BRITISH STANDARD

BS 6319-6: 1984

Testing of resin compositions for use in construction —

Part 6: Method for determination of modulus of elasticity in compression

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Civil Engineering and Building Structures Standards Committee (CSB/-) to Technical Committee CSB/20 upon which the following bodies were represented:

British Adhesive Manufacturers' Association
British Plastics Federation
Cement and Concrete Association
Concrete Society
Construction Industry Research and Information Association
County Surveyors' Society
Department of the Environment (Building Research Establishment)
Department of the Environment (Property Services Agency)
Department of the Environment (Transport and Road Research Laboratory)
Federation of Epoxy Resin Formulators and Applicators Ltd.
Institution of Civil Engineers
Institution of Highways and Transportation
Institution of Structural Engineers
Plastics and Rubber Institute
Society of Chemical Industry
Coopted member

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Contents

Foreword

This Part of this British Standard has been prepared under the direction of the Civil Engineering and Building Structures Standards Committee. This Part describes a method for measuring the modulus of elasticity and is one of a series of Parts describing methods for measuring basic physical properties of resin based materials.

This Part of this British Standard should be read in conjunction with Part 1 which provides general information and describes a method for preparing test specimens.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 and 2, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This Part of BS 6319 describes a method for the determination of the modulus of elasticity in compression of specimens of resin based mortars and concretes in the form of rectangular prisms.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 6319 the definitions given in BS 6319-1 apply, together with the following.

2.1
compressive stress

the compressive force carried at any time by the test specimen per unit area of the original cross section

2.2
compressive strain

the ratio of the change in the distance between two reference points along the axis of the test specimen when related to their original spacing

2.3
elastic modulus

the ratio of stress to corresponding strain below the proportional limit, where the proportional limit is the greatest stress which a material is capable of supporting without any deviation from proportionality of stress to strain (Hooke's Law)

2.4
secant modulus

the ratio of stress to corresponding strain measured relative to a level of pre-stress applied to bed firmly the specimen platens and ball seating. Accordingly, the secant modulus is based on the stress required to extend the gauge length of the test specimen by 0.2 % from a pre-stress of approximately 10 % of the expected force at 0.002 strain

NOTE In general, the secant modulus is defined as the ratio of stress to corresponding strain at any given point on the stress-strain curve. However, with specimens loaded in a compression testing machine, the above definition applies.

3 Principle

The principle of the test is the subjection of a prism of **4.1** aspect ratio to a controlled axial compressive load and relating the compressive stress to the longitudinal strain induced by that stress.

4 Apparatus

4.1 *Compression testing machine,* of suitable capacity for the test, i.e. when the expected load at failure of the specimen lies in the upper four-fifths of the selected range of the machine being used, and complying with clauses **3** to **7** of BS 1881-115:1983. It shall be capable of applying load at the rate specified in **6.2.4** and shall comply with the requirements for grade A of BS 1610 as regards repeatability and accuracy. If a compression cage is used to convert the action of a tensile or universal test machine to the compressive mode, a sub-assembly shall be used to provide the necessary self-alignment facility to one platen.

The auxiliary platens shall comply with BS 1881-115.

A spacing block or blocks may be interposed between the prism or the auxiliary platen and the lower machine platen to reduce the test space, provided that the system is stable throughout the test and means are available for the prism to be correctly centered. No more than two blocks plus an auxiliary platen shall be used. Each spacing block shall be solid with a rectangular vertical section, and shall support the prism or the auxiliary platen over the whole of its area. The properties of the material, and the surface flatness, surface texture and parallelism of the contact faces of each block shall comply with the requirements of BS 1881-115.

4.2 *Moulds,* complying with the requirements of BS 6319-1 and of a size to produce rectangular prisms in accordance with **5.2**.

4.3 *Two strain gauges or compressometers,* each having a minimum gauge length of 20 mm and maximum sensitivity 50 units of microstrain and providing a continuous indication of change in the gauge length.

NOTE 1 The change should preferably be recorded autographically in the form of a force/compression curve.

The instrument shall be calibrated by a suitable method to ensure that the error does not exceed 2 % of the actual strain.

NOTE 2 The instrument needs to be essentially free from inertia lag at the specified speed of testing.

