

Australian/New Zealand Standard™

**Masonry units, segmental pavers and flags—
Methods of test****Method 15: Determining lateral modulus of
rupture**

This Standard incorporates Amendment No. 1 (August 2004). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

1 SCOPE

This Standard sets out the method for determining the lateral modulus of rupture of masonry units.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

2193 Calibration and classification of force-measuring systems

AS/NZS

4456 Masonry units, segmental pavers and flags—Methods of test

4456.0 Part 0: General introduction and list of methods

4456.1 Method 1: Sampling for testing

4456.2 Method 2: Assessment of mean and standard deviation

3 DEFINITIONS

For the purpose of this Standard, the definitions given in AS/NZS 4456.0 apply.

4 PRINCIPLE

A test specimen with length to depth ratio of at least 5:1 is placed with its ends on bars and with the bedding faces vertical. A load is applied through two bars at approximately the third points of the span, until the specimen fails. The maximum bending moment is used to calculate the lateral modulus of rupture.

5 APPARATUS

The following is required:

- (a) A testing machine that complies, as regards accuracy, with the provisions for Grade A or Grade B machines given in AS 2193.

The machine shall be fitted with support bars and loading bars that will permit the loading of test specimens as simple beams, as shown diagrammatically in Figure 1. The support bars and loading bars shall be not less than 25 mm and not more than 40 mm diameter, parallel, and normal to the long axis of the specimen. Both loading bars and one of the support bars shall be self-aligning. For specimens made from multiple units, the loading bars shall be symmetrically located on the central unit of

the specimen and at a distance apart equal to one third of the span. If the loading points lie outside the central unit, the loading bars shall be located on the central unit within 30 ± 5 mm of each joint. For specimens consisting of a single unit, the loading bars shall be symmetrically located at the third points of the span.

NOTE: It is permissible to determine the lateral modulus of rupture on samples of 10 individual units by means of an apparatus that applies pure bending moment.

- (b) A rule that can be read to an accuracy of 1 mm over the dimensions of the units being tested.

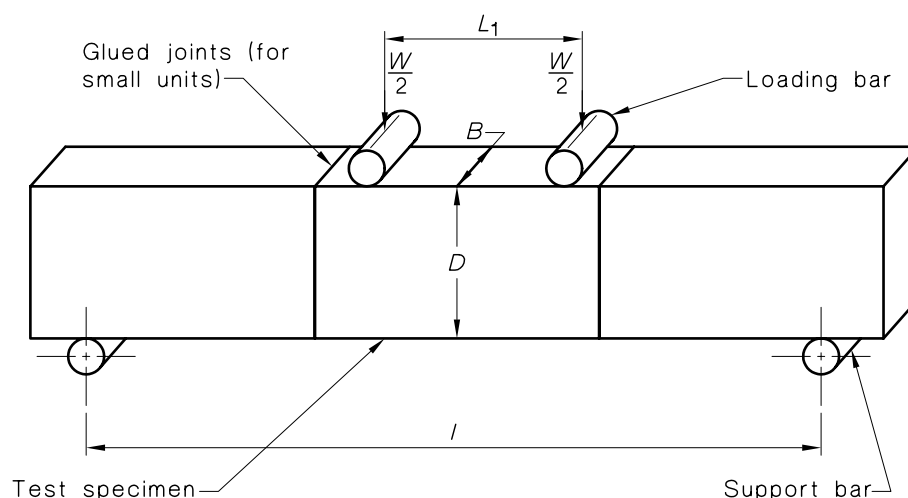


FIGURE 1 METHOD OF LOADING TEST SPECIMEN

6 PREPARATION OF TEST SPECIMENS

6.1 Selection

Specimens accumulated from continuous sampling shall be deemed to meet the requirements of this method. For assessment of an individual lot, a sufficient number of units for 10 beams shall be selected in accordance with AS/NZS 4456.1.

Assembled specimens (see Figure 1) shall have a span to depth ratio not less than 5, and a total length of at least 50 mm greater than the span.

Large solid units with length sufficient to accommodate the required span-to-depth ratio may be used without further preparation.

Other units of similar external dimensions shall be bonded end to end with epoxy resin to construct specimens with the required span-to-depth ratio. Care shall be taken to align the side and bedding faces.

Specimens may be tested without preconditioning. Specimens may be allowed to air-dry before testing. Details of any preconditioning shall be reported.

6.2 Dimension used for calculations

Where the work sizes are known, these dimensions shall be used for the calculation of gross areas or face-shell areas.

When the work sizes are not known, the dimension shall be obtained from the mean of three measured specimens to an accuracy of 1 mm. For hollow units with face-shells, where work sizes are not known, the face-shell thickness at mid-height of the unit shall be used.

7 PROCEDURE

The procedure shall be as follows:

- (a) Centre the specimen on the support bars with the bedding faces of the units vertical.
- (b) Bring the loading bars to bear on the upper face of the specimen symmetrically between the support bars.
- (c) Apply the test load, without shock, at a uniform rate not greater than 6 kN/min until failure occurs.
- (d) Observe and record the maximum load (W) carried by the specimen, the location of the failure and whether the failure is in the central unit.

NOTE: It is acceptable to use the load at the failure of a joint but this should be noted; however, there is the option of regluing the joint and repeating the test.

- (e) Measure and record the following dimensions to the nearest millimetre:
 - (i) The distance (l) between centres of supporting bars in the testing machine.
 - (ii) The distance (l_1) between centres of loading bars in the testing machine.

8 CALCULATION OF RESULTS

The lateral modulus of rupture of each specimen, with the exception of any specimen in which failure occurs, other than in the joint or central unit, shall be calculated from the following expression:

NOTE: Failure in or adjacent to the joint is not truly representative of the flexural properties of the unit but can be conservatively used in the assessment of the lateral modulus of rupture.

$$T_n = M / Z$$

where

- T_n = lateral modulus of rupture, in megapascals
 M = bending moment at failure, in newton millimetres
 $= 1000W \left(\frac{l - l_1}{4} \right)$
 W = total load at which the specimen fails, in kilonewtons
 l = distance between support bars, in millimetres
 l_1 = distance between loading bars, in millimetres
 Z = section modulus of test specimen, in cubic millimetres
 $= \frac{BD^2}{6}$ for solid and cored units, or $\frac{B(D^3 - d^3)}{6D}$ for hollow units
 B = work size width of each specimen, in millimetres (see Figure 1)
 D = work size depth of each specimen, in millimetres (see Figure 1)
 d = $D - 2 \times$ (work size face-shell thickness)

For the purpose of these calculations, no allowance shall be made for any reduction in area of the cross-section of a specimen from frogs or perforations.

NOTE: If the work sizes for the unit are not available, the procedures of Clause 6.2 should be used.