



PlyBrace™ Plywood Test Reports

Version 3 July 2026

Endless possibilities.



PlyBrace™ P21 Test Reports

bbi® AraucoPly® F8 Structural Pine Plywood 7mm 200mm Wall, Brackets

bbi® AraucoPly® F8 Structural Pine Plywood 7mm 400mm Wall, Brackets

bbi® AraucoPly® F8 Structural Pine Plywood 7mm 600mm Wall, Brackets

bbi® AraucoPly® F8 Structural Pine Plywood 7mm 1200mm **LVL** Wall, Brackets

bbi® AraucoPly® F8 Structural Pine Plywood 9mm 400mm Wall, Brackets

bbi® AraucoPly® F8 Structural Pine Plywood 9mm 600mm Wall, Brackets ®

bbi AraucoPly® F8 Structural Pine Plywood 9mm 1200mm Wall, Brackets

bbi® Blondeline® Birch Poplar Core Plywood 9mm 1200mm Wall, Brackets

bbi® Blondeline® Birch Poplar Core Plywood 12mm 1200mm Wall, Brackets

bbi® Blondeline® Lite Birch Falcata Core Plywood 9mm 1200mm Wall, Brackets

bbi® Blondeline® Lite Birch Falcata Core Plywood 12mm 1200mm Wall, Brackets ®

bbi Redline® Poplar Core Plywood 9mm 1200mm Wall, Brackets

bbi® Redline® Poplar Core Plywood 12mm 1200mm Wall, Brackets

bbi® Redline® Premium Hardwood Core Plywood 12mm 1200mm Wall, Brackets

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AraucoPly® is a registered trademark of Maderas Arauco S.A.

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P21 Test Report

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bbi® AraucoPly®

**F8 Structural Pine Plywood
7mm 200mm Wall, Brackets**

Results

To:	Martin Wallace	From:	Doug Gaunt
Organisation:	bbi Wood Products	Subject:	P21:2010 bbi AraucoPly DD F8 Structural Pine Plywood 7mm 200mm Wall, Brackets
Location:	Hastings	Date:	30 May 2022
Fax No.:	021 745783	No. of	5
Tel No.:	06 8715539	Pages:	

Martin

Please find below the P21 bracing results for your three 200mm x 2.4m bbi AraucoPly DD F8 Structural Pine Plywood 7mm one side Walls with Brackets.

1. BU wind = 8 (41 BU/m) as limited by the serviceability load capacity.
2. BU Earthquake = 10 (49 BU/m) as limited by the ultimate load capacity.

Figures 1, 2 & 3 show the load deflection plots, Figure 4 shows the P21:2010 calculations.

Wall Construction

bbi AraucoPly DD F8 Structural Pine Plywood 7mm one side,
90x45 H1.2 SG8 framing, studs at 200mm centres, no nogs
Plywood fixed with 50x2.8mm Galv clouts at 150 centres to end studs and plates,
No brackets used
One M12 hold down bolt with 50x50x3mm washer to centre of bottom plate
P21 Supplementary restraints used.

RISK AND LIMITATION OF LIABILITY: Scion's liability to the Client arising out of all claims for any loss or damage resulting from this work will not exceed in aggregate an amount equal to two times the Service Fees actually paid by the Client to Scion. Scion will not be liable in any event for loss of profits or any indirect, consequential or special loss or damage suffered or incurred by the Client as a result of any act or omission of Scion under this Agreement.