5 Test specimens

5.1 Preparation of test specimens. The preparation of test specimens, including the conditioning, proportioning and mixing of the materials and the conditioning and filling of the mould shall be in accordance with BS 6319-1.

5.2 Dimensions of test specimens. Test specimens shall be rectangular prisms of size 40 mm × 40 mm × 160 mm unless the material contains an aggregate, of which at least 90 %, when sampled in accordance with BS 812-1, will not pass through a BS 410 test sieve of nominal mesh size 5 mm. For such materials the width and depth of the prism shall be between 7.0 and 8.0 times the nominal mesh size of the smallest BS 410 sieve through which 90 % of the aggregate will pass. The length to width ratio of the prism shall be 4 : 1.

6 Procedure

6.1 Sample. Test a minimum of three specimens at a time for each prescribed set of test conditions.

6.2 Testing

6.2.1 *Temperature*. Carry out the test at 20 ± 1 °C unless, for a specific purpose, an alternative temperature is deemed more appropriate. Maintain the test specimens at the test temperature conditions for not less than 16 h before testing commences.

6.2.2 *Measurement*. Measure the width and thickness of the specimen at its centre to the nearest 0.1 mm and calculate the cross-sectional area.

6.2.3 *Placing the test specimen in the testing machine*. Fit two strain gauges or compressometers to opposite cast sides of the test specimen, their gauge lengths being centrally disposed over the axis of the test specimen. When a compressometer is attached to the test specimen, take care to ensure that any distortion of, or damage to, the test specimen is minimal. There shall be no slippage between the compressometer grips and the test specimen.

NOTE BS 4408-2 gives guidance on the use of strain gauges.

Wipe clean the bearing surfaces of the testing machine and of any auxiliary platens. Remove any loose grit or other material from the surfaces of the test specimen that are to be in contact with the compression platens. Place the test specimen in the machine in such a manner that the load is applied axially, i.e. parallel to the long axis of the test specimen. Place the test specimen on the lower machine platen and carefully centre.

Do not use packing at any of the interfaces between the test specimen, auxiliary platens, spacing blocks and machine platens.

6.2.4 *Loading*. Apply a load smoothly at a rate of 2 N/s to 10 N/s until a strain of approximately 0.0022 is indicated. Record the applied load, N_1. Smoothly remove and re-apply the load at least twice to ensure that the specimen and platens are well seated and that the strain gauges are indicating consistently.

If the individual strains are not within a range of ± 10 % of their mean value at N_1, centre the test specimen again and repeat the procedure. If it is not possible to reduce the differences to within this range, do not proceed with the test.

Next, zero the strain gauges (or the recorder) while the specimen is under a load, N_2, approximately 10 % of that previously recorded. Measure the increase in strain as the load is quickly cycled between loads N_2 and N_1, four cycles being recorded.

7 Calculation

Calculate the secant modulus by dividing the difference between the two levels of applied load by the means of the eight strain readings and expressing this as compressive stress per unit cross-sectional area. Calculate the mean secant modulus for a minimum of three specimens originating from the same mix. Express the value of the secant modulus to the nearest 0.1 kN/mm^2.

8 Test report

The following information shall be included in the test report:

a) date and site of sample preparation;

b) date of test;

c) ambient conditions during the preparation, curing and testing of the test specimen and the age of the test specimen when tested;

d) complete identification of the material tested including type, source, manufacturer's code numbers and history;

e) cross-sectional area of the centre of the test specimen;

f) upper (N_1) and lower (N_2) load levels used in the testing cycle;

g) mean strain;

h) secant modulus of elasticity of each test specimen;

i) arithmetic mean secant modulus of elasticity;

j) type of test machine used;

k) type of strain gauge or compressometer used.

Publications referred to

BS 410, *Specification for test sieves.*
BS 812, *Methods for sampling and testing of mineral aggregates, sands and fillers.*
BS 812-1, *Sampling, size, shape and classification.*
BS 1610, *Methods for the load verification of testing machines.*
BS 1881, *Testing concrete.*
BS 1881-115, *Specification for compression testing machines for concrete.*
BS 4408, *Recommendations for non-destructive methods of test for concrete.*
BS 4408-2, *Strain gauges for concrete investigations.*
BS 6319, *Testing of resin compositions for use in construction.*
BS 6319-1, *Method for preparation of test specimens.*

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