ST0990B

P21 Testing of 1200 mm Walls with Customwood Sheathing

Author: David Carradine
Structural Engineer

Reviewer: Graeme Beattie
Principal Structural Engineer

Contact:
BRANZ Limited
Moonshine Road
Judgeford
Private Bag 50908
Porirua City
New Zealand
Tel: +64 4 237 1170
Fax: +64 4 237 1171
www.branz.co.nz

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   iii. any defects in the Products the subject of the Services; or
   iv. any changes, modifications or alterations to the Products the subject of the Services.

P21 Testing of 1200 mm Walls with Customwood Sheathing

1. CLIENT

Daiken New Zealand Ltd.
Upper Sefton Road
Ashley
Rangiora 7477
New Zealand

2. OBJECTIVE

To determine the bracing ratings of a 1.2 m long wall constructed using 9 mm thick medium density fibreboard (MDF) manufactured by Daiken New Zealand Limited as the sheathing material on one side and intended for use on a timber or concrete floor, where the bottom plate is respectively either bolted or coach screwed down to the floor.

3. LIMITATION

The results reported here relate only to the items tested. The test walls were built by BRANZ to the instructions of the client.

4. DESCRIPTION OF SPECIMENS

4.1 Product Description

Medium density fibreboard (MDF) manufactured by Daiken New Zealand Limited having a nominal 9 mm thickness was supplied by the client for testing. Sheets supplied were 2.4 m long by 1.2 m wide.

4.2 Construction of the Specimens

Three replicate specimens were constructed according to typically accepted methods for building walls using MDF as the sheathing material. The timber frames were assembled from 90 x 45 mm MSG8 kiln dried Radiata Pine. The plates were connected to the studs with two 90 x 3.15 mm power-driven nails. The overall frame dimensions were 2.42 m high by 1.20 m long as shown in Figure 1. No nogs were used.

The MDF sheets were fastened to one side of the timber framing using 2.8 mm x 40 mm hot-dipped galvanised flat-head nails. These were placed at the locations shown in Figures 1 and 2. The fasteners were placed 10 mm from vertical edges and 18 mm from the top and bottom edges. Fasteners around the perimeter of specimens were installed at 150 mm centres. The long edges of each MDF sheet were flush with the outside vertical edges of the framing. The bottom edge of each sheet was 10 mm short of the bottom of the bottom plates. The top edge of each sheet was 10 mm short of the top of the top plate.

Each end stud was secured to the bottom plate using a GIB® HandiBrac® hold-down which includes a galvanised steel 90 x 60 x 54 x 1.55 mm thick angle bracket, a 50 x 60 x 5 mm thick electroplated washer and attached using eight Type 17 screws (35 x 5 mm

diameter), as can be seen in Figure 3. Of the eight fasteners, five were installed in the stud and three were installed into the bottom plate.

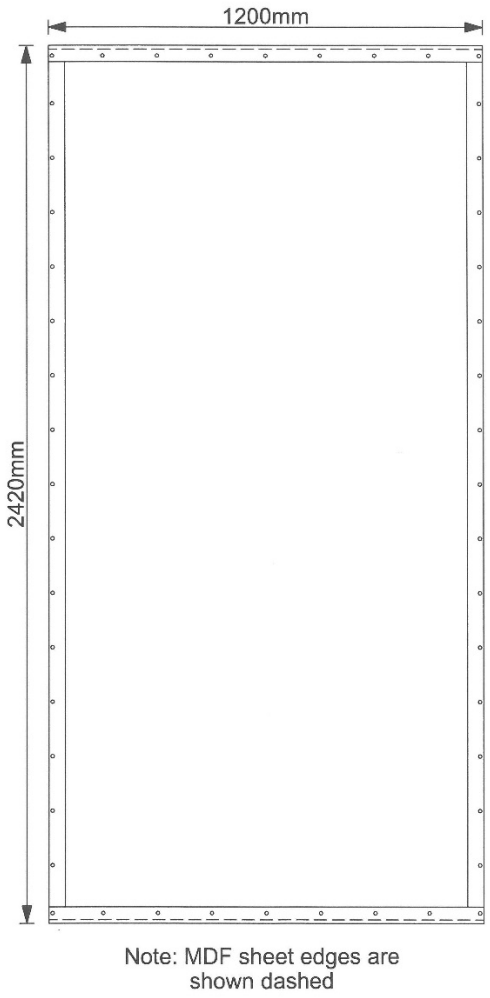

Figure 1. Daiken Customwood 1200 mm Long Specimen Overall Dimensions

(Note: P21 End Restraints, Centre Stud and Handibrac® Hold-Downs Not Shown)

