STRUCTURES TEST REPORT

ST10322-001

A SERVICEABILITY LEVEL RACKING TEST ON A ROCKCOTE RESENE LTD AAC PANEL WALL CAVITY SYSTEM

CLIENT

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All tests and procedures reported herein, unless indicated, have been performed in accordance with the BRANZ ISO9001 Certification

TEST SPONSOR

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LIMITATION

The results reported here relate only to the items tested.

TERMS AND CONDITIONS

This report is issued in accordance with the Terms and Conditions as detailed and agreed in the BRANZ Services Agreement for this work.

SIGNATORIES

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1. OBJECTIVE

The test was performed to examine the damage to a nominal 50 mm thick autoclaved aerated concrete (AAC) Rockcote cavity wall system when the wall was subjected to both serviceability level and ultimate level seismic racking deflections. These were taken to be ±19.8 mm and ±62 mm, respectively over a 2.4 m height, equivalent to ± 24 mm and 75 mm, respectively over a 2.9 m storey height.

2. DESCRIPTION OF SPECIMEN

This report pertains to the wall tested only. This was a timber framed wall clad with 8 lightweight panels screwed to the timber framing through polystyrene battens on the face of the studs.

The timber frame for the nominally 2.4 m x 2.4 m test specimen was constructed by BRANZ staff. The remainder of the specimen was constructed at BRANZ by contractors under the direction of Rockcote Resene Ltd. Photographs at various stages of construction are given in Photos 1 to 3.

The studs were at 600 mm centres and nogs at 800 mm centres. All framing timber was 90 mm x 45 mm grade SG8 Radiata Pine assembled using normal trade practice. The end studs were fixed to the bottom plate and top plate with a 25 mm x 1 mm thick steel strap wrapped around the timber plates and nailed to the stud and plate with hot dipped galvanised flat head nails of nominal length 30 mm and 2.5 mm shank diameter. Six nails were installed into each side of the stud and three into each side face of the plate.

Polystyrene battens of cross-section dimensions 37 mm x 20 mm were used between wall framing and panels.

The galvanised steel screws used to fix the panels were 100 mm long and had a 14 mm diameter head. These screws had a shank of 5.0 mm diameter, were fully threaded over their length with an outside thread diameter of 6.4 mm. They were designed to be self-drilling in timber and had a countersunk head shape.

The panels were made from autoclaved aerated concrete with a nominal density of 620 kg/m^3 and contained a steel mesh with vertical 3.2 mm diameter bars at nominal spacing of 200 mm along the length of the panel and horizontal bars nominally 160 mm across the panel. Panels were installed with the long axis horizontal as shown in Photo 2. The panels were nominally 50 mm thick, 600 mm high and approximately 1000 mm or 1500 mm long so that the combination of two adjacent panels extended approximately 50 mm beyond the outside face of the end studs. Screws described in the paragraph above were used to fix each panel to the studs at 100 mm from the top and bottom of the panel at each stud. The head of each screw finished slightly below the surface of panels. All panel joints were filled with a cement-based mortar. Finally, a 5 mm thick surface plaster coating containing an unidentified blue fibreglass mesh was applied on the front surface of the panels.

The panels finished flush with the bottom of the bottom plate as can be seen in Photo 3.

3. DESCRIPTION OF TESTING

3.1 Date and location of test

The test was carried out in June 2018 at the Structural Engineering Laboratory of BRANZ Ltd, Judgeford, New Zealand.

3.2 Test arrangement and equipment

The racking test specimen was installed in a rigid steel loading frame. P21 end restraints were installed in accordance with the recommendations of BRANZ P21:2010. "A Wall Bracing Test and Evaluation Procedure" [1]. Photo 4 provides a view of the end of the specimen installed in the test rig.

The bottom plate was fixed through a strip of 20 mm thick particle board floor and the timber foundation beam to the steel test rig using M12 threaded rods at 100 mm from the outside face of the end studs and at 100 mm from one side of the middle stud. A 50 mm x 50 mm x 3 mm washer was installed between the nut on each rod and the bottom plate.

Horizontal load was applied to the centre of the specimen top plate with a 30 kN closed loop electro-hydraulic ram and measured with a 25 kN load cell.

Out-of-plane movement of top plates was prevented by mechanical restraints located as close as possible to the ends of the specimens. A linear potentiometer was used to measure the horizontal displacement of the top plate.

The test load and displacement measurements were recorded using a computer-controlled data acquisition system. The load cell was calibrated to International Standard EN ISO 7500-1:2015 [2] Grade 1 accuracy and the linear potentiometers were calibrated to an accuracy of 0.2 mm.

3.3 Test procedure

The loading sequence consisted of 3 displacement-controlled cycles of the specimen top plate to displacements of approximately ±10, ±20, ±30, ±62 and ±75 mm. The test was paused at the completion of each set of cycles to record observations.

4. OBSERVATIONS

No damage was observed during the ±10 mm and ±20 mm cycling.

During the cycles to ± 30 mm there was no damage to the face of the specimen. The screws at the top corners of the specimen appeared to be bending, but there was no observed damage to the panels.

While displacing towards + 62 mm, when the displacement reached 45mm the top corner of the top panel at one end of the specimen cracked and then broke at + 62 mm (Photo 5). In the reversing direction to – 62 mm, the top corner at the other end of the specimen broke off (Photo 6).

During the cycles to ± 75 mm the screws at the top and bottom of the specimen were bending as the panels displaced relative to the timber framing. At the completion of the cycling to

± 75 mm there was no observable damage to the plaster coating or the AAC panels except at the top corners of the specimen. The AAC panels were still well attached to the timber frame after the testing was complete.

5. CONCLUSIONS

In an earthquake, the AAC Rockcote cavity wall system is expected to “ride out” the expected deflections of the light timber frame to which it is attached with no observable damage at Serviceability Limit State deflections. Any slight cracking of the panels is not expected to be visible due to the plaster surface coating and would be of negligible consequence.

This conclusion does not apply at building corners which were not investigated in this study. Any damage here is expected to be repairable.

6. REFERENCES

(1) Shelton, R. 2010. Technical Paper P21 (2010) *A Wall Bracing Test and Evaluation Procedure*. BRANZ Ltd, Judgeford, New Zealand.

(2) International Organisation for Standardisation (ISO). 2015. *ISO 7500-1:2015 Metallic Materials – Verification of Static Uniaxial Testing Machines, Part 1: Tension/Compression Testing Machines – Verification and Calibration of the Force-Measuring System*. ISO, Geneva, Switzerland.

PHOTOS

Photo 1: Timber frame with polystyrene spacers fixed in place

Photo 2: Specimen with AAC panels installed

Photo 3: Contractor applying plaster and mesh

Photo 4: End view of the specimen in the test rig

Photo 5: Crack at the top corner during the + 62 mm cycle

Photo 6: Broken off piece of panel during the – 62 mm cycle

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