IAN BENNIE & ASSOCIATES

Test Report No. 2024-029-S1

200mm Interlocking Shadowline Cladding Board

Strength limit state
FATIGUE WIND LOAD TESTS

By the methods of AS:4040.3-2018

For

Knotwood Pty. Ltd.

July 2024

Accredited Laboratory No. 2371
Accredited for compliance with ISO/IEC 17025 - Testing

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IAN BENNIE & ASSOCIATES PTY. LTD.
Building Performance Testing
ACN : 007 133 253

Accredited Laboratory No. 2371

TEST REPORT NUMBER 2024-029-S1

Test Client: **Knotwood Pty. Ltd.**
7 /63 Burnside Road, Stapylton, QLD 4207

Specimen Identification: 200mm Interlocking Shadowline Cladding Board

200 mm Cladding Board (Part No. KEC200LW)
Cladding Starter (Part No. KEDSTR-SQ)
Cladding Finishing Base (Part No. KECFBF)
Cladding Finishing Top Trim (KECFTTLM
Cladding Clip (Part No. KAOCC45)

The sample consisted of Knotwood 200mm cladding board fixed horizontally to vertical 90x25mm aluminium top hat with Knotwood cladding clips and 10G Tek screws at 450mm centres. The top hat was fixed to 90x45mm structural Pine frame at 450mm centres with 14-guage cyclonic zips. The tested sample was 2295 mm high x 1890mm wide.

Sample drawings provided by the client are given in Appendix C.
Drawings received: 1st May 2024

Test Location: Ian Bennie & Associates, Dandenong South, Victoria

Test Date: 11th June 2024, 18th June 2024

Test Officer: Lochie Howe

Test Method and Procedure:

Strength limit state testing was conducted in accordance with AS 4040.3:2018 *Methods of testing sheet roof and wall cladding, Method 3: Resistance to wind pressures for cyclone regions* in accordance with Section 6: *Procedure for testing wall cladding systems,* as described in Appendix A: A1 of this report.
The AS 4040.3 Strength limit state test procedure in full is given in Appendix A of this report.

Test Results:

The test sample was subjected to *Resistance to wind pressures for cyclone regions* tests for wall cladding in accordance with AS 4040.3 Section 6: *Procedure for testing wall cladding systems.* Observations and results of the tests conducted are given in Appendix B of this report.

1 Luisa Avenue, Dandenong South, 3175, Victoria, Australia
Telephone: (03) 9768 3640 International: +613 9768 3640 Web: ibalab.net

Conclusion:

AS 4040.3-2018 procedure for testing of wall cladding systems states that Strength limit state design pressures shall be increased by dividing by the material capacity reduction factor (a factor less than unity). If the material capacity factor is not available, the pressure shall be divided by 0.9.
In the instance of this testing, the test pressure (Pt) was derived by dividing the nominated design pressure by 0.9. Only the test pressures have been reported in this document. No housing rates have been included in the outcomes of this report. Engineering Input will be required to evaluate the design pressure of the test sample for the Strength Limit State.

The **200mm Interlocking Shadowline Cladding Board test** sample as described in 'Specimen Identification' and depicted in Appendix C of this report, sustained loading to the strength limit state test requirements by the methods of AS 4040.3-2018 *Methods of testing sheet roof and wall cladding, Method 3: Resistance to wind pressures for cyclone regions* to the Low to High fatigue loading sequence derived from the test pressure (Pt) nominated below;

Table 1. Non-Housing Ratings – cyclone regions.

Condition	Test Pressure (Pt) (kPa)	
	Positive	Negative
PROCEDURE FOR TESTING WALL CLADDING SYSTEMS – LOW to HIGH FATIGUE LOADING SEQUENCE	-	-6.56

Disclaimer:

Sample information, including material properties and detailing, was supplied by the client, and no verification of actual construction details or sampling of production stock could be performed. The test results contained herein apply to the sample as tested. Ian Bennie & Associates accepts no liability for claims of losses, expenses, damages, and costs arising as a result of the use of the product(s) referred to in this report.

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Written by

Lochie Howe 15th July 2024
Authorised Signatory

Checked by

James Maskiell 15th July 2024
Authorised Signatory

Appendix A – Test Procedure

A0. General

Strength limit state testing under negative loads only was conducted in accordance with AS 4040.3:2018 *Methods of testing sheet roof and wall cladding, Method 3: Resistance to wind pressures for cyclone regions.*

The test sample provided was subjected to the Low-High loading procedure for walls as described in Appendix A: A1 of this report.