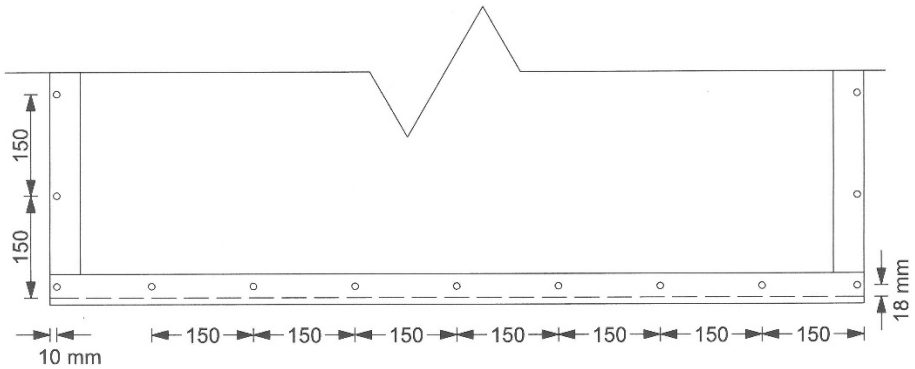

Figure 1. Daiken Customwood 1200 mm Long Specimen Fastener Spacing Pattern

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Figure 3. Daiken Customwood 1200 mm Long Specimen Showing GIB® HandiBrac® Hold-Downs

5. DESCRIPTION OF TESTS

5.1 Date and Location of Tests

The tests were carried out in October 2013 at the Structural Engineering Laboratory of BRANZ Ltd, Judgeford, New Zealand.

5.2 Test Arrangement and Equipment

The racking test specimens were installed in a rigid steel loading frame. P21 end restraints were installed in accordance with the recommendations of BRANZ P21:2010. "A Bracing Wall Test and Evaluation Procedure", available on the BRANZ website.

The bottom plates of all specimens were secured to the test frame using 12 mm diameter threaded rods which were placed through holes drilled through the bottom plates and included and secured to the HandiBrac® hold-downs with doubled nuts on the threaded rods. All specimens were placed on top of a strip of 20 mm thick particle board floor and a timber foundation beam. The foundation beam was securely bolted to the steel beams of the P21 testing frame. Figure 3 shows the threaded rods and nuts used to secure specimen bottom plates to the testing frame.

Horizontal load was applied to the centre of the specimen top plates using 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 1999 Grade 1 accuracy and the linear potentiometers were calibrated to an accuracy of 0.2 mm.

5.3 Test Procedure

The tests were performed according to the recommendations of BRANZ P21:2010 test method. The loading sequence consisted of 3 displacement controlled cycles of each specimen top plate to displacements of ±9, ±15, ±22, ±29, ±36 and ±43 mm. The cyclic regime used can also be seen in the hysteresis plot presented in Appendix A of this report.

6. OBSERVATIONS

During the tests some damage to the MDF around the fasteners was observed as the nails rotated during loading. There was also some bending observed in the HandiBrac® hold-downs in the portions that were attached to bottom plates. Behaviour of the MDF and nail heads is shown in Figure 4. Upon disassembly it was also noted that there was damage to the timber framing in the areas around nails, particularly closer to the bottom of specimens.

Figure 4. Typical Nail Movement as Observed Following Testing of 1200 mm MDF Sheathed Wall Panels

7. RESULTS

Calculation sheets and typical test hysteresis loops are given in Appendix A. P21 results are summarised in Table 1. The bracing rating is only applicable to the construction as tested.

