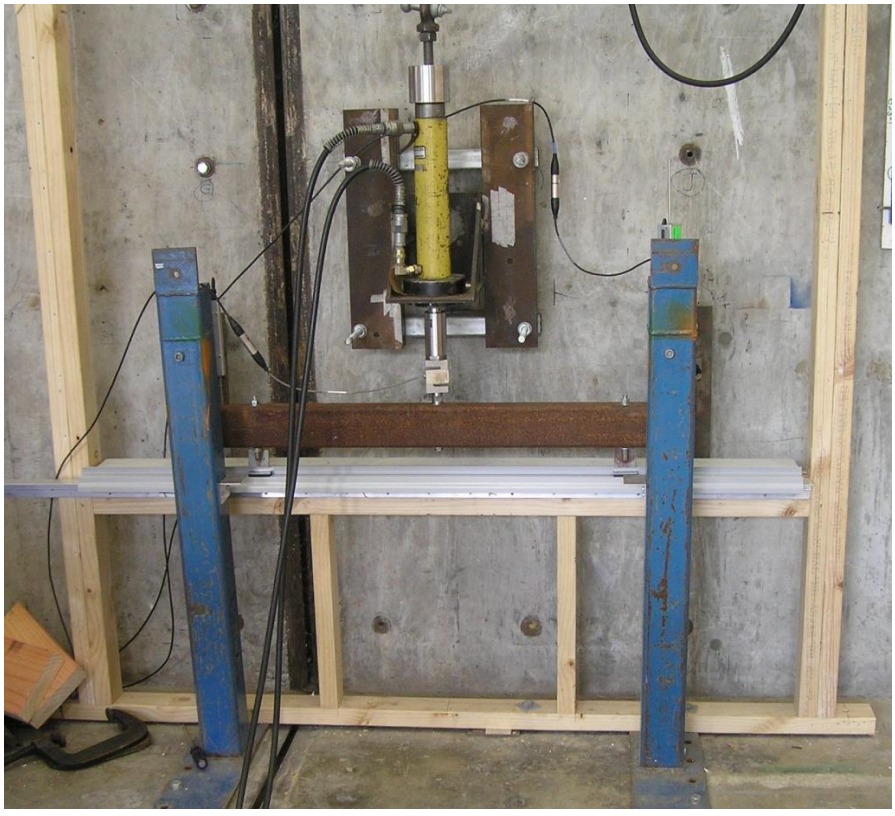
Evaluation Method

No. 6 (2011)

Test and evaluation procedure for window and door supports



The development of the method outlined here was funded by the Building Research Levy and Department of Building Housing

BRANZ EM6 Evaluation method

Purpose: For testing and evaluation of the capacity of systems to support vertical loads from aluminium window and/or door joinery frame units.

1.0 Use and limitation of the test method

The method may only be used for systems supporting aluminium window and/or door joinery frame units which comply with NZS 4211:2008. The results are only applicable to support systems installed in timber framed buildings which are within the scope of NZS 3604:2011 and which incorporate drained cavities (including brick veneer construction) complying with E2/AS1:2011.

The results are only applicable to load eccentricities less than or equal to 50 mm.

The results are only applicable to the support substrate as tested and to the fixings used in the test. The possible support substrates in the test are timber framing, in-situ concrete slabs, and concrete slabs edged with 'masonry header blocks'. The maximum window weight, W, determined in Section 4 for construction using concrete 'header blocks' is deemed to also be applicable for in-situ concrete slabs.

The maximum weight of a window system with multiple panes, within the same window frame, may not be greater than the window weight, W, as derived in the test method herein. This may be increased for multi-pane systems if separately assessed by the testing laboratory or a Chartered Professional Engineer using the data from the test report.

Background to this test method is given by Thurston (2010).

2.0 General description of test arrangement and procedure

The test arrangement is shown in Figures 1 and 2. The timber framing used in the test shall be constructed to NZS 3604:2011 using kiln dried 90 x 45 mm SG8 framing. The system to support vertical window/door loads shall be installed in the test in the manner to be used on site.

Load is applied to the mid-span of a load beam which is supported on load plates at the two locations shown, being at quarter points of the overall frame opening. The eccentricity in the out-of-plane direction of the half-round welded to the load plate is 50 mm (see Figure 1). The load plate rests on the window support mechanism and the two may be screwed together for stability. The applied load and the deflection of the frame at each load plate location is be monitored continuously during the test.

3.0 Details of testing

This section provides details of the test to support vertical loads from a window. The setup for testing supports for doors is similar. The material properties and test arrangement shall simulate the worst conditions to which the support system may be used in practice and comply with the following:

- Timber framing and fixings shall comply with NZS 3604:2011.
- Concrete shall be either 17.5 MPa concrete from a certified ready mix plant or else volume batched using a 6:1 sand/cement ratio with no admixtures.