USE OF NAME: The Client will not use Scion's name in association with the sale and/or marketing of any goods or services

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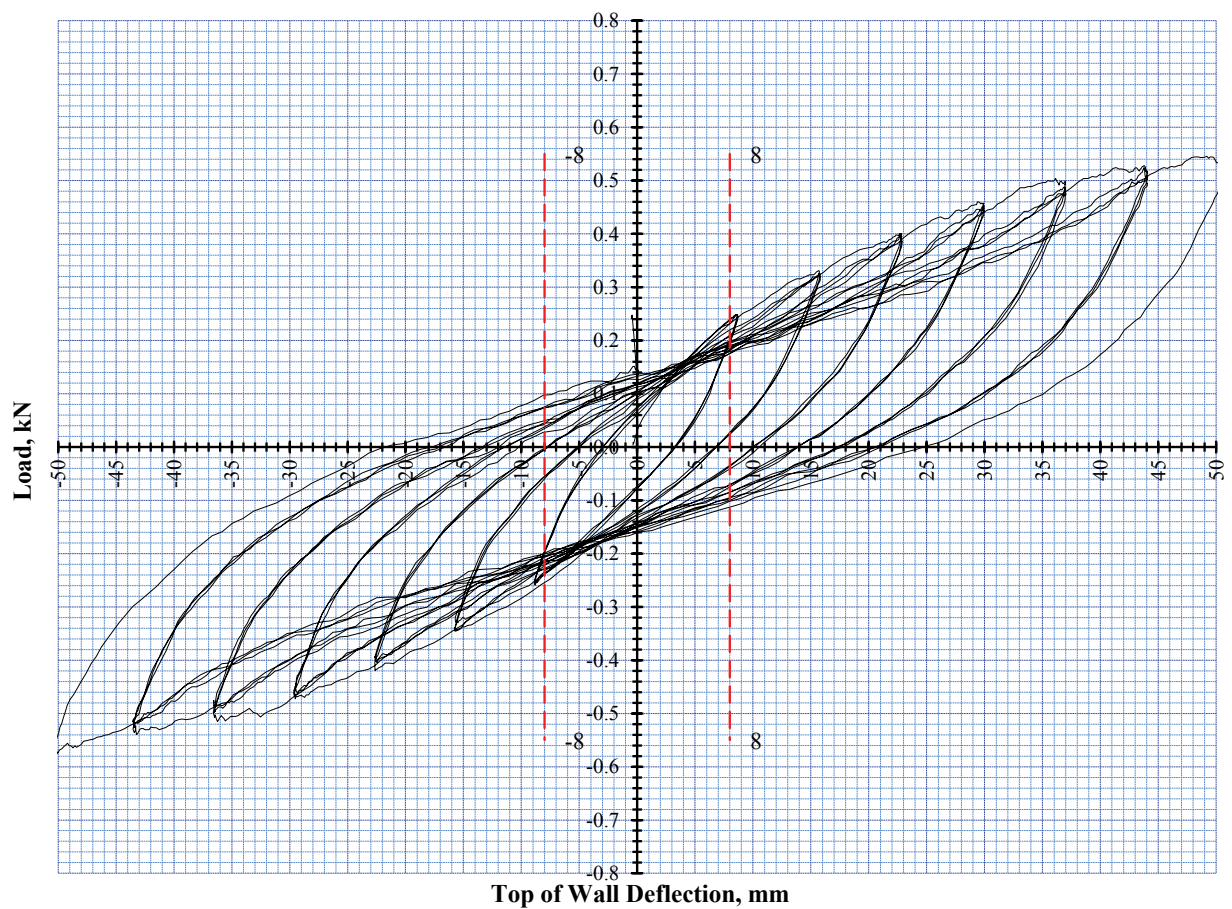


