

Date of issue: 11 October 2022

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Managing Director

Pacific Building Products Ltd

## BTS2203 CERTIFICATE OF TEST: SUMMARY

### Measurement of the Flexural Properties of 4.5mm, 6mm and 9.5mm thick Fibre-cement Boards

#### 1. Objective:

- 1.1 BEAL Testing Services were contracted by Pacific Building Products Ltd to verify that the 4.5mm, 6mm and 9.5mm thick fibre-cement Boards will meet one of the essential requirements necessary for the product to contribute to the performance requirements of the New Zealand Building Code.
- 1.2 Testing was carried out to verify the new product's flexural strength at room conditions.

#### 2. Methodology:

- 2.1 BEAL TP-106 Ver 2.3, Tensile Strength of Membranes, follows AS/NZS **2908.2:2000: Cellulose – cement products Part 2 - Flat sheets; S8.1.2.1 Bending strength.**, in accordance with the requirements of **ISO 17007**.

#### 3. Test Equipment:

- 3.1 Use was made of a Tinius Olsen H5KS Universal Testing Machine together with a four-point flex jig.

#### 4. Test Specimen Preparation:

- 4.1 BEAL follow the BEAL TP115 (BEAL Standard sampling procedure) for obtaining test specimens. Test specimens were cut to suit, the test pieces being 500mm x 100mm.

#### 5. Specimen Conditioning – if any:

- 5.1 Specimens were prepared at room conditions.

#### 6. Test Criterion:

- 6.1 Unless specified by the client or selected by BEAL, the results obtained from this test procedure are to be assessed by a person with appropriate experience and skills.

#### 7. Specimen Preparation:

- 7.1 The span between supports for the new material was 400mm with point loads at 100mm and 300mm from above;
- 7.2 The typical width of test specimens was 100mm for new material.
- 7.3 All specimens were prepared from material in cross-direction.

**8. Test Conditions:**

- 8.1 All testing was conducted at room temperature.

**9. Test Results:**

- 9.1 Summary of test results

	New material
<b>4.5mm</b>	
MOE (MPa)	14900
MOR (MPa)	19.6
<b>6.0mm</b>	
MOE (MPa)	13400
MOR (MPa)	25.4
USD* MOE (MPa)	15900
USD* MOR (MPa)	25.9
<b>9.5mm</b>	
MOE (MPa)	8100
MOR (MPa)	22.7
USD* MOE (MPa)	1100
USD* MOR (MPa)	34.4

\* upside down

**10. Comment:**

- 10.1 It is apparent that there is a significant improvement in performance between the 'original samples' and new materials supplied.

**11. Attachments:**

- 11.1 Tensile testing graphs (from Tinius Olsen Tensile Testing Machine H5KS)
- 11.2 Relevant Photos (2).



