BRANZ
1222 Moonshine Road
Judgeford RD1
Porirua 5381
New Zealand
T +64 4 237 1170
F +64 4 237 1171
branz@branz.co.nz
www.branz.co.nz

TEST REPORT

ST1044

SHEAR TESTS OF ROCKCOTE AAC WALL CAVITY SYSTEMS

CLIENT

Rockcote Resene Limited
10B Abros Place
Burnside
Christchurch
New Zealand

SIGNATORIES

Author

David Carradine
Structural Engineer

Reviewer

Asif Iqbal
Structural Engineer

DOCUMENT REVISION STATUS

ISSUE NO.	DATE ISSUED	REVIEW DATE	DESCRIPTION
1	7 October 2014		Final Issue

1. INTRODUCTION

Testing was performed in order to determine the characteristic shear strength of Rockcote cavity wall systems using nominal 50 mm thick autoclaved aerated concrete (AAC) for the cladding and including expanded polystyrene battens on top of timber and steel studs. This data was used to verify the adequacy of the systems to carry the self-weight of the AAC cladding.

2. LIMITATIONS

The results reported here are applicable only to the items tested.

3. 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.

4. DESCRIPTION OF SPECIMENS

A total of 12 specimens were tested as shown in Figure 1 and Figure 2. Three replicate specimens of four different test configurations were tested. Six specimens had a central timber stud and three had a central “C” channel steel stud. On each face of the central stud a 200 x 650 mm AAC panel was fixed to the stud with two anchors and with a polystyrene batten of either 20 mm or 40 mm thick sandwiched between. Additionally, specimens having a steel stud had an additional layer of 10 mm thick foam material between the stud and the polystyrene batten on both sides, as seen in Figure 2. The central stud was the same length (650 mm) as the panels but was offset by 50 mm as shown in Figure 1. Testing configurations are described in Table 1.

All specimens were supplied by the client already assembled for the tests. Based on previous testing on similar products, the following materials were used for testing:

- Hot dipped galvanised steel screws with a 14 mm diameter head. The screws had a shank of 5.0 mm diameter, with the bottom 80 mm threaded with an outside thread diameter of 6.4 mm and were designed to be self-drilling in timber and steel.
- Autoclaved aerated concrete (AAC) panels with a density of 622 kg/m^3 and nominal dimensions 200 x 650 x 50 mm thick. Steel mesh of 3.2 mm diameter bars at 140 mm nominal spacing in two directions embedded centrally in the AAC.
- Polystyrene battens 50 mm wide and 600 mm long with 20 mm or 40 mm thickness.
- Thermal barrier foam material 10 mm thick (only used for steel stud specimens).
- Either, a Radiata Pine kiln dried timber stud of dimensions 90 x 45 x 650 mm long or a 90 mm deep, 50 mm wide cold-rolled steel “C” shaped channel with 10 mm lips, rolled from 0.8 mm thick sheet.