Table 1. Bracing Rating for Daiken Customwood 1200 mm Long System

BRANZ Identifier	Nominal Wall Length	Earthquake		Wind	
		Specimen rating (BU)	Rating per metre (BU)	Specimen rating (BU)	Rating per metre (BU)
CUSTW -1.2	1.2 m	163	136	183	153

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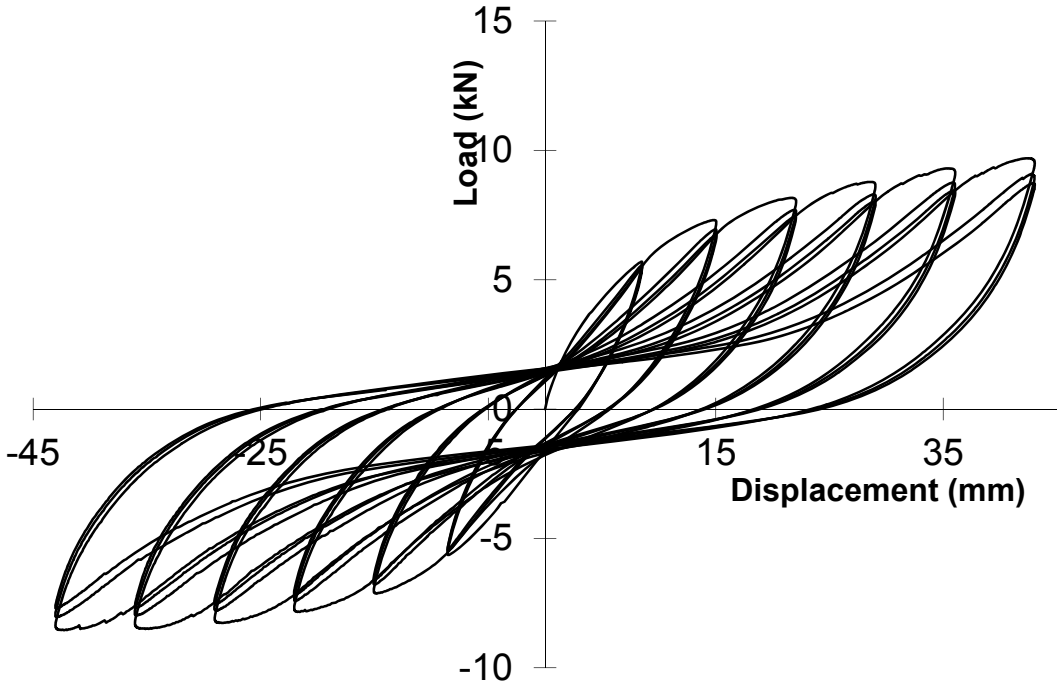
APPENDIX A TYPICAL SPECIMEN HYSTERESIS LOOPS AND CALCULATIONS



	Servicability Cycles Cycle To Displacement x = 8 (mm)		Ultimate Cycles Cycle To Displacement y = 36 (mm)			
Specimen No.	Load S (kN)	Residual Displacement C (mm)	Maximum Load P(kN)	Calculated P/2(kN)	Displacement @P/2=d (mm)	4th Cycle Load at y mm R (KN)
1	+ 5.89	+ 2.60	+ 10.06	+ 5.03	+ 6.30	+ 8.86
	- 5.81	- 2.10	- 8.38			- 7.38
2	+ 5.56	+ 2.80	+ 9.30	+ 4.65	+ 5.85	+ 8.51
	- 5.52	- 2.50	- 8.50			- 7.63
3	+ 5.19	+ 3.20	+ 9.29	+ 4.64	+ 6.50	+ 8.23
	- 5.75	- 2.35	- 9.49			- 8.38
Averages	S= 5.62	C= 2.59	P= 9.17		d= 6.22	R= 8.16

K1 = 1.4 - C/X = 1.00

F = K1 x S = 5.62

The "Asymmetry Of Performance" criterion in the last paragraph of Section 6.5 shall be followed.

u = y/d = 5.79

u	1.00	2.00	2.50	3.00	3.50	4.00
K4	0.35	0.60	0.67	0.74	0.87	1.00

For other values of u, linear interpolation is used to determine K4

Therefore K4 = 1.00

EVALUATION : EARTHQUAKE PERFORMANCE

BU(EQ) = 20 x the lesser of K4R or Fx1.2/0.55

K4 x R = 8.16 Fx1.2/0.55 = 12.3

Therefore BU(EQ) = 20 x 8.16 **BU(EQ) = 163 Bracing Units**

EVALUATION : WIND PERFORMANCE

BU(wind) = 20 x the lesser of P or Fx1.2/0.71

P = 9.17 Fx1.2/0.71 = 9.5

Therefore BU(WIND) = 20 x 9.17 **BU(WIND) = 183 Bracing Units**

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