Date of issue:29 November 2022

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Premier Building Products Ltd

BTS2230-1 CERTIFICATE OF TEST: TR-221017-1&2 + TR221025-1 v2

Measurement of Fixing Shear Resistance to Assess the (vertical) Tile Weight Capacity of the 13mm thick PBP Water Resistant Gypsum Board

1. Objective:

1.1 BEAL Testing Services were contracted by Premier Building Products Ltd to verify that the 10mm and 13mm thick Water-Resistant Gypsum Board product, supplied by the client, when ceramic tiles are adhered, will meet the performance requirements of the New Zealand Building Code and a specified tile weight of 26Kg/m^2 for the 10mm product and 40Kg/m^2 for the 13mm product, based on a specified timber frame fixing detail.
(Stud centres 600mm and fixing centres max. 150mm as per Table 1).

1.2 A comparison with the performance of a similar water-resistant gypsum board product, was carried out by way of fixing shear resistance testing. An engineer would then assess the results.

2. Methodology:

2.1 Measurement of potential creep using a shear resistance test, BEAL TP145 'Fixing Shear Resistance', was selected for the purpose.

3. Test Specimen:

3.1 5 specimens approx. 100mm x 90mm (well clear of any tapered edge) of each of the two brands of 13mm thick water-resistant gypsum board product were prepared and screw-fixed by way of 6g x 40mm long self-tapping screws, to a timber block as per the test procedure. A steel bar was then fixed to the timber block to enable it to be held in the jig of the Universal Testing Machine. Refer photo.

4. Specimen Conditioning – if any:

4.1 Specimens were prepared at room conditions.

5. Test Criterion:

5.1 A structural engineer was asked to assist in the development of this assessment procedure.

5.2 The purpose of the method was to measure the shear resistance of typical screw fixing in order to assess the board's tile weight carrying capacity. The test results would be subject to the evaluation procedure described in Appendix B of AS/NZS1170. Refer calculation sheet.

6. Test Result:

Two sets of test results were produced, though one test result for the PBP product was discounted, owing to a non-conforming preparation process.

TR221017-1 13mm Premier Building Products Water Resistant Gypsum Board

Specimen	Break distance(mm)	Maximum Force (N)	Limiting Fixing Load*
2221-1	3.29	414	162.5
2221-2	4.18	484	156.25
2221-3	6.29	327 (abnormally low)	143.25
2221-4	4.22	419	193.75
Average		414	163.94
SD		56.0	21.43

* taken from the graph

TR221017-2 13mm Aqualine Gypsum Board

Specimen	Break distance(mm)	Maximum Force (N)	Limiting Fixing Load*
2222-1	9.10	756	237.5
2222-2	6.79	740	287.5
2222-3	5.03	715	312.5
2222-4	6.05	595	200.0
2222-5	5.76	666	287.5
Average		694	265.0N
SD		65.5	

* taken from the graph

Based on the above, the engineer requested one final set of tests to represent the effects of fixing shear near a cut edge.

TR221025-1 13mm Premier Building Products Water Resistant Gypsum Board

Specimen	Break distance(mm)	Maximum Force (N)
2223-1	3.29	355
2223-2	4.18	330
Average		342
SD		18.0

7. Calculations:

Refer to the attached calculation sheets for the PBP board and Aqualine board.

8. Comment:

8.1 The shear resistance for the 13mm Premier Gypsum Board is significantly less than the NZ manufactured gypsum board product, when the fixing was tested in the centre of the board specimens. This results in a characteristic capacity of 172N (17.5Kg per screw fixing) for the Aqualine product versus a characteristic capacity of 101.78N (10.4Kg per screw fixing) for the Premier Building Product's product.

However, when considering the weight of tiles that the PBP product could carry, based on 600mm spaced studs, with fixing centres at no more than 150mm, the test results indicate that the PBP product will meet the tile weight requirement of 40Kg per sq.m. as set out in the attached table 1:

Stud Centre (maximum)	Fasteners Centre (maximum)	Lining Thickness	Tile Weight
600mm maximum	150mm maximum	10mm	26kg/m^2
		13mm	40kg/m^2

Table 1

8.2 Based on the test results found in TR221025-1, 3rd graph) where testing was carried out on a fixing at a typical 11mm from a cut edge on 13mm thick board, the capacity of the fixings would appear to be satisfactory to meet the tile weight of 40Kg/m^2.
Based on an extrapolation of these results, it appears that the 10mm thick board is suitable for 26Kg/m^2.