Colin Prouse – Building Scientist

Authorised signatory

**Building Element Assessment Laboratory Limited**

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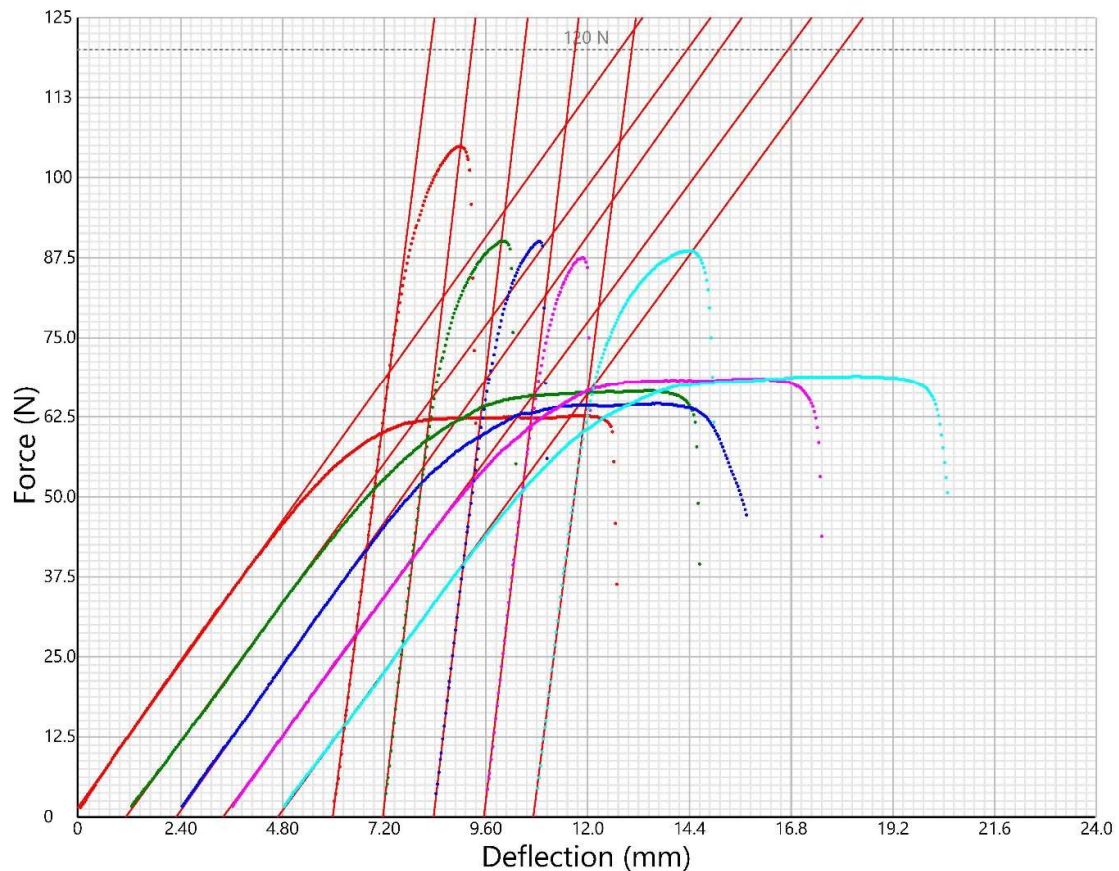
Mechanical Testing  
 Using a Tinius Olsen Universal Testing Machine  
 H5KS Machine Output



Client:	Premeair Building
Job Number:	BTS2203
TR #:	220824-2
Product Name:	4.5 FCSheet
Conditioning:	NIL
Tested by:	DC

Method Name:	TP-106 MOE & MOR Flexural test - Brittle
Standard:	ASTM D790
Speed:	20.0 mm/min
Calibration:	Yes
Batch Start Date and Time:	24/08/2022 2:55 pm
Graph Offset:	5.00 %

Specimen #	Area mm <sup>2</sup>	Thickness mm	Break Dist. mm	Max Force N	MOE MPa	MOR MPa	MoF Description	Explanation
S1216-1	450	4.50	12.6	62.7	15200	18.6	Brittle fracture	break
S1216-2	450	4.50	13.3	66.7	14700	19.8	Brittle fracture	break
S1216-3	450	4.50	12.7	64.7	15200	19.2	Ductile yielding/dDeformed	
S1216-4	450	4.50	13.7	68.5	14900	20.3	Brittle fracture	break
S1216-5	450	4.50	15.4	69.0	14700	20.4	Brittle fracture	break
S1216-6	189	4.50	3.21	105	6310	23.1	Ductile yielding/dDeformed	
S1216-7	189	4.50	3.00	90.0	6960	19.8	Ductile yielding/dDeformed	
S1216-8	189	4.50	2.57	90.0	6840	19.8	Ductile yielding/dDeformed	
S1216-9	189	4.50	2.43	87.5	6870	19.3	Ductile yielding/dDeformed	
S1216-10	189	4.50	4.01	88.5	6590	19.5	Ductile yielding/dDeformed	
Average				79.2	10800	20.0		
SD				14.6	4340	1.23		
CoV				18.4	40.1	6.15		