A1. Strength limit state procedure for testing wall cladding systems

A1.1. Test Pressure Derivation

Design wind pressures for strength limit state and serviceability limit state may be calculated from the relevant wind speeds Vu and Vs listed in AS/NZS 1170.2 for the appropriate cyclone regions. The design pressure shall be derived from a combination of internal positive pressure and external negative pressure, including local pressure factors where appropriate, for the particular part of the wall being tested. Alternatively for residential construction, the design net wall pressures shall be obtained directly for the C wind classifications from AS 4055.

C wind classifications in accordance with AS 4055 for ultimate strength pressures are given in Table A1 for walls below.

Table A1. Ultimate Strength Pressures for WALLS (EXCERPT of AS 4055: Table 3.5(A))

WIND CLASSIFICATION	ANY POSITION	AWAY FROM CORNERS	WITHIN 1200 mm OF CORNERS
Pressure Zone	G, SC	G	SC
N1w	0.62	-0.53	-0.94
N2w	0.86	-0.74	-1.30
N3w	1.35	-1.16	-2.03
N4w	2.01	-1.72	-3.01
N5w	2.96	-2.53	-4.44
N6w	3.99	-3.42	-5.99
C1w	1.80	-1.80	-2.70
C2w	2.68	-2.68	-4.02
C3w	3.94	-3.94	-5.91
C4w	5.33	-5.33	-7.99

The test pressure (Pt) for strength limit state shall be the design pressure for strength limit state increased by dividing by the material capacity reduction factor (a factor less than unity). If the material capacity factor is not available, the pressure shall be divided by 0.9.

A1.2. Procedure and performance requirements for wall cladding

The cladding/fastener system shall be subjected to the fatigue loading sequence specified in Table 1. The single load cycle shall be held for 1 min. The behaviour of cladding, fastenings, supporting members and substructure shall be observed and recorded.

Table A2. FATIGUE LOADING SEQUENCE

Range of test pressure	Number of cycles
0 to -0.40 Pt	8000
0 to -0.50 Pt	2000
0 to -0.65 Pt	200
0 to -1.30 Pt*	1
*As a rule, this test pressure will be met by testing one sample that satisfies the criteria. If two samples are tested, the final cycle may be reduced to 1.2Pt, and if three samples are tested, it may be reduced to 1.0Pt	

For the purposes of reporting the following terminology is used to describe the behaviour of the sample under test:

Stable: The cladding, fastenings, supporting members and substructure remained in position without permanent distortion, the pressure was sustained.

Note: 'Remained in position' means that the cladding has not disengaged or separated from any fastener/clip/bracket/tongue or along the side laps of the test specimen.

Unstable: elements of the cladding, fastenings, supporting members or substructure disengaged or separated, notwithstanding any permanent distortion that may have occurred in the sheeting and fastenings.

A2. Strength limit state procedure for testing roof or wall cladding systems

A2.1. Test Pressure Derivation

Design wind pressures for strength limit state and serviceability limit state may be calculated from the relevant wind speeds Vu and Vs listed in AS/NZS 1170.2 for the appropriate cyclone regions. The design pressure shall be derived from a combination of internal positive pressure and external negative pressure, including local pressure factors where appropriate, for the particular part of the wall being tested. Alternatively for residential construction, the design net wall pressures shall be obtained directly for the C wind classifications from AS 4055.

C wind classifications in accordance with AS 4055 for ultimate strength pressures are given in Table A1 for walls, and Table A3 below for roofs.

Table A3. Ultimate Strength Pressures for ROOFS (EXCERPT of AS 4055: Table 3.5(A))

WIND CLASSIFICATION	ANY POSITION	GENERAL AWAY FROM EDGES	WITHIN 1200 mm OF EDGES	AT CORNERS WITHIN 1200 mm OF BOTH EDGES
Pressure Zone	G, RE, RC	G	RE	RC
N1r	0.44	-0.69	-1.25	-1.81
N2r	0.60	-0.95	-1.73	-2.51
N3r	0.95	-1.49	-2.70	-3.92
N4r	1.41	-2.21	-4.02	-5.83
N5r	2.07	-3.25	-5.91	-8.58
N6r	2.80	-4.39	-7.99	-11.58
C1r	1.43	-2.16	-3.38	-4.59
C2r	2.12	-3.21	-5.02	-6.83
C3r	3.12	-4.73	-7.39	-10.05
C4r	4.22	-6.39	-9.98	-13.58

The test pressure for serviceability limit state and strength limit state shall be equal to the relevant design pressure (determined in accordance with Clause 7.2.1) multiplied by the factor for variability.
NOTES:
1 The factors to allow for variability of structural units are set out in AS 1562.1.
2 Guidance on selection of number of test replications is given in Guide to LHL cyclic testing.

Table A4. EXCERPT of AS 1562.1: Table 5.1.

