstha

Syndicate Bank Building, Gandhinagar	**Bangalore 9**	**Telephone 2 76 49**
534 Sardar Vallabhbhai Patel Road	**Bombay**	**,, 35 69 44**
5 Chowring Approach	**Calcutta 13**	**,, 23-08 02**
5-9-201/2 Chirag Ali Lane	**Hyderabad 1**	**,, 5 34 35**
117/418 B Sarvodaya Nagar	**Kanpur 5**	**,, 82 72**
54 General Patters Road	**Madras 2**	**,, 8 72 78**

Printed at Neelkamal Printers, Delhi-6, Indi

AMENDMENT NO. 1 AUGUST 1983

TO

IS:4332(Part X)-1969 METHODS OF TEST FOR STABILIZED SOILS

PART X TEST FOR SOIL-BITUMINOUS MIXTURES

Alterations

(*Page 8, clause 2.10, line 2*) - Substitute 'IS:460(Part I)-1978*' *for* 'IS:460-1962*'.

(*Page 8, foot-note with '*' mark*) - Substitute the following for the existing foot-note:

'*Specification for test sieves: Part I Wire cloth test sieves (*second revision*).'

(BDC 23)

Reprography Unit, ISI, New Delhi, India