Method: TP-106 MOC & MOR Flexura -cs- - Brittle (rev. 68)  
 v10.2.5.0 - 605745GB - BEAL (Building Element Assessment Laboratory)

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Output: BEAL Flexibility - 3 Point - (rev. 65)  
 H5KS/06 : 5000N. Printed: 6/10/2022 4:11 pm

Figure 1 Original & New 4.5mm FC



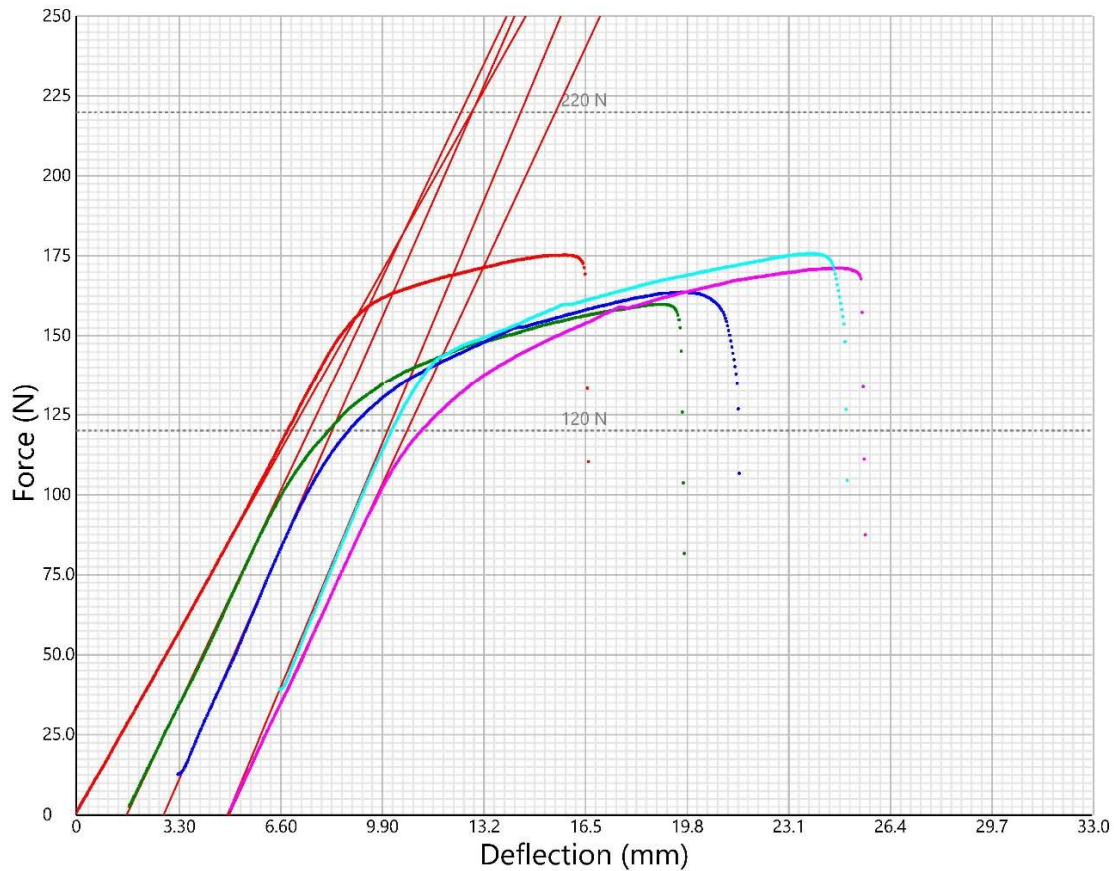
Mechanical Testing  
Using a Tinius Olsen Universal Testing Machine  
H5KS Machine Output



Client:	Premier Building
Job Number:	BTS2203
TR #:	220825-1
Product Name:	Fibre-Cement Sheet
Conditioning:	NIL
Tested by:	DC

Method Name:	TP-106 MOE & MOR Flexural test - Brittle
Standard:	ASTM D790
Speed:	20.0 mm/min
Calibration:	Yes
Batch Start Date and Time:	25/08/2022 1:50 pm
Graph Offset:	5.00 %