8.3 Note that the limiting fixing load taken from each test corresponded to the point where the resistance commenced to reduce (i.e. the onset of non-linearity).

8.4 Based on a 40Kg per sq.m. requirement or a minimum load capacity requirement of 33.4N per fixing at the centre of a sheet, the PBP 13mm board meets this requirement.

8.5 Based on the 10mm PBP Water resistant gypsum board being of the same constituents and same density as the 13mm product, the 10mm board will meet the tile weight requirement of 26Kg/m^2.

Authorised signatory
C R Prouse
Building Element Assessment Laboratory Limited

BUILDING ELEMENT ASSESSMENT LABORATORY LIMITED

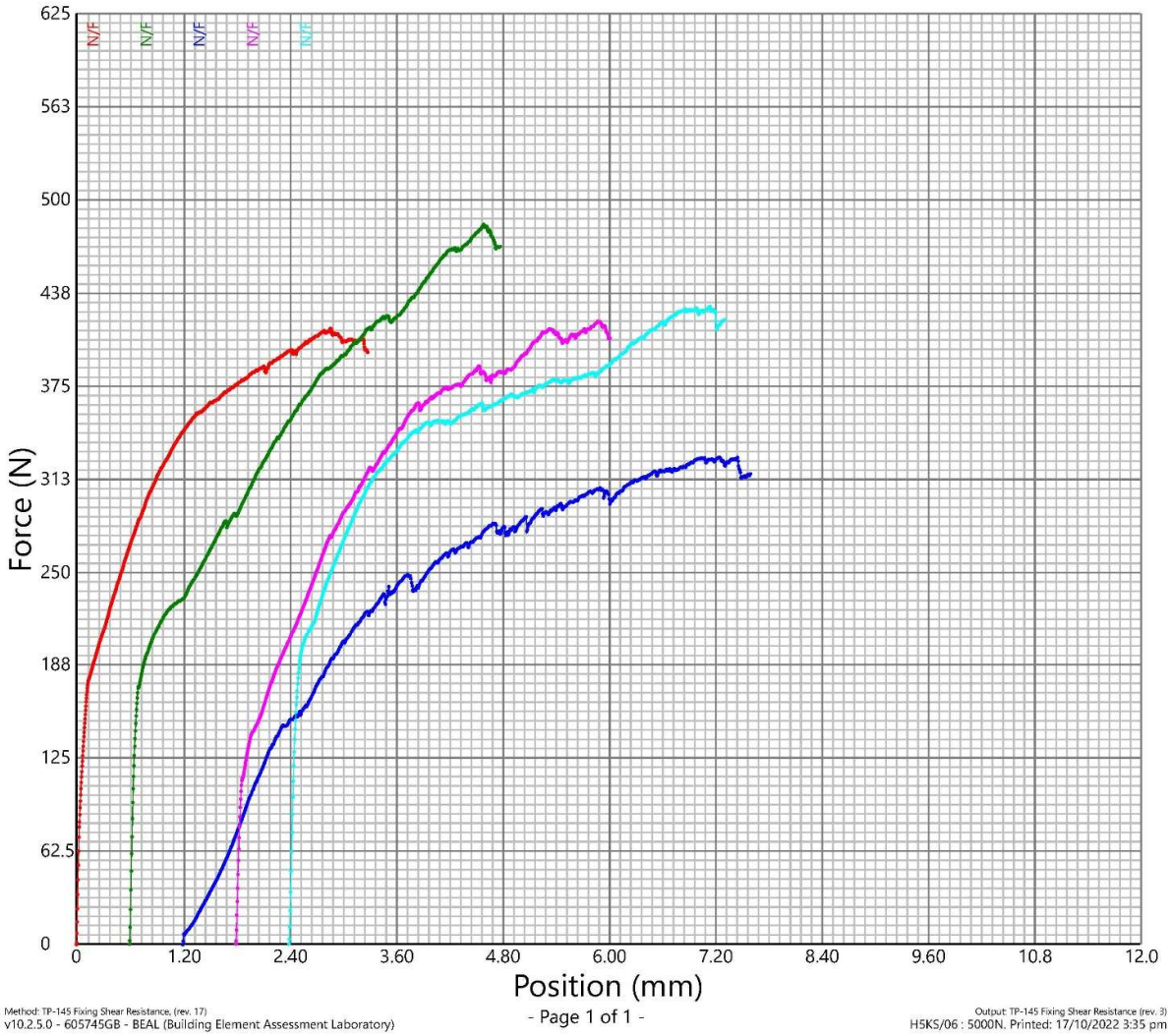
Mechanical Testing
Using a Tinius Olsen Universal Testing Machine
w H5KS Machine Output