A cross sectional detail of the loading to be applied where the window support is fixed to timber framing is shown in Figure 1(a). Where the window support is a concrete slab, or concrete blocks forming formwork for a concrete slab, the test shall be done using the concrete blocks as shown in Figure 1(b).

An elevation of the test setup for window supports fixed to timber framing, shown before the window support system is installed, is shown in Figure 2. The bottom plate shall be bolted to the floor and the top plate shall be prevented from moving in the horizontal plane by fixing it to a reaction frame or strong-wall. The setup for fixing to a concrete slab support is similar except the sill trimmer is replaced with appropriate substrate as shown in Figure 1(b).

A load ram is fixed to a rigid frame or strong-wall at one end and the other end applies load to a load beam. The ram location shall be arranged so that the applied load is at the target eccentricity of 50 mm.

Where the support system is attached to a substrate at discrete points (e.g. screws) the fixings shall be arranged in the test in the worst possible location that could occur relative to the support locations in practice. Only the results of the weakest layout shall be used in the analysis. *For instance, where a support system is continuous with intermittent screws, load shall be applied in one test directly above a screw and separately tested at mid-way between screws Where the support system is not continuous, but consists of two or more discrete elements, the load shall be applied in the worst possible location that could occur on site if the support system is placed compliant with the installation instructions.*

Load shall be applied at a maximum rate of 2 kN/minute until failure or the target load is reached.

The window deflection shall be measured at the locations shown in Figure 1, and the maximum value from the two readings shall be used in the calculations in Section 4.0. The deflection measurements must be performed with instruments calibrated to be accurate to 0.2 mm.

The total applied load shall be measured with a load cell with calibration to International Standard EN ISO 7500-1 1999 and be of Grade 1 accuracy at 0.2 kN.

4.0 Evaluation of maximum window weights.

The maximum window weight, W, shall be the lesser of the values obtained from serviceability limit state criteria W_s, and ultimate limit state criteria, W_u, as defined below.

- $W_s = F_s/k_t$
- $W_u = F_u/(1.35 \times k_t)$

Where:

- F_s (the serviceability limit load) is the lesser of the load at which damage occurred in the test specimen or will occur in the prototype on site at that deflection, or will result in loss of function or visual impairment. Loss of function includes loss of water-tightness or windows jamming etc. This is a deflection level selected by the window support manufacturer but shall not be more than 2 mm.
- F_u (the ultimate limit state load) is the lesser of the load at which collapse occurs, a fixing or element ruptures in the window support system, the deflection exceeded 30 mm, and the maximum load applied to the test specimen. (Note, the ultimate action force from NZS 1170.0 is 1.35 times the gravity load.)
- k_t is as defined in AS/NZS 1170.0:2002 Appendix B assuming a coefficient of variation of 15%. This defines a prototype design capacity = minimum value of test results/k_t. Thus, for EM6, if two identical specimens were tested use k_t =1.64 and put F_s or F_u as applicable = the minimum of the two results.

  Note, 1 kN can be taken as 102 kg weight.

5.0 Reporting

The report shall contain the following information:

(1). The name of the testing agency performing the tests.
(2). The name of the person responsible for the test.
(3). The location and dates over which the testing was undertaken.
(4). Framing timber, sizes and grade and fixing method.
(5). Details of the window framing used.
(6). Full details of the vertical support system and fixings.
(7). An elevation drawing to scale and with dimensions showing framing member layout.
(8). Full details of the construction used, including the window framing and support system so that a third party could duplicate the test.
(9). Details of glazing setting blocks, window support blocks and other window components relevant to the load path.
(10). Load location with respect to support details.
(11). Load eccentricity used.
(12). Details of instrumentation used.
(13). Description of the mode of failure.

(14). Plot of the load versus displacement monitored by each deflection gauge.
(15). Calculation sheets showing derivation of the maximum window weight, W, that may be used with the support system.
(16). Photographs and drawings.

Where the framing uses members or fixings additional to what is specified in NZS 3604:2011, the details must be specified in the test report and in the window/door support manufacturer's installation instructions and must be used in the construction used on site.

6.0 References.

Department of Building Housing. 2011. Compliance Document for the New Zealand Building Code, Acceptable Solution E2/AS1 for Clause E2. DBH, Wellington, New Zealand.