Figure 1: Wall 289145

Observations

No obvious signs of failure to framing or plywood

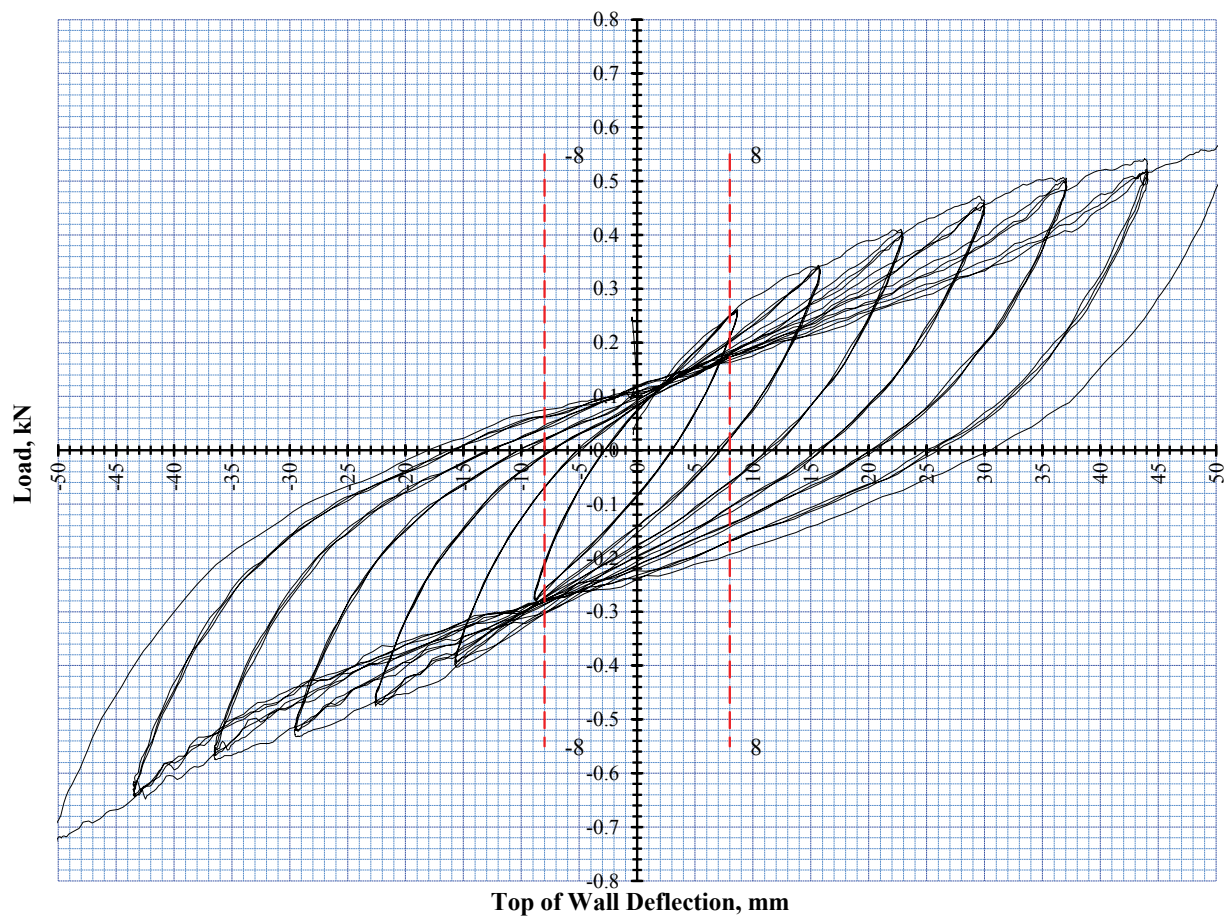
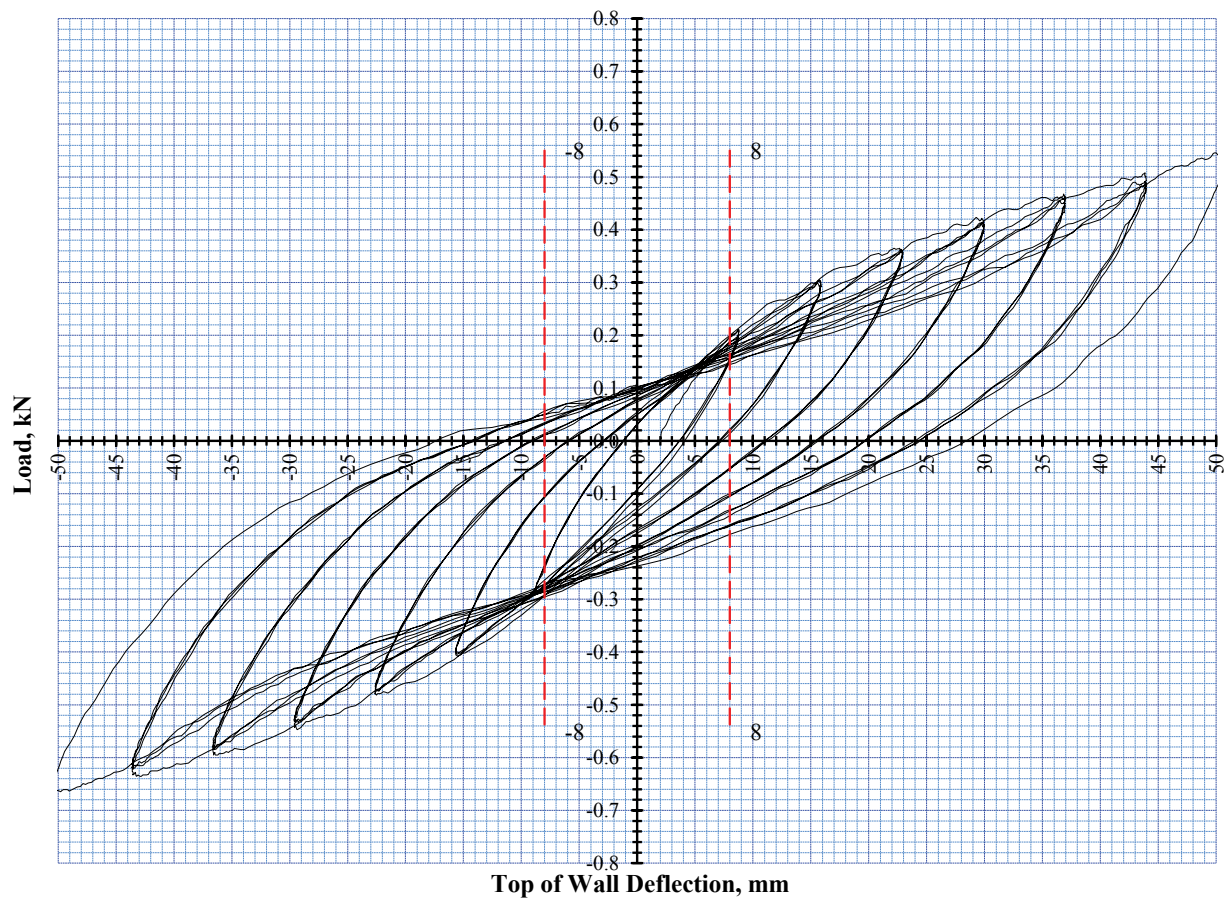