Specimen #	Area mm <sup>2</sup>	Thickness mm	Break Dist. mm	Max Force N	MOE MPa	MOR MPa	MoF Description	Explanation
1218-1	642	6.34	16.5	175	10200	25.9	Brittle fracture	fracture
1218-2	644	6.38	17.9	160	11500	23.4	Brittle fracture	fracture
1218-3	640	6.31	17.9	164	13800	24.3	Brittle fracture	fracture
1218-4	627	6.17	20.5	171	12900	26.5	Brittle fracture	fracture
1218-5	631	6.23	18.1	176	18800	26.8	Brittle fracture	fracture
Average				169	13400	25.4		
SD				7.10	3320	1.49		
CoV				4.20	24.7	5.86		



Method: TP-106 MOE & MOR Flexural test - Brittle (rev. 68)  
v10.2.5.0 - 605745GB - BEAL (Building Element Assessment Laboratory)

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Output: BEAL Flex1.tpy - 3 Plot: 1 (rev. 65)  
H5KS/06 : 5000N. Printed: 6/10/2022 4:06 pm

Figure 2 New 6mm FC



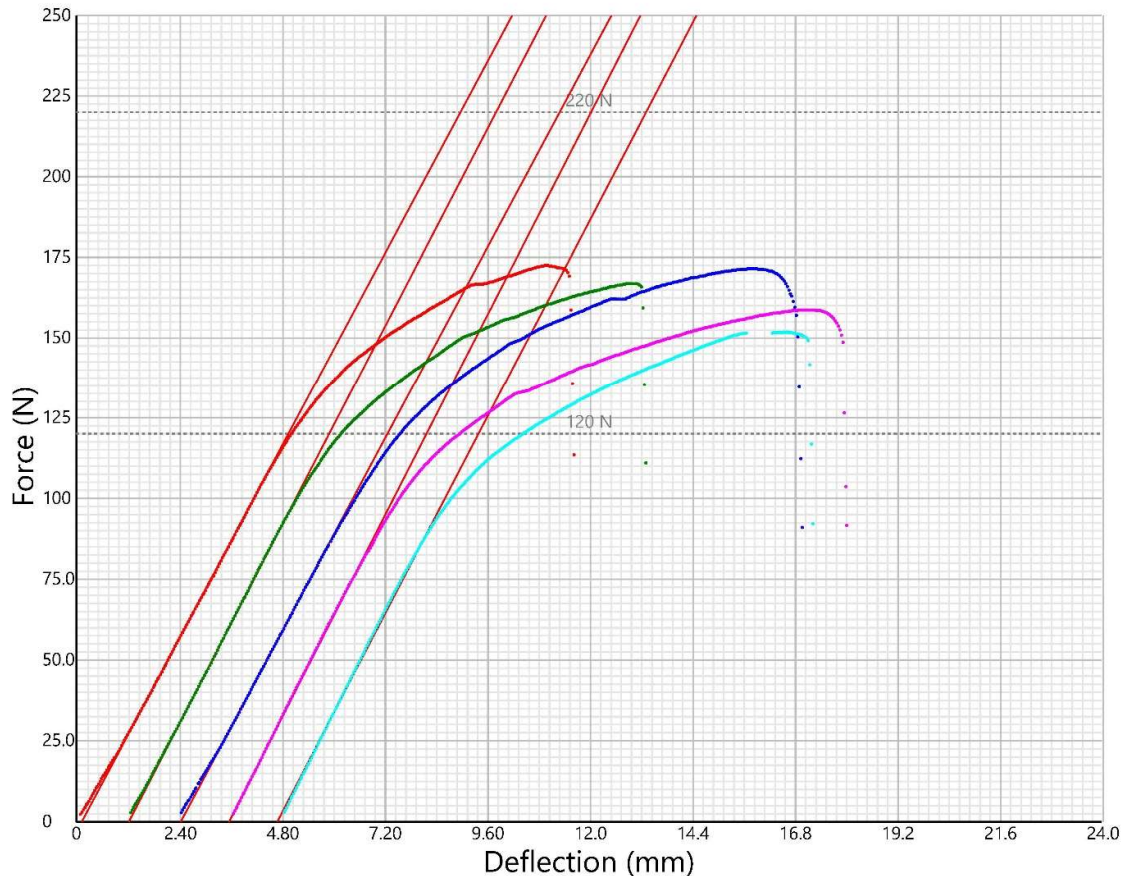
Mechanical Testing  
Using a Tinius Olsen Universal Testing Machine  
H5KS Machine Output