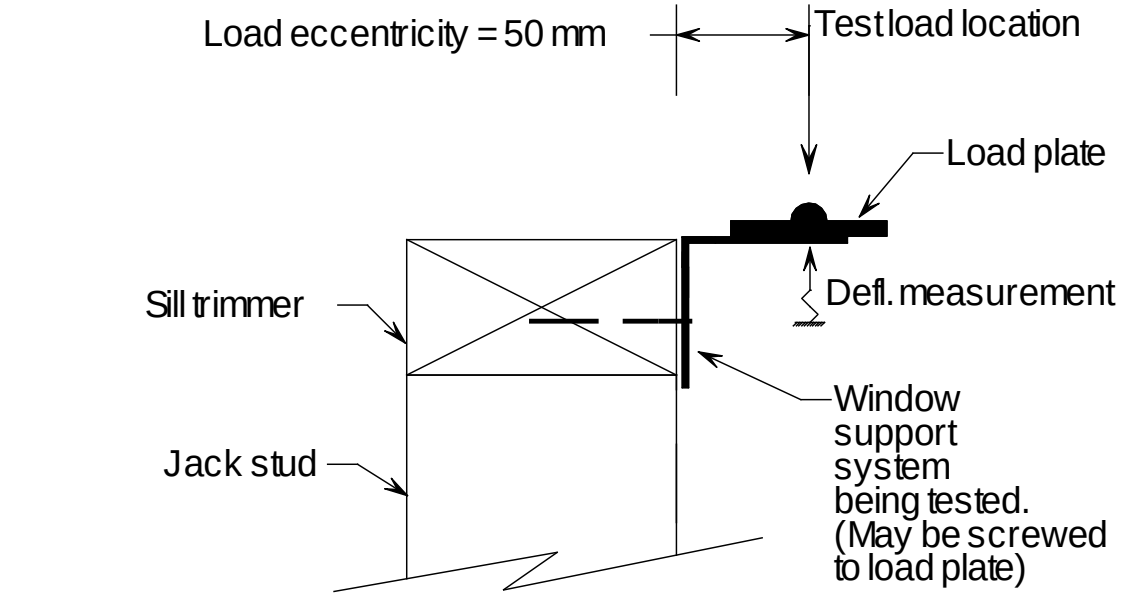
International Organization for Standardisation. 2004. Metallic materials - Verification of static uniaxial testing machines - Part 1: Tension/compression testing machines - Verification and calibration of the force-measuring system. ISO 7500-1 2004.

Standards New Zealand. 2002. AS/NZS 1170.0 *Structural design actions. Part 0: General principles.* SNZ, Wellington, New Zealand.

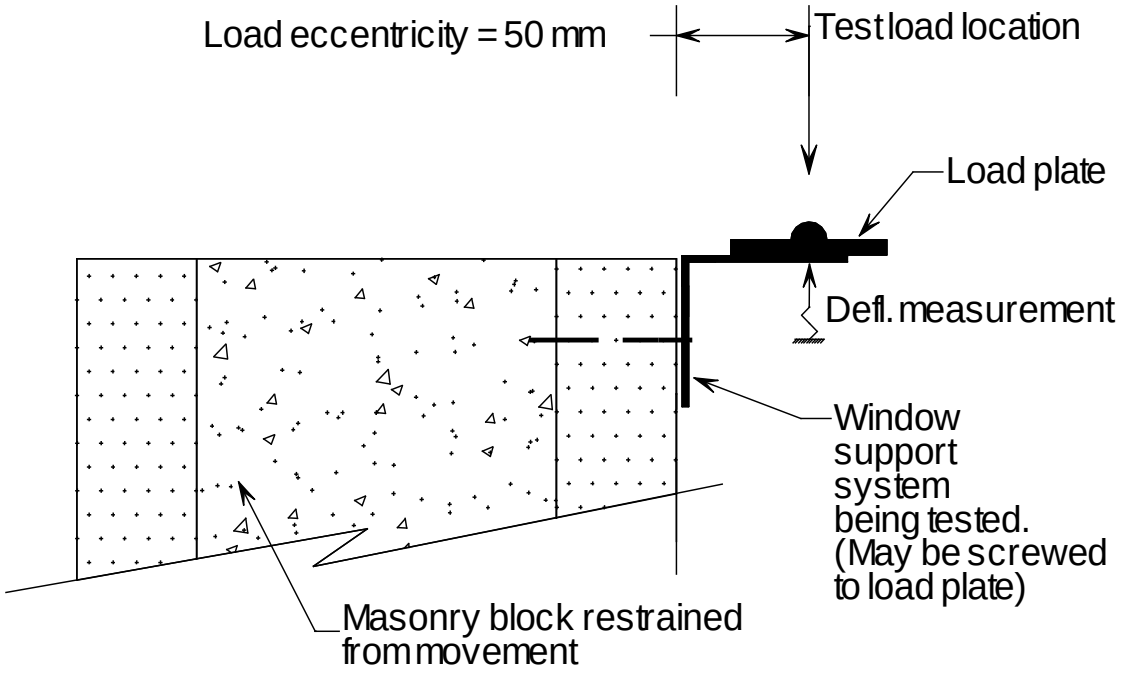
Standards New Zealand. 2008. NZS 4211 *Specification for performance of windows.* SNZ, Wellington, New Zealand.