Tinius Olsen

TR #:	221017-1
Client:	PBP
Job Number:	BTS2230-2
Product Name:	13mm Gypsum Bd
Conditioning:	Nil
Tested by:	D Cunngham
Calibration:	No

Method Name:	TP-145 Fixing Shear Resistance
Standard:	Nil
Speed:	1.5 mm/min
Batch Start Date and Time:	17/10/2022 2:54 pm
Graph Offset:	5.00 %

Specimen #	Diameter mm	Head diameter mm	Break Distance mm	Max Force N	MoF Description	Note Additional information
2221-1	3.87	0	3.29	414	Simple crush point	Material crushed
2221-2	3.87	0	4.18	484	Simple crush point	Material crushed
2221-3	3.87	0	6.29	327	Simple crush point	Material crushed
2221-4	3.87	0	4.22	419	Simple crush point	Material crushed
2221-5	3.87	0	4.81	429	Simple crush point	Material crushed
Average			4.56	414		
SD			1.11	56.0		



Method: TP-145 Fixing Shear Resistance, (rev. 17)
v10.2.5.0 - 605745GB - BEAL (Building Element Assessment Laboratory)

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Output: TP-145 Fixing Shear Resistance (rev. 3)
H5KS/06 : 5000N. Printed: 17/10/2022 3:35 pm