Client:	PBP
Job Number:	BTS2203
TR #:	221011-1
Product Name:	6mm FC Board!
Conditioning:	NIL
Tested by:	C Prouse

Method Name:	TP-106 MOE & MOR Flexural test - Brittle
Standard:	AS/NZS2908.2
Speed:	20.0 mm/min
Calibration:	
Batch Start Date and Time:	11/10/2022 1:48 pm
Graph Offset:	5.00 %

Specimen #	Area mm <sup>2</sup>	Thickness mm	Break Dist. mm	Max Force N	MOE MPa	MOR MPa	MoF Description	Explanation
#001	630	6.23	11.5	173	14800	26.4	Brittle fracture	Fractured
#002	615	6.09	12.0	167	16400	26.8	Brittle fracture	Fractured
#003	618	6.12	14.4	172	15600	27.2	Brittle fracture	Fractured
#004	619	6.14	14.3	159	16300	25.0	Brittle fracture	Fractured
#005	620	6.14	12.3	152	16200	23.9	Brittle fracture	Fractured
Average				164	15900	25.9		
SD				8.84	689	1.34		
CoV				5.38	4.35	5.19		



Method: TP-106 MOE & MOR Flexural test - Brittle (rev. 6/8)  
v10.2.5.0 - 605745GB - BEAL (Building Element Assessment Laboratory)

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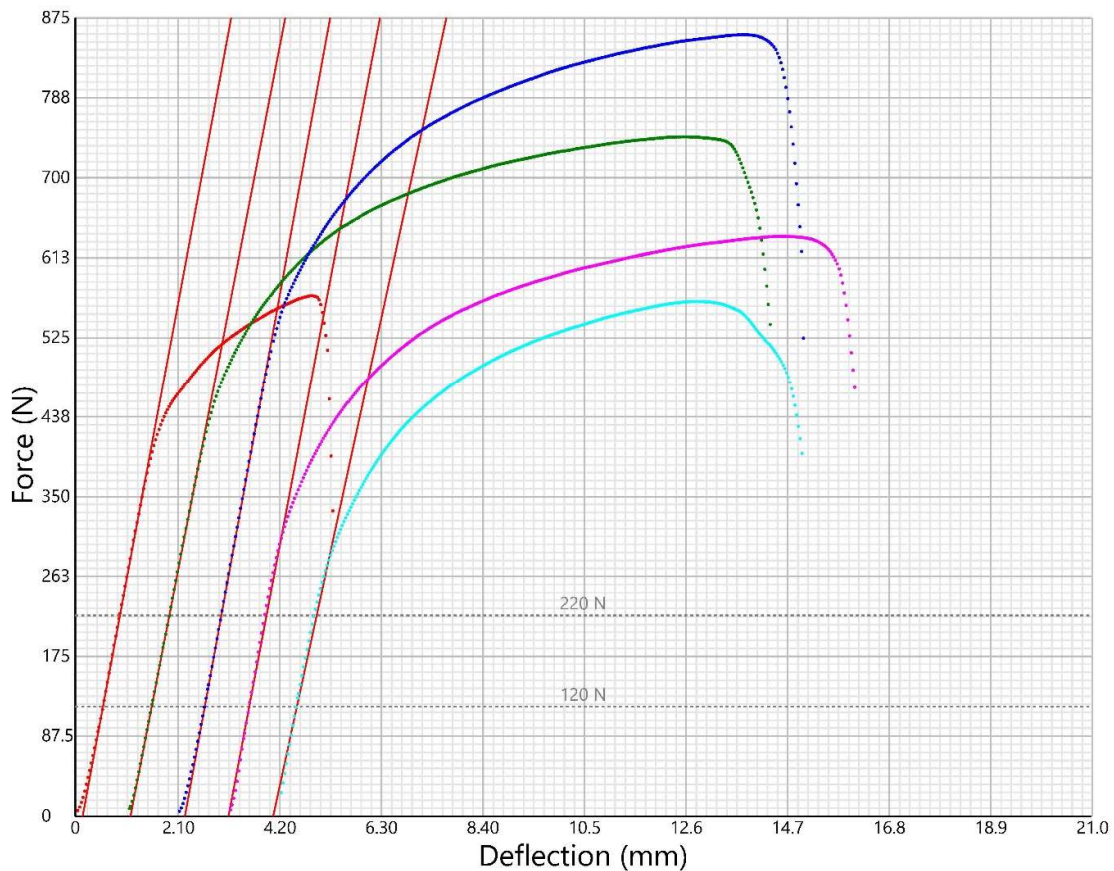
Output: BEAL Flexibility - 3 Point - (rev. 6/9)  
H5KS/06 : 5000N. Printed: 11/10/2022 2:16 pm

