BRANZ

ST0791/3

A face load test on a Rockcote AAC panel wall cavity system

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   iii. any defects in the Products the subject of the Services; or

   iv. any changes, modifications or alterations to the Products the subject of the Services.

A face load test on a Rockcote AAC panel wall cavity system

1. CLIENT

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2. OBJECTIVE

The results from pull-though tests of screws connecting Rockcote aerated concrete panels to timber framing are given in BRANZ test report ST0791/1. Based on these test results, values for design wind speeds and wind pressures were calculated corresponding to the wind zones of New Zealand's timber framed building standard NZS 3604[1]. The purpose of the tests described herein was to verify that the results are applicable to complete walls using the Rockcote aerated concrete panel cavity wall system and to verify that no unexpected failure mechanism is likely to influence these conclusions.

3. DESCRIPTION OF TEST SPECIMENS

A test specimen of nominal size 2.4 m x 2.4 m was constructed by the client at BRANZ. The specimen size was selected to fit in the opening in the laboratory pressure chamber as shown in Figure 1. Studs were at nominal 600 mm centres and nogs at 1200 mm centres. All framing timber was 90 x 45 grade MSG 8 Radiata Pine assembled using normal trade practice. Full height polystyrene battens, of cross section 50 x 20 mm, were fixed to the front face of the studs to leave a 20 mm air-gap between studs and panels. Short lengths of these battens were also used between studs on the front face of top and bottom plates and nogs. General photographs of construction and installation of the specimen into the pressure chamber and shown in Figures 1 to 3.

This report pertains to the wall tested only. This was a timber framed wall clad with 12 lightweight panels screwed to the timber framing.

The galvanised steel screws were 100 mm long and had a 14 mm diameter countersunk head. The screw had a 5.0 mm shank diameter with the bottom 50 mm threaded with a 6.4 mm outside thread diameter. They were designed to be self drilling in timber and steel.

The panels were made from autoclaved aerated concrete panels with a measured density of 622 kg/m^3 and contained a steel mesh with 3.2 mm diameter bars at nominal spacing of 180 mm in both directions. The panels were nominally 50 mm thick, 600 mm height and 600 or 900 mm long as shown in Figure 8. Screws described in the paragraph above were used to fix each panel to the studs at mid-height and 50 mm from the top and bottom of the panel. The screws were countersunk into the panels so that the top of the head of each screw finished slightly indented into each panel. All panel joints were filled with a cement based mortar (Multistop Bedding Compound). After assembly, the panel was coated with a 3 mm thick plaster which had a blue fibreglass mesh embedded in the top surface. The panel was finished with a Rockcote texture.

The panels finished flush with the underside of the bottom plate.

4. TEST DESCRIPTIONS

4.1 Date and Location of Tests

The tests were carried out at the Structures Testing Laboratory of BRANZ, Judgeford, Wellington during September 2009.

4.2 Test Equipment

The specimen was secured in an upright position within the front opening of an airtight pressure chamber with the plastered face inside. The top and bottom plates were securely fixed directly to the perimeter of the chamber with Tek screws. A layer of 250 µm polythene film was placed between the timber battens and the lightweight panels at the time of the specimen construction to achieve air tightness. The sides of each specimen were not fixed, but were sealed all around using the polythene sheet and adhesive tape so that the studs of the test wall could deflect without restraint from the side of the chamber.

Negative pressure (suction) was applied to the chamber using a centrifugal air pump. The fan speed was automatically computer controlled during the test to the target cyclic loading regime.

The pressure was measured with a Schaevitz differential pressure transducer connected to the inside of the chamber by a length of thick walled plastic tube.

The test pressure was recorded using a PC running a software program to record the data.

4.3 Test Procedure

The specimen was tested under negative pressure applied to the chamber shown in Figure 1 corresponding to “suction” on a building. The pressure was applied in increasing steps of 0.1 kPa. Each pressure step was held for one minute. The pressure was then released back to zero for 15 seconds before the next level of pressure was applied to the specimen. This test procedure is based on AS 4040.2:1992[2].

5. OBSERVATIONS

At 3.6 kPa the studs had sheared 20 mm on the top plate. To help preclude failure here and at the bottom of the specimen, a strong-back was installed at both top and bottom stud/plate junctions. In addition a strong-back was installed at wall mid-height to help share the load between studs should one stud be weaker than the others. Photographs of these strong backs are shown in Figures 4 to 5.

At 5.5 kPa one end stud had cracked at a knot as shown in Figure 6. The strongback was extended at this location so that the stud loading was partially resisted by the edge of the pressure box as shown in Figure 6.

As the conclusions reached in this report requires the wall framing to be specifically designed for the design loads, these strong-back modifications are not considered to prejudice the conclusions reached.

At 5.0 kPa suction a horizontal crack was visible through the surface plaster coating at 1.8 m from the base of the wall. This was at a line of horizontal panel joints.