Figure 2: Wall 289146



Top of Wall Deflection, mm

Figure 3: Wall 289147

P21:2010 BRACING RACKING TEST RESULT EVALUATION								
Wall Construction								
200mm, bbi AraucoPly DD F8 Structural Pine Plywood 7mm one side								
90x45 H1.2 SG8 framing, studs at 200mm centres, no nogs								
Plywood fixed 50mmx2.8mm Galv Steel Nails at 150mm centres						Summary		
to plates and external studs						Earthquake	49 (U)	BU/m
7mm min edge distances all around.						Wind	41 (S)	BU/m
One M12 hold down bolt with 50x50x3mm washer to centre of bottom plate								
P21 Supplementary restraints used								
Date of test:-		25-May-22	Ship No.		3251	Tested by		John Lee
Date of calc's:-		30-May-22	Job No.		TE21-068	Analysed by		Doug Gaunt
Calculated to BRANZ P21:2010, AS/NZS1170.2&5, NZS3604:2011 Scion, Private Bag 3020 Rotorua.								
		Serviceability Cycles		Ultimate Cycles				
Lab Number	Direction	Cycle to H/300 or DLQ or DLW		Cycle to Displacement		Wall dimensions		
		8.0	X mm	y=(mm)		L(mm)		H(mm)
		Loads	Residual	Maximum		200		2410
		(P ₈)	Defln, C	Load	def @ P	d at P/2		4th, R
		kN	mm	P(kN)	y (mm)	P/2 (kN)	d mm	kN
289145	+	0.24	3.20	0.50	36.0	0.25	9.0	0.46
	-	0.24	2.50	0.51	36.0			0.48
289146	+	0.25	3.00	0.50	36.0	0.25	8.0	0.48
	-	0.26	2.80	0.57	36.0			0.52
289147	+	0.20	3.60	0.46	36.0	0.23	9.5	0.44
	-	0.28	1.10	0.59	36.0			0.57
		(P ₈)	(C)	(P)	(y)	P/2 (kN)	(d)	(Ry)
Averages		0.24	2.70	0.52	36.00	0.24	8.83	0.49
Coefficient of Variation %		9.97	29.32	8.50	0.00	3.97	7.06	8.56
y = average failure deflection or peak deflection of the three tests.								
d= average first cycle displacement at half peak, (the very first cycle wall reaches the load)								
R = Residual load, P = Peak Load, S = Serviceability load								
Displacement Recovery Factor (K1), (0.8 <= K1 <= 1.0)						Systems factor K2 = 1.2		
Average Structural Displacement Ductility factor						u = y/d 4.08		
Ductility Modification factor						K4 = 1.00		
DLW = Selected deflection limit for wind forces				DLQ = Selected deflection limit for earthquake forces				
P21:2010 BR Calc's								
Lab Number		K1 (= 1.4 - C/X)	EQ ultimate BU's	EQ service BU's	Wind Ultimate BU's	Wind Service BU's		
289145	(BU)	1.00	9.5	10.4	10.1	8.1		
	(BU/m)		47	52	51	40		
289146	(BU)	1.00	10.0	11.1	10.7	8.6		
	(BU/m)		50	56	54	43		
289147	(BU)	1.00	10.1	10.5	10.5	8.1		
	(BU/m)		51	52	53	41		
		289145	-6% Ok result	-4% Ok result	-5% Ok result	-4% Ok result		
<20% Result Check		289146	2% Ok result	6% Ok result	4% Ok result	6% Ok result		
		289147	4% Ok result	-3% Ok result	1% Ok result	-3% Ok result		
Note: Where the value of BR Wind or BR EQ for any specimen is more than 20% greater than either of the other two specimens, assign it a value of 1.2 times the lower value before averaging.								
Average Earthquake BR			Ultimate		Serviceability			
EQ (BU's)		20 x K4 x Ry =	10	(P8 x K1) x (K2/0.55) =		11		
			49 BU/m	Limited by		Ultimate limit state		
Average Wind BR			Ultimate		Serviceability			
Wind (BU's)		20 * P =	10	(P8 x K1) x (K2/0.71) =		8		
			41 BU/m	Limited by		Serviceability limit state		

Figure 4: P21:2010 calculations for 200mm x 2.40m bbi AraucoPly DD F8 Structural Pine Plywood 7mm one side wall

Please feel free to contact me to discuss this information.

Doug Gaunt

P21 Test Report

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bbi® AraucoPly®

**F8 Structural Pine Plywood
7mm 400mm Wall, Brackets**

Results

To:	Martin Wallace	From:	Doug Gaunt
Organisation:	bbi Wood Products	Subject:	P21:2010 bbi AraucoPly DD F8 Structural Pine Plywood 7mm 400mm Wall, Brackets
Location:	Hastings	Date:	30 May 2022
Fax No.:	021 745783	No. of	5
Tel No.:	06 8715539	Pages:	

Please find below the P21 bracing results for your three 400mm x 2.4m bbi AraucoPly DD F8 Structural Pine Plywood 7mm one side Walls with Brackets.

1. BU wind = 22 (56 BU/m) as limited by the serviceability load capacity.
2. BU Earthquake = 23 (58 BU/m) as limited by the ultimate load capacity.

Figures 1, 2 & 3 show the load deflection plots, Figure 4 shows the P21:2010 calculations.