Figure 3 New 6mm FC, face down

Client:	PBP
Job Number:	BTS2203
TR #:	220712-2
Product Name:	BGC FC Sheet
Conditioning:	nil
Tested by:	David.C

Method Name:	TP-106 MOE & MOR Flexural test - Brittle
Standard:	ASTM D790
Speed:	20.0 mm/min
Calibration:	Yes
Batch Start Date and Time:	12/07/2022 1:15 pm
Graph Offset:	5.00 %

Specimen #	Area mm <sup>2</sup>	Thickness mm	Break Dist. mm	Max Force N	MOE MPa	MOR MPa	MoF Description	Explanation
S1206.3-2	1030	10.3	5.07	571	8140	19.6	Ductile fracture	Typical fracture of the FC
S1206.3-3	1050	10.5	13.0	745	7910	25.1	Ductile fracture	Typical fracture of the FC
S1206.3-4	1040	10.4	12.5	857	8350	29.1	Ductile fracture	Typical fracture of the FC
S1206.3-5	1060	10.6	12.6	636	7950	20.8	Ductile fracture	Typical fracture of the FC
S1206.3-6	1040	10.4	10.5	565	8170	19.1	Ductile fracture	Typical fracture of the FC
Average				675	8100	22.7		
SD				125	177	4.26		
CoV				18.5	2.18	18.7		



Method: TP-106 MOE & MOR Flexural test - Brittle (rev. 66)  
v10.2.5.0 - 605745GB - BEAL (Building Element Assessment Laboratory)

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Output: BEAL Flexibility - 3 Point (rev. 65)  
H5K: 5000N, Printed: 6/10/2022 3:27 pm