BUILDING ELEMENT ASSESSMENT LABORATORY LIMITED

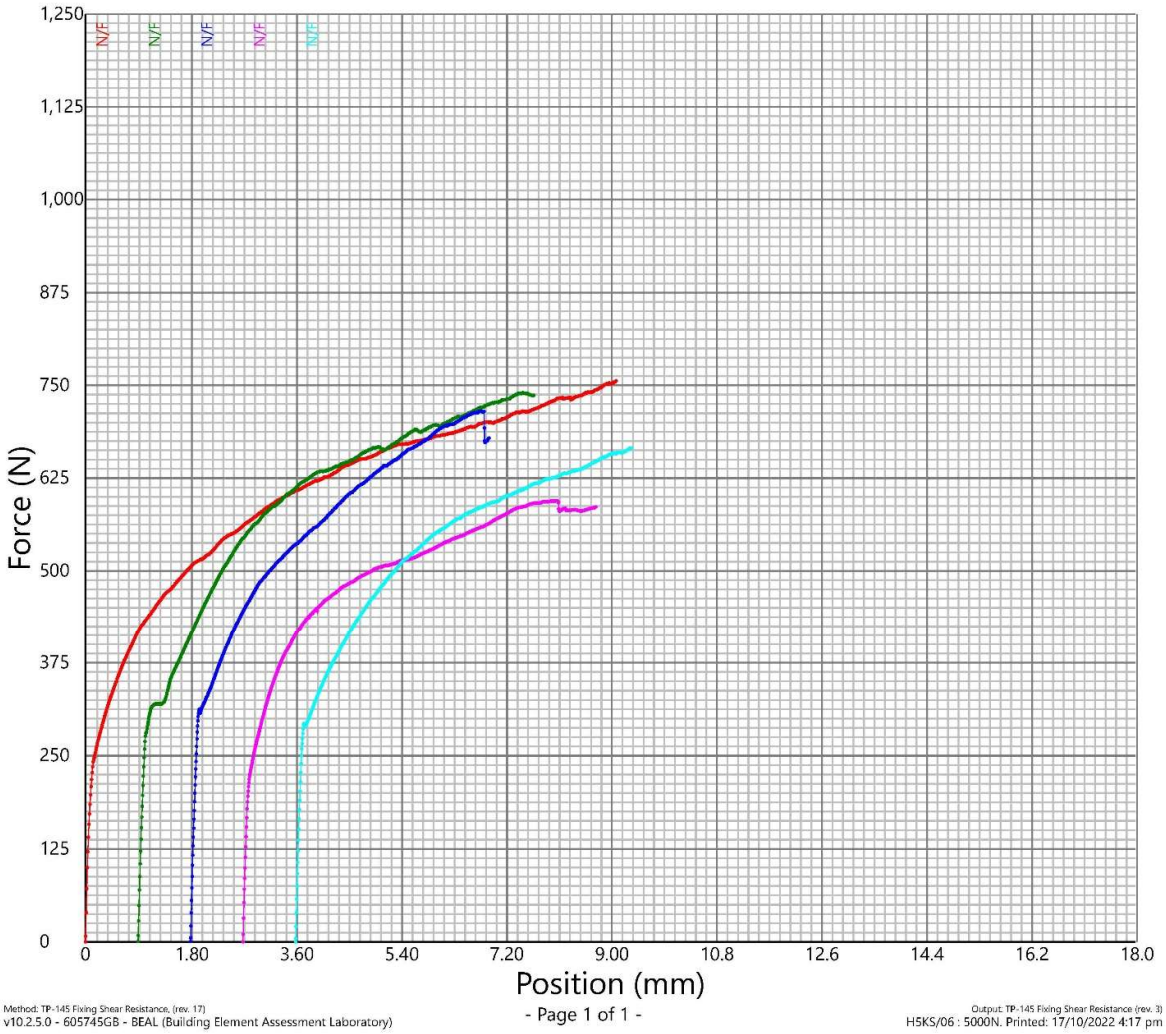
Mechanical Testing
Using a Tinius Olsen Universal Testing Machine
w H5KS Machine Output

Tinius Olsen

TR #:	TR221017-2
Client:	PBP
Job Number:	BTS2230-2
Product Name:	13mm Aqualine
Conditioning:	NIL
Tested by:	D Cunningham
Calibration:	No

Method Name:	TP-145 Fixing Shear Resistance
Standard:	NIL
Speed:	1.5 mm/min
Batch Start Date and Time:	17/10/2022 3:42 pm
Graph Offset:	5.00 %

Specimen #	Diameter mm	Head diameter mm	Break Distance mm	Max Force N	MoF Description	Note Additional information
2222-1	3.87	0	9.10	756	Simple crush point	Screw head pulled through
2222-2	3.87	0	6.79	740	Simple crush point	Screw head pulled through
2222-3	3.87	0	5.03	715	Simple crush point	Screw head pulled through
2222-4	3.87	0	6.05	595	Simple crush point	Screw head pulled through, abnormal early failure
2222-5	3.87	0	5.76	666	Simple crush point	Screw head pulled through, abnormaly low value
Average			6.55	694		
SD			1.56	65.5		



Method: TP-145 Fixing Shear Resistance, (rev. 17)
v10.2.5.0 - 605745GB - BEAL (Building Element Assessment Laboratory)

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Output: TP-145 Fixing Shear Resistance (rev. 3)
H5KS/06 : 5000N. Printed: 17/10/2022 4:17 pm

AS/NZS1170.0 Appendix B Analysis

BTS2230-1 TR221017-1&2

Fixing shear resistance test of 13mm PBP Water resistant Gypsum Board

Step One: Enter the number of samples and their test value.

Must also adjust Mean, SD, and Samples Size formulas below.