No. of units to be tested	Coefficient of variation of structural characteristics (Vsc)			
n	5%	10%	15%	20%
1	1.20	1.46	1.79	2.21
2	1.17	1.38	1.64	1.96
3	1.15	1.33	1.56	1.83
4	1.15	1.30	1.50	1.74
5	1.13	1.28	1.46	1.67
10	1.10	1.21	1.34	1.49
20	1.06	1.13	1.21	1.29
100	1.01	1.01	1.01	1.01

Notes:

1. Where tests evaluate deflection under serviceability limit state loads, a coefficient of 5% may be assumed unless there is evidence showing that a higher figure is warranted.
2. A coefficient of variation of 10% may be assumed for strength of metal claddings and metal supporting systems unless there is evidence showing that a higher figure is warranted.
3. A coefficient of variation of 20% should be assumed for connection sub-assemblies unless there is evidence showing that a different figure is warranted.
4. Higher coefficients of variation for serviceability, strength of cladding and strength of connections may be expected if a compliant material (e.g. coil) is to be sourced from more than one supplier subsequent to the testing program.
5. Interpolation is allowed in Table 5.1. within the same category (Vsc)
6. Guidance on determining the number of units to be tested is available in Guide to the Low-High-Low cyclic testing by the Cyclone Testing Station.
7. This table is based on Table B1 of AS/NZS 1170.0 and Table 8.2.3 of AS 4600

A2.2 Procedure and performance requirements for wall of roof cladding

The cladding/fastener system shall be subjected to the fatigue loading sequence specified in Table 2. The single load cycle (Sequence D) shall be held for a minimum of 10 s. The behaviour of cladding, fastenings, supporting members and substructure shall be observed and recorded.

Table A5. LOW-HIGH-LOW PRESSURE SEQUENCE FOR ROOF OR WALL CLADDING SYSTEMS

Sequence	Number of cycles	Load
A	4500	0 to 0.45 Pt
B	600	0 to 0.6 Pt
C	80	0 to 0.8 Pt
D	1	0 to 1.0 Pt
E	80	0 to 0.8 Pt
F	600	0 to 0.6 Pt
G	4500	0 to 0.45 Pt

For the purposes of reporting the following terminology is used to describe the behaviour of the sample under test:

Stable: The cladding, fastenings, supporting members and substructure remained in position without permanent distortion, the pressure was sustained.
Note: 'Remained in position' means that the cladding has not disengaged or separated from any fastener/clip/bracket/tongue or along the side laps of the test specimen.

Unstable: elements of the cladding, fastenings, supporting members or substructure disengaged or separated, notwithstanding any permanent distortion that may have occurred in the sheeting and fastenings.

Appendix B – Test Observations and Results

GENERAL:

The test sample was tested to a Low to High test sequence derived from a test pressure (Pt) of -6.56 kPa corresponding to an AS 4055 C3w corner Ultimate strength pressure of -5.91 kPa increased by dividing by 0.9 (in absence of a known material capacity reduction factor). Additional details of test pressure derivation are given in Appendix A of this report.
The resultant sequence is given as:

Table C1. Client-nominated test sequence.

6.56 Range of test pressure	Number of cycles
0 to -2.62	8000
0 to -3.28	2000
0 to -4.26	200
0 to -8.53	1

Testing is summarised below:

CYCLIC FATIGUE TEST 1. **11/06/2024**

Table C2. Cyclonic fatigue sequence strength limit state results.

Sequence	Number of cycles	Test Load (kPa)	Observations
A	8000	0 to -2.93	Stable
B	2000	0 to -3.28	Stable
C	200	0 to -4.27	Unstable (1)
D	1*	0 to -8.53	N/R

N/R – No Result. This sequence was not completed.

(1) After the conclusion of Sequence B and at within 10 cycles of the commencement of the Sequence C loading, the perimeter of the test sample sheared its fixings into the stud frame at the exterior-facing right-hand side. The exterior-facing bottom right corner of the stud frame released from position.
Prior to subsequent tests, the Client reset the stud frames position and fixed the perimeter back to the stud frame with appropriate fixings.

CYCLIC FATIGUE TEST 2. **18/06/2024**

Table C3. Cyclonic fatigue sequence strength limit state results.

Sequence	Number of cycles	Test Load (kPa)	Observations
A	8000	0 to -2.93	Stable
B	2000	0 to -3.28	Stable
C	200	0 to -4.27	Stable
D	1*	0 to -8.53	Stable

*Cycle held at pressure for 1 minute.

The cladding, fastenings, supporting members and substructure remained in position without permanent distortion, the pressure was sustained. No disengagement was observed.

Appendix C – Sample Drawings

As provided by the Client