Figure 4 - 9.5mm New FC



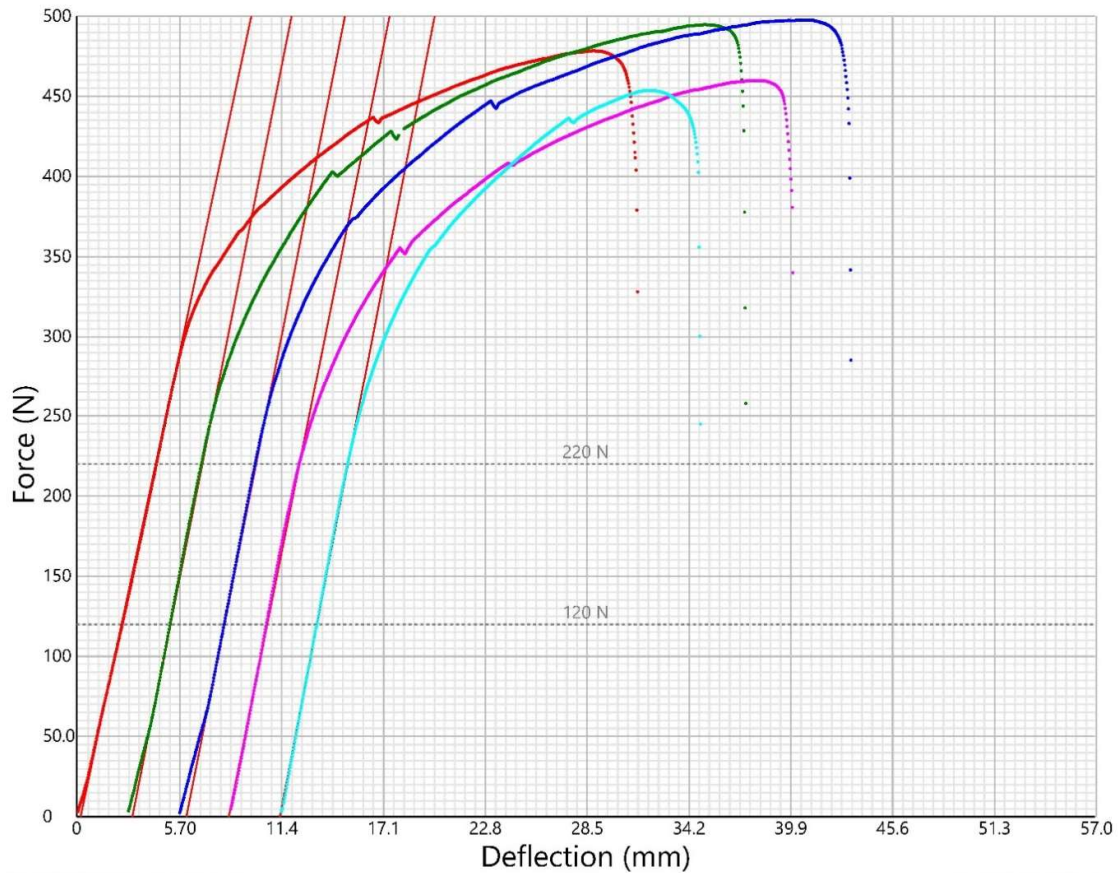
Mechanical Testing  
Using a Tinius Olsen Universal Testing Machine  
H5K5 Machine Output



Client: PBP  
Job Number: BTS2241  
TR #: TR220826  
Product Name: New 9.5mm FC Board  
Conditioning: NIL  
Tested by: C ProuseAS/NZS2980.2

Method Name: TP-106 MOE & MOR Flexural test - Brittle  
Standard: ASTM D790  
Speed: 20.0 mm/min  
Calibration: Yes  
Batch Start Date and Time: 26/08/2022 11:41 am  
Graph Offset: 5.00 %

Specimen #	Area mm <sup>2</sup>	Thickness mm	Break Dist. mm	Max Force N	MOE MPa	MOR MPa	MoF Description	Explanation
1	953	9.12	31.1	479	9670	33.0	Brittle fracture	Fractured
2	936	9.01	34.4	495	10700	35.2	Brittle fracture	Fractured
3	924	8.94	37.4	498	10700	36.1	Brittle fracture	Fractured
4	917	8.90	31.3	460	11700	33.8	Brittle fracture	Fractured
5	910	8.91	23.3	454	12100	33.6	Brittle fracture	Fractured
Average				477	11000	34.4		
SD				19.9	950	1.29		
CoV				4.18	8.66	3.76		



Method: TP-106 MOE & MOR Flexural test - Br3.c (rev. 68)  
v10.2.5.0 - 605745GB - BEAL (Building Element Assessment Laboratory)

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Output: BEAL Flexibility - 3 Point - (rev. 65)  
H5K - 5000N. Printed: 6/10/2022 4:03 pm

Figure 5 New 6mm FC, face down





*Figure 6 - 4pt Flex testing for new specimens*

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*Figure 7 - 4pt Flex Test for New specimens*