Sample Number	**Derived test values (N)**	- at the first indication of failure
1	162.5	
2	156.25	
3	143.25	
4	193.75	
5		

Mean	163.938
SD	21.431
CoV	13.073
Sample size	4.000
CoV Correction	13.890

Step 2: To find the relevant Kt value for the COV or COV(cor), must turn into a percentage(COV*100)

	Interpolation
COV(%)	13.073

We use the row from the table which refers to our number of samples.

	Table COV	Lower & Upper COV's k_t's from the table
Lower Range	15	1.5
Upper Range	20	1.74
kt		1.41

K_t [COV] *	1.41	K_t [COV(cor)] *	1.46
N [char]	**101.78**	N[char] from COV(cor)	**98.12**

* K_t value is Found in Table B1 of AS-NZS 1170.0 using interpolation or double interpolation.

k_t Table B1 of AS NZS 1170

	Coefficient of variation of Sturctural characteristics percentage						
Number of units i	5	10	15	20	25	30	40
1	1.2	1.46	1.79	2.21	2.75	3.45	5.2
2	1.17	1.28	1.64	1.96	2.36	2.86	3.9
3	1.15	1.33	1.56	1.83	2.16	2.56	3.3
4	1.15	1.3	1.5	1.74	2.03	2.37	2.9
5	1.13	1.28	1.46	1.67	1.93	2.23	2.27
10	1.1	1.21	1.34	1.49	1.66	1.85	2.1

AS/NZS1170.0 Appendix B Analysis

BTS2230-1 TR221017-2

Fixing shear resistance test of 13mm AQUALINE Gypsum Board

Step One: Enter the number of samples and their test value.

Must also adjust Mean, SD, and Samples Size formulas below.

Sample Number	**Derived test values (N)**	- at the first indication of failure
1	237.5	
2	287.5	
3	312.5	
4	200	
5	287.5	

Mean	265.000
SD	45.415
CoV	17.138
Sample size	5.000
CoV Correction	17.995

Step 2: To find the relevant Kt value for the COV or COV(cor), must turn into a percentage(COV*100)

	Interpolation
COV(%)	13.073

We use the row from the table which refers to our number of samples.

	Table COV	Lower & Upper COV's k_t's from the table
Lower Range	15	1.46
Upper Range	20	1.67
kt		1.38

K_t [COV] *	1.38	K_t [COV(cor)] *	1.46
N [char]	**172.22**	N[char] from COV(cor)	**136.99**

* K_t value is Found in Table B1 of AS-NZS 1170.0 using interpolation or double interpolation.

k_t Table B1 of AS NZS 1170

Coefficient of variation of Sturctural characteristics percentage

Number of units i	5	10	15	20	25	30	40
1	1.2	1.46	1.79	2.21	2.75	3.45	5.2
2	1.17	1.28	1.64	1.96	2.36	2.86	3.9
3	1.15	1.33	1.56	1.83	2.16	2.56	3.3
4	1.15	1.3	1.5	1.74	2.03	2.37	2.9
5	1.13	1.28	1.46	1.67	1.93	2.23	2.27
10	1.1	1.21	1.34	1.49	1.66	1.85	2.1