No other damage was observed during the test.

6. RESULTS

The minimum value of maximum pressure resisted for at least one minute was 6.40 kPa. The test was stopped before failure as this was close to the limit of the BRANZ test rig.

7. CONCLUSIONS ON DESIGN WIND PRESSURES

The analysis below assumes that the framing is separately designed for the design wind loading. The conclusions given below are only applicable if the screws fixing the panels are used at the locations described in this report.

AS 4040.2-1992[2] states that the test pressures are to be equal to the design pressures multiplied by the appropriate factor for variability. The factor for variability has been taken from Table 5.1 of AS 1562.1:1992[3] and for a single specimen it is 1.5 for Strength Limit State. The Ultimate Limit State (ULS) design differential pressure, p_d, is therefore given by p_d = 6.48/1.5 = 4.32 kPa. This is less than the 4.93 kPa design wind differential pressure for a screw given in BRANZ test report ST0791/1. Thus, the design wind differential pressure is taken as 4.32 kPa.

8. REFERENCES

1. Standards New Zealand. NZS 3604:1999. *Timber Framed Buildings*. SNZ, Wellington, New Zealand
2. Standards Australia. AS 4040.2 – 1992. *Method of testing roof and wall cladding. Method 2: Resistance to wind pressures for non-cyclone regions.* SA, Sydney, Australia.
3. Standards Australia. AS 1562.1 – 1992. *Design and installation of sheet roof and wall cladding*. SA, Sydney, Australia.

Figure 1. Specimen in the test chamber

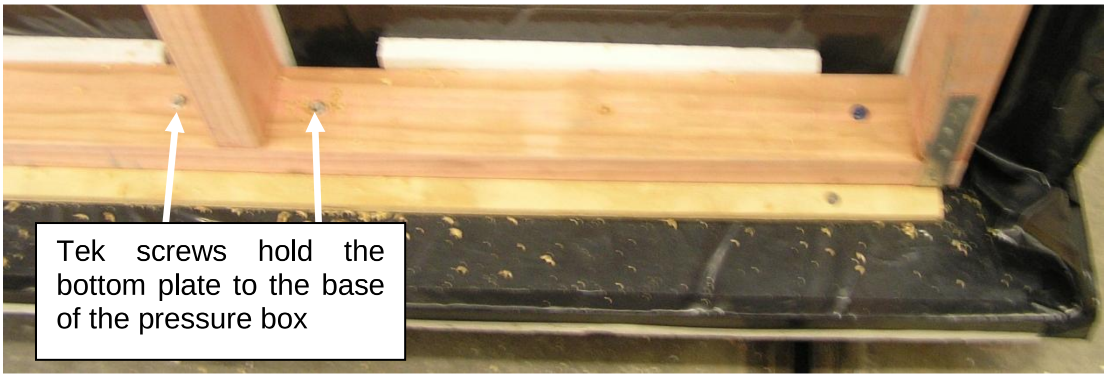

Figure 2. Tek screws used to fix the test wall at the base.

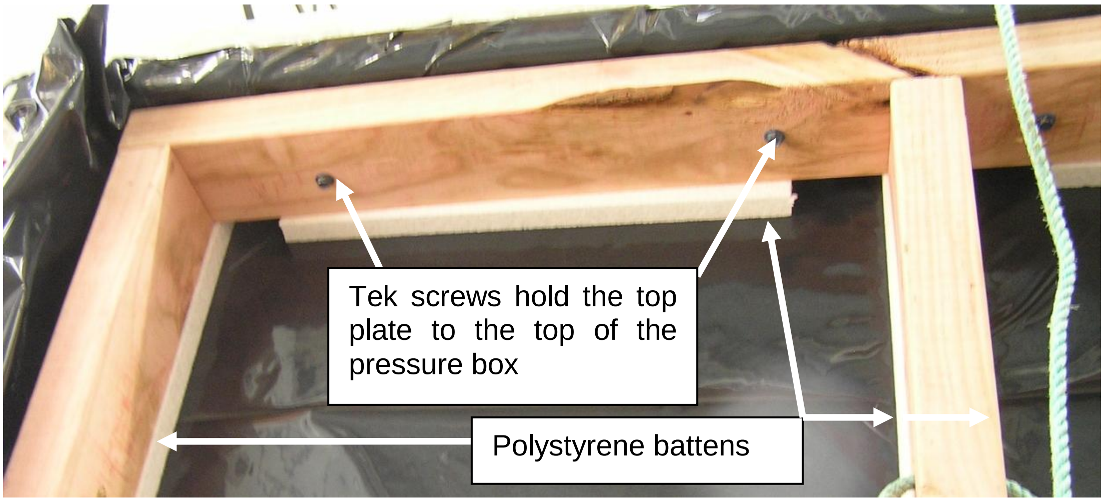

Figure 3. Tek screws used to fix the test wall at the top and polystyrene battens.