Standards New Zealand. 2011. NZS 3604 *Timber framed buildings.* SNZ, Wellington, New Zealand.

Thurston, SJ. 2010. Installation of domestic windows. BRANZ Study Report 242. BRANZ Ltd, Judgeford, New Zealand.



(a) Support fixed to timber framing



(b) Support fixed to masonry block

Figure 1. Cross section of test loading of window frame.

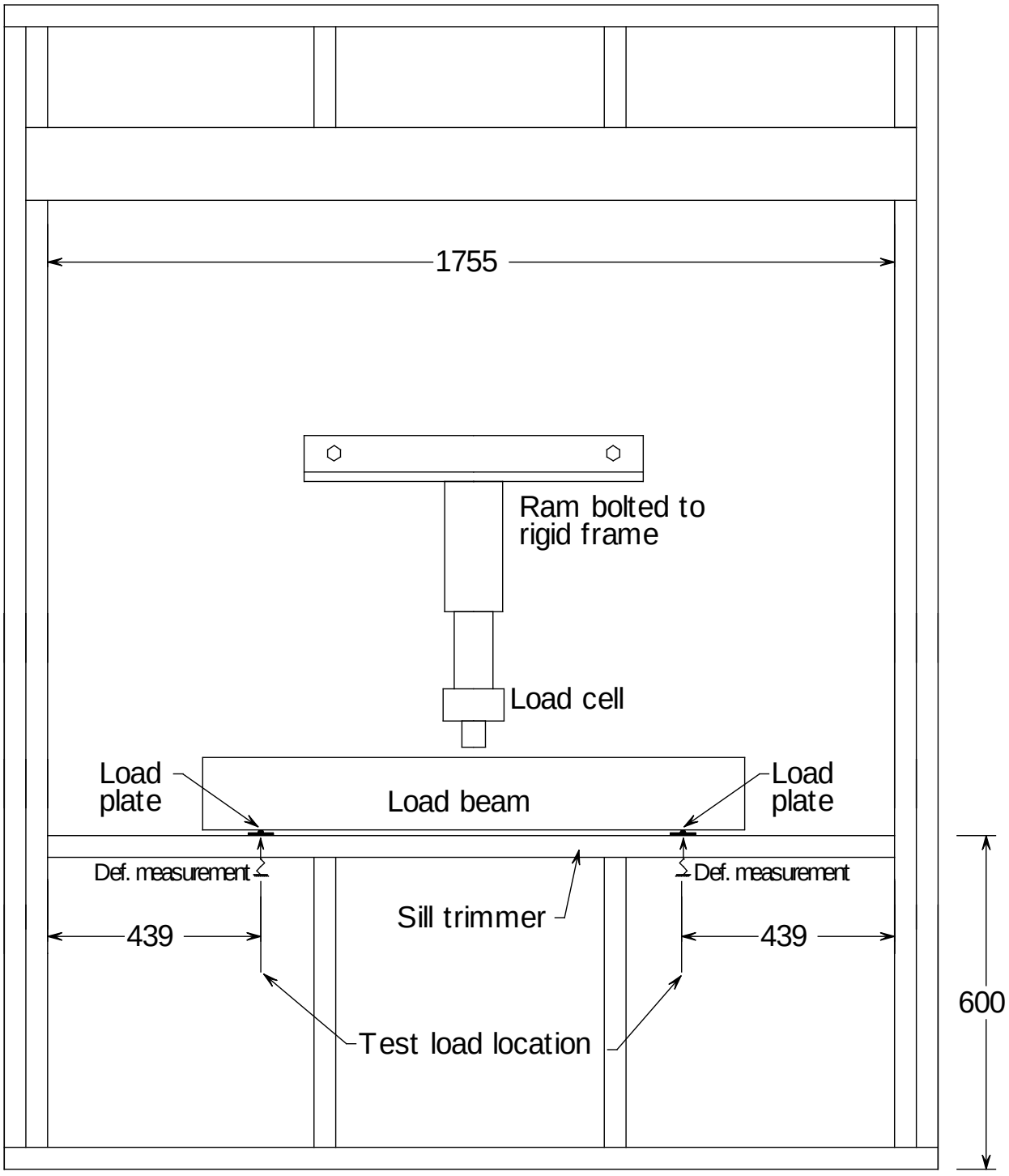


Figure 2. Elevation of test setup – before support system is installed.