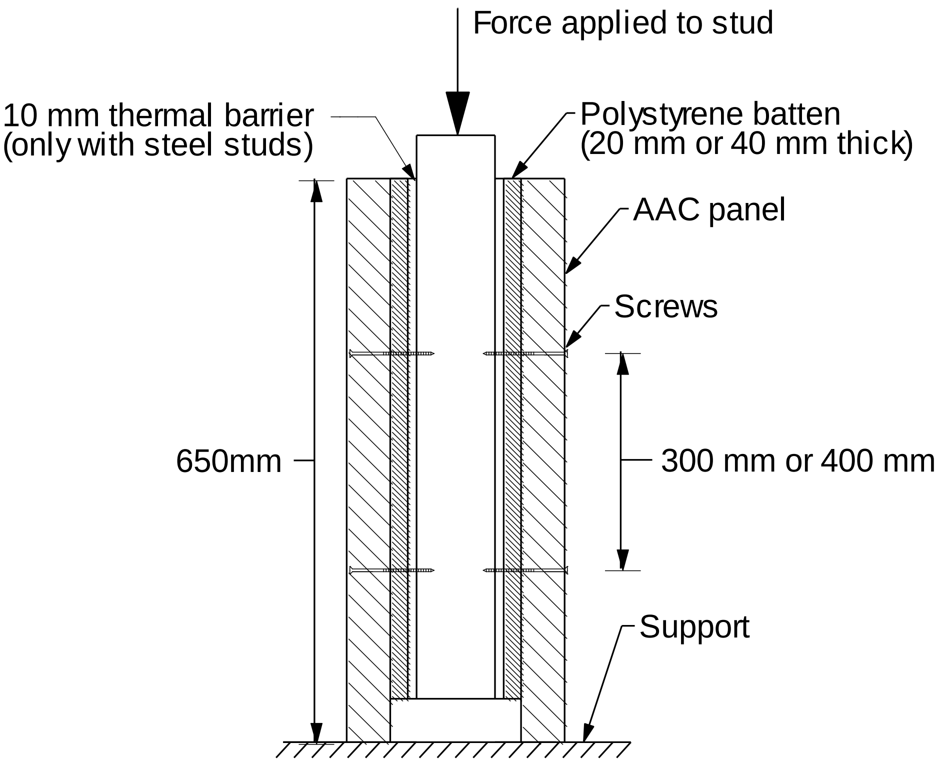

Figure 1. Schematic Drawing of Shear Test Specimen

Figure 2. Sample Shear Test Specimen (Steel Stud)

Table 1. Shear Test Configurations Using Rockcote AAC Panels

Test Configuration	Stud Material	Batten Thickness (mm)	Screw Length (mm)	Distance between Screws (mm)
A	Timber	40	125	400
B	Timber	20	100	300
C	Steel	40	125	400
D	Steel	20	125	400

5. DESCRIPTION OF TESTS

5.1 Date and Location of Tests

The tests were carried out in August 2014 at the Structural Engineering Laboratory of BRANZ Ltd, Judgeford, New Zealand.

5.2 Test Arrangement and Equipment

The tests were undertaken in a Dartec Universal testing machine. A view of the test setup is provided in Figure 2.

The test load was measured with a 50 kN load cell calibrated to International Standard EN ISO 7500-1 1999 (2004) Grade 1 accuracy. Loads were recorded continuously during testing using a computer controlled data acquisition system.

5.3 Test Procedure

Compression load was applied to the top of each stud to give a vertical movement of approximately 0.5 mm per second. This was transferred via shear load in the four screws to the outside AAC panels. Loading was continued until peak resistance was exceeded. Failure modes were different for different test configurations.

6. TEST RESULTS

Included in Table 2 are the average peak loads, typical failure modes and characteristic load carrying resistance of individual screws for each configuration. For each test configuration, the shear load capacity per screw was derived using methods described in Appendix B of AS/NZS1170.0 (2011). According to AS/NZS1170.0, the characteristic strength capacity is considered to be S_{min} / k_t where S_{min} is the minimum value of the test results and k_t is a derived factor based on the standard deviation of structural characteristic values and the number of specimens tested. The k_t values used were based on standard deviations determined during testing and tested specimen numbers of 12 because there were 4 fasteners per test specimen.

Table 2. Results from Rockcote AAC Shear Testing

Test Configuration	Average Peak Load per Specimen (kN)	Typical Failure Mode	Characteristic Shear Load Carrying Capacity per Screw (kN)
A	6.40	Screws broken at face of timber	1.45
B	7.83	Screws broken at face of timber	1.78
C	5.93	Screw heads pulled through AAC	1.35
D	6.17	Screw heads pulled through AAC	1.15

7. ABILITY OF FIXINGS TO CARRY SELF-WEIGHT OF AAC PANELS

For an assumed cladding self-weight of 622 kg/m^3 and maximum fastener spacing of 300 mm vertically and 600 mm horizontally, the gravity shear load F_G per anchor for a 50 mm thick AAC panel is the following:

$F_G = 622 \times 9.81 \times 0.05 \times 0.3 \times 0.6 \times 10^{-3} = 0.055$ kN.

When the gravity shear load of 0.055 kN is compared to any of the single screw characteristic shear strengths, it can be shown that any of the tested configurations are capable of carrying the required loads from the self-weight of the cladding. Even considering the possible variability in anchor shear strengths and the extra weight of any surface plastering (render), the results show that the fasteners have far more than the required strength to support the cladding self-weight.

8. CONCLUSIONS

All of the tested fastener/stud/batten configurations have far more than the required strength to support the Rockcote Cavity System cladding self-weight.

9. REFERENCES

International Organisation for Standardisation (ISO). 2004. *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.

Standards New Zealand. AS/NZS 1170.0:2011. Structural design actions. Part 0: General Principles. SNZ, Wellington, New Zealand.