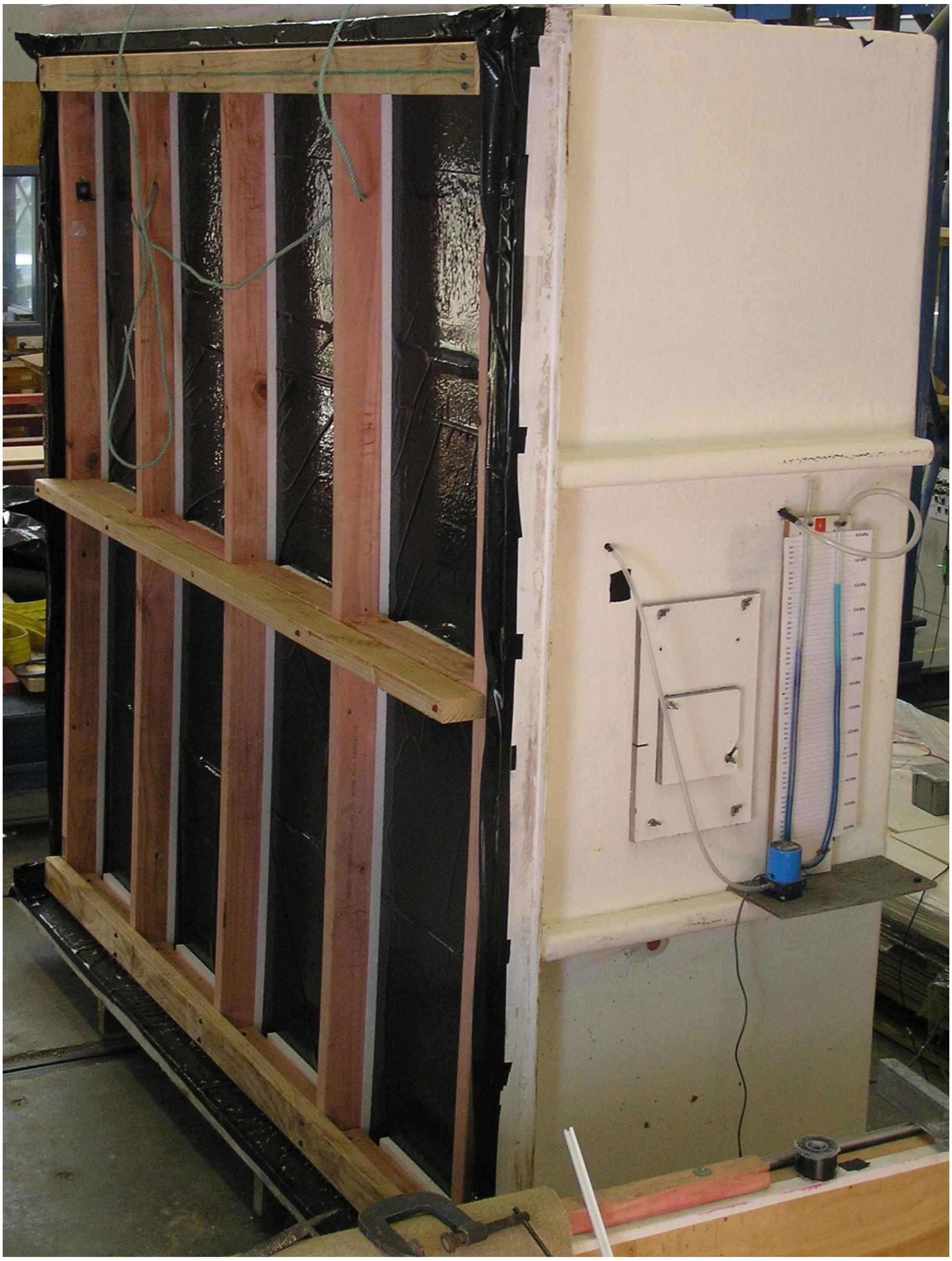

Figure 4. Strong-backs added. Photograph at 4.0 kPa load.

Figure 5. Detail of strong-backs at the top

Figure 6. Stud cracking at a knot at 5.5 kPa and stiffening piece G-clamped to strong-back

Figure 7. Stud bending at 6.0 kPa

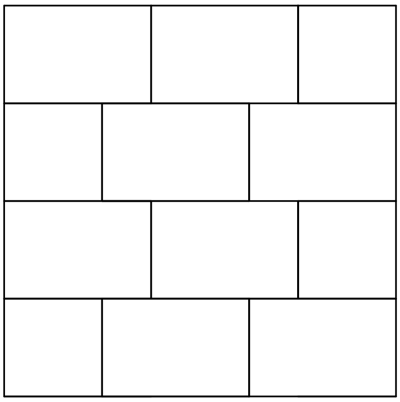

Figure 8. Panel layout

(Note, panels are 600 mm high and either 900 or 600 mm long)