

STANDARDS AUSTRALIA

RECONFIRMATION

OF

AS 1012.17—1997

Methods of testing concrete

**Method 17: Determination of the static chord modulus of elasticity and Poisson's ratio
of concrete specimens**

RECONFIRMATION NOTICE

Technical Committee BD-042 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

Certain documents referenced in the publication may have been amended since the original date of publication. Users are advised to ensure that they are using the latest versions of such documents as appropriate, unless advised otherwise in this Reconfirmation Notice.

Approved for reconfirmation in accordance with Standards Australia procedures for reconfirmation on 9 September 2014.

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The University of New South Wales

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NOTES

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Methods of testing concrete

Method 17: Determination of the static chord modulus of elasticity and Poisson's ratio of concrete specimens

PREFACE

This Standard was prepared by the Standards Australia Committee BD/42, Methods of Testing Concrete, to supersede AS 1012.17—1976. This Standard is part of a series applying to the sampling and testing of concrete.

The objective of this Standard is to provide those involved in the testing of concrete with methods for the determination of static chord modulus of elasticity and a method for the determination of Poisson's ratio.

In preparing the methods set out in this Standard, the Committee has taken into account experience in Australia and the methods described in ASTM C469, *Standard Method of Test for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression*. Acknowledgment is made of the assistance received from this source.

The term 'normative' has been used in this Standard to define the application of the appendices to which it applies. A 'normative' appendix is an integral part of a Standard.

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE This Standard sets out methods for the determination of static chord modulus of elasticity and a method for the determination of Poisson's ratio.

1.2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS

- 1012 Methods of testing concrete
- 1012.8 Method 8: Method for making and curing concrete compression, indirect tensile and flexure tests specimens, in the laboratory or in the field
- 1012.9 Method 9: Method for the determination of the compressive strength of concrete specimens
- 1012.12 Method 12: Method for the determination of mass per unit volume of hardened concrete
- 1012.14 Method 14: Method for securing and testing cores from hardened concrete for compressive strength
- 1379 The specification and manufacture of concrete
- 1545 Methods for the calibration and grading of extensometers
- 3600 Concrete structures

SECTION 2 METHODS FOR THE DETERMINATION OF THE STATIC CHORD MODULUS OF ELASTICITY

2.1 SCOPE OF SECTION This Section sets out the methods for the determination of the static chord modulus of elasticity of moulded concrete cylinders and cores.

NOTE: The static chord modulus of elasticity is defined as a gradient of the chord drawn between two specified points on a stress/strain curve.

The methods are as follows:

- (a) *Method 1* Method 1 is based on the measured compressive strength of the concrete. It requires a test load of 40 percent of the average compressive strength of moulded cylinders or cores tested in accordance with AS 1012.9 or AS 1012.14 respectively.
- (b) *Method 2* Method 2 is based on the characteristic strength of the concrete (f'_c). It requires a test load of 40 percent of the characteristic strength (f'_c), as defined in AS 3600 and AS 1379.
- (c) *Method 3* Method 3 is based on density of the concrete. This method describes the procedure for the determination of the static chord modulus of elasticity of moulded concrete cylinders and cores for which neither the compressive strength nor the characteristic strength of the concrete is known. The test load is that which is equivalent to the strain limits given in Table 2.1, which depend upon the density of the test specimens.

2.2 MEASUREMENT PROCEDURES Procedures applicable to Methods 1, 2 and 3 shall be as follows:

- (a) Measurement of strain by compressometer, as described in Clause 2.3.2(c) and (d).
- (b) Measurement of strain by means of attached strain gauges, as described in Appendix A.

2.3 APPARATUS

2.3.1 General The apparatus for the determination of compressive strength of moulded cylinders shall be in accordance with AS 1012.9, and deformation measuring apparatus shall be in accordance with AS 1545, Grade C, and comply with Clause 2.3.2. The deformation sensing device may use dial or digital gauges, linear variable displacement transducers (LVDT), OR bonded strain gauges.

2.3.2 Deformation-measuring apparatus The deformation-measuring apparatus shall be as follows:

- (a) *General* The apparatus shall consist of a sensing device suitable for measuring the deformation to the nearest 10×10^{-6} m/m. The apparatus shall be positioned symmetrically about the mid-height of the specimen and shall read the deformation on at least two gauge lines, which shall be diametrically opposite, or if more than two are used they shall be symmetrically distributed around the specimen. If bonded strain gauges are used, they shall be of a design suitable for use on concrete, and all of those used on the one specimen shall be from the same batch.

The lengths over which the measurements are made shall be neither less than three times the nominal maximum aggregate size, nor greater than two-thirds of the height of the specimen.

- (b) *Compressometer consisting of two yokes and two gauges* (see Figure 2.1) Both yokes shall be rigidly attached to the specimen, by means of at least three symmetrically placed attachment points on each yoke.
- (c) *Compressometer consisting of two yokes, a mechanical averaging device, and one gauge* (see Figure 2.2) One yoke shall be rigidly attached to the specimen by means of at least three symmetrically placed attachment points. The other yoke shall be attached at two diametrically opposite points so that, within limits, it is free to rotate.