BUILDING ELEMENT ASSESSMENT LABORATORY LIMITED

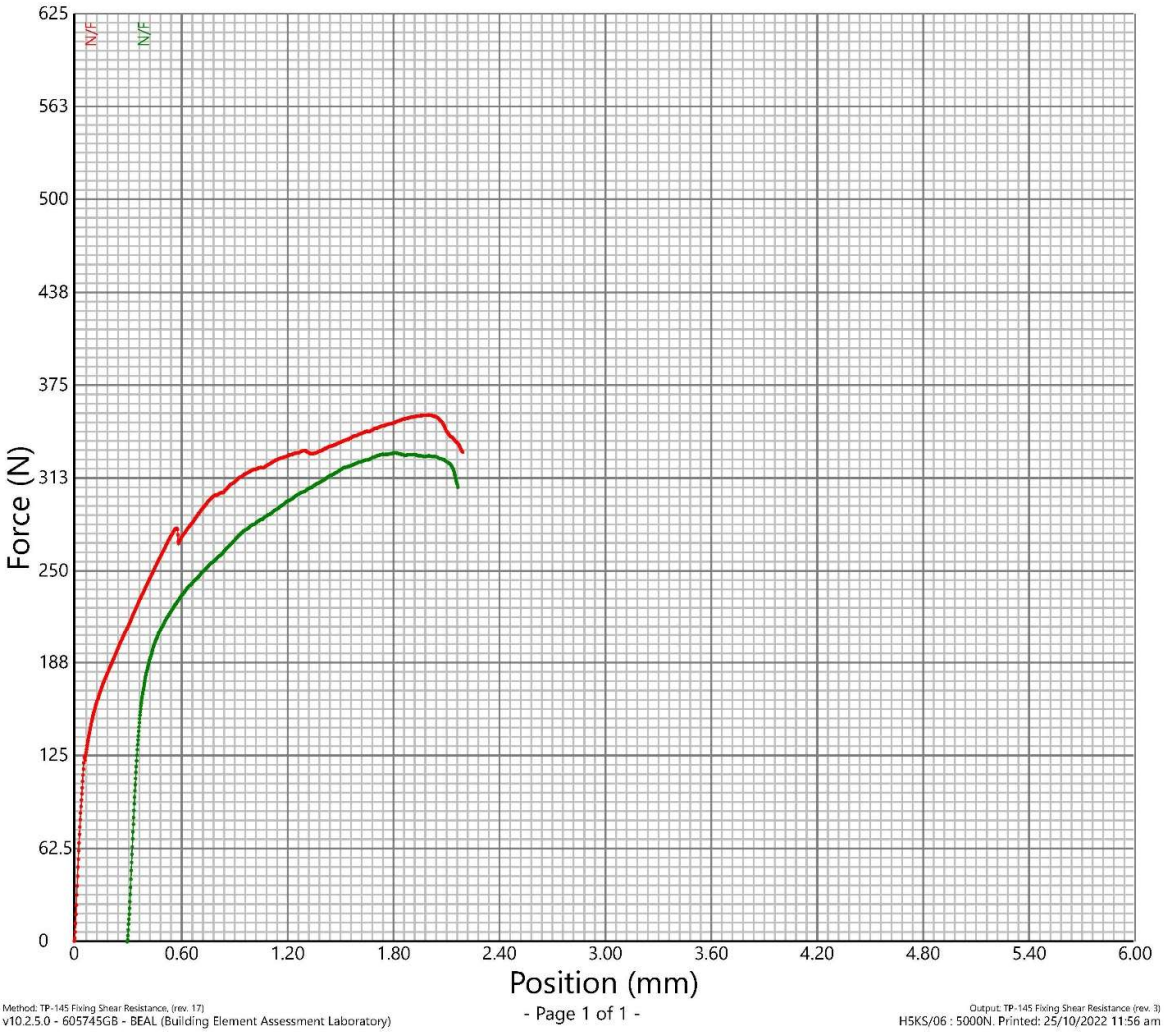
Mechanical Testing
Using a Tinius Olsen Universal Testing Machine
w H5KS Machine Output

Tinius Olsen

TR #:	tr221025-1
Client:	PBP
Job Number:	BTS2230-3
Product Name:	13mm PBP Gypsum Board
Conditioning:	Nil
Tested by:	C Prouse
Calibration:	No

Method Name:	TP-145 Fixing Shear Resistance
Standard:	Nil
Speed:	1.5 mm/min
Batch Start Date and Time:	25/10/2022 11:45 am
Graph Offset:	5.00 %

Specimen #	Diameter mm	Head diameter mm	Break Distance mm	Max Force N	MoF Description	Note Additional information
S2223-1	3.88	8.1	2.20	355	Simple crush point	Progressive crushing
S2223-2	3.88	8.1	1.87	330	Simple crush point	Progressive crushing
Average			2.04	342		
SD			0.23	18.0		



Method: TP-145 Fixing Shear Resistance, (rev. 17)
v10.2.5.0 - 605745GB - BEAL (Building Element Assessment Laboratory)

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Output: TP-145 Fixing Shear Resistance (rev. 3)
H5KS/06 : 5000N. Printed: 25/10/2022 11:56 am