The rotating yoke shall be connected to the fixed yoke by a pivot rod to maintain at this point a constant distance between the two yokes. A gauge shall be located on the point diametrically opposite to the pivot rod to measure the change in distance resulting from the rotation of the one yoke relative to the rigidly attached yoke. The measurement will be a function of the average deformation between the diametrically opposite attachment points of the rotating yoke and those of the fixed yoke, and the symmetry of the compressometer. The deformation of the specimen is calculated from the following equation:

$$d = \frac{g e_r}{e_r + e_g} \quad \dots 2.3.2$$

where

d = total deformation of the specimen through the effective gauge length, in millimetres

g = gauge reading, in millimetres

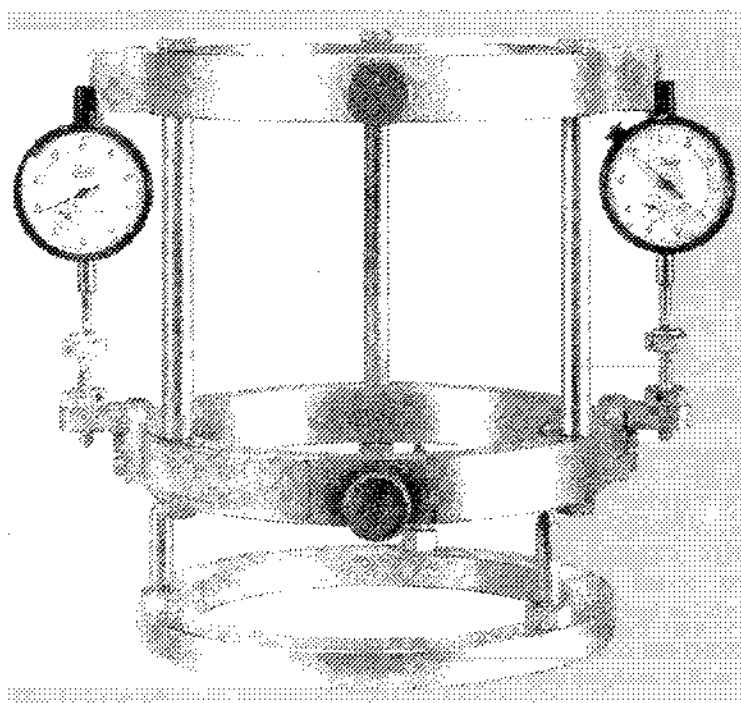
$\frac{e_r}{e_r + e_g}$ = the compressometer factor

e_r = eccentricity of the rod, measured in millimetres to the nearest 0.0025 mm from the axis of the specimen

e_g = eccentricity of the gauge, measured in millimetres to the nearest 0.0025 mm from the axis of the specimen.

NOTE: It is suggested that, for the compressometers described above, a jig and positioning rods of the type illustrated in Figure 2.1 should be used to centre the compressometer around the specimen before clamping in place. The jig and positioning rods are removed prior to the commencement of loading.

- (d) *Demountable gauges* For this apparatus, reference points shall be positively attached to the concrete specimen. An adhesive shall be used which is appropriate for use on concrete, and which shall be applied in accordance with the manufacturer's instructions. Reference points relying on friction shall not be used.
- (e) *Attached strain gauges* Strain gauges shall be attached firmly to the concrete by means of an adhesive using a technique appropriate to the type of gauge used. One method which has been successfully adopted for flexible resistance gauges is outlined in Appendix B.



NOTE: Note the jig and positioning rods used to centre the compressometer before clamping.

FIGURE 2.1 TYPICAL COMPRESSOMETER ARRANGEMENT FOR MEASUREMENT OF LONGITUDINAL STRAIN

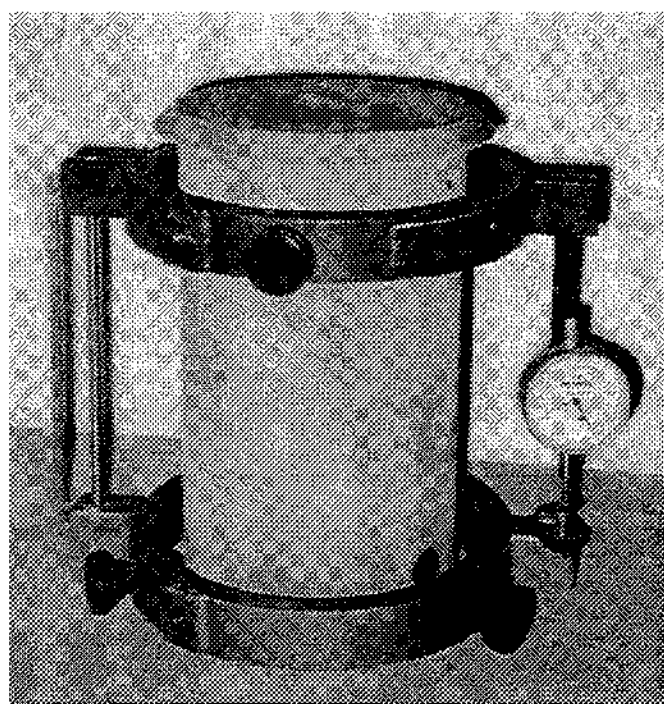


FIGURE 2.2 TYPICAL COMPRESSOMETER ARRANGEMENT FOR MEASUREMENT OF LONGITUDINAL STRAIN (WITH A MECHANICAL AVERAGING DEVICE AND ONE DIAL GAUGE ONLY)