Wall Construction

bbi AraucoPly DD F8 Structural Pine Plywood 7mm one side,
90x45 H1.2 SG8 framing, studs at 400mm centres, no nogs
Plywood fixed with 50x2.8mm Galv clouts at 150 centres to end studs and plates,
GIB Handibracs brackets used
M12 hold down bolts to bottom plate and brackets
P21 Supplementary restraints used.

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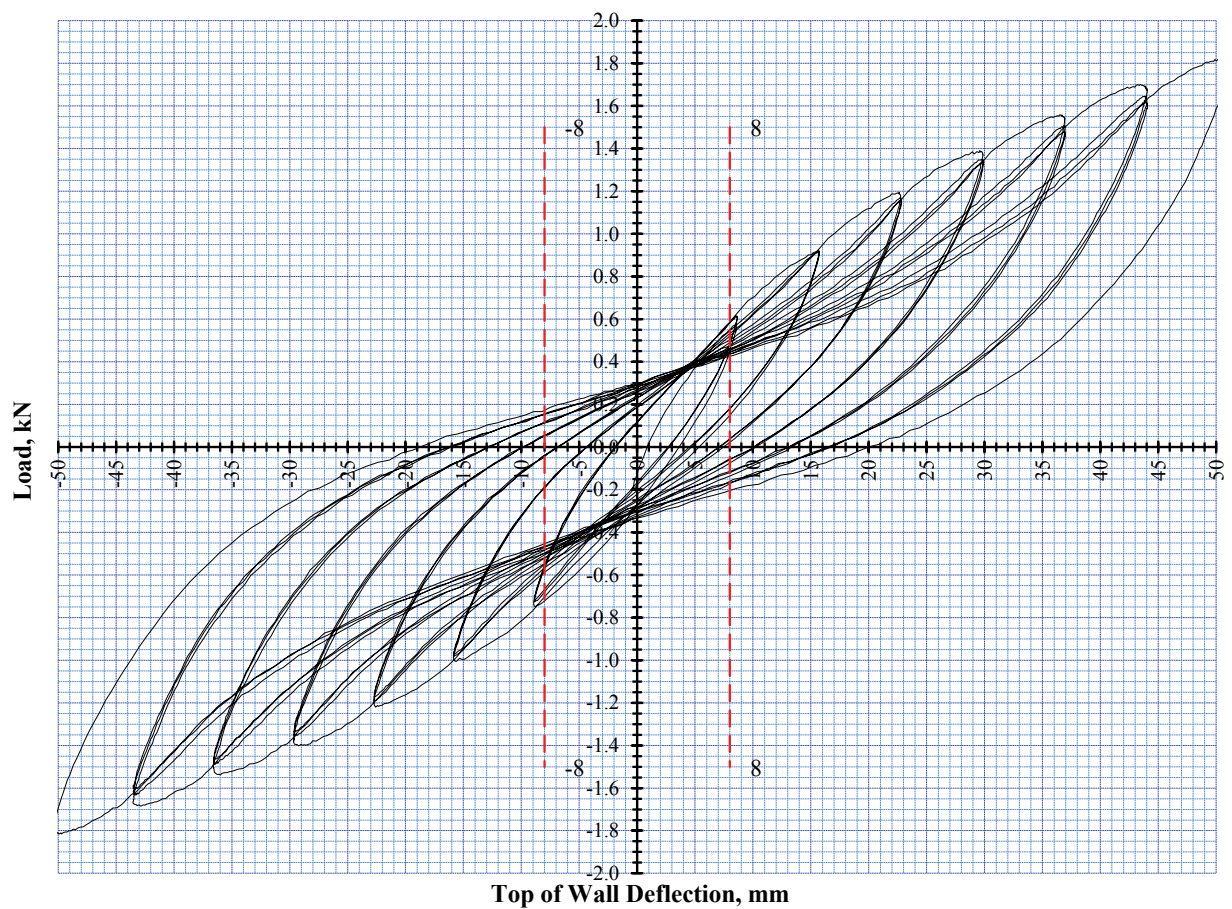


Figure 1: Wall 289142

Observations

No obvious signs of failure to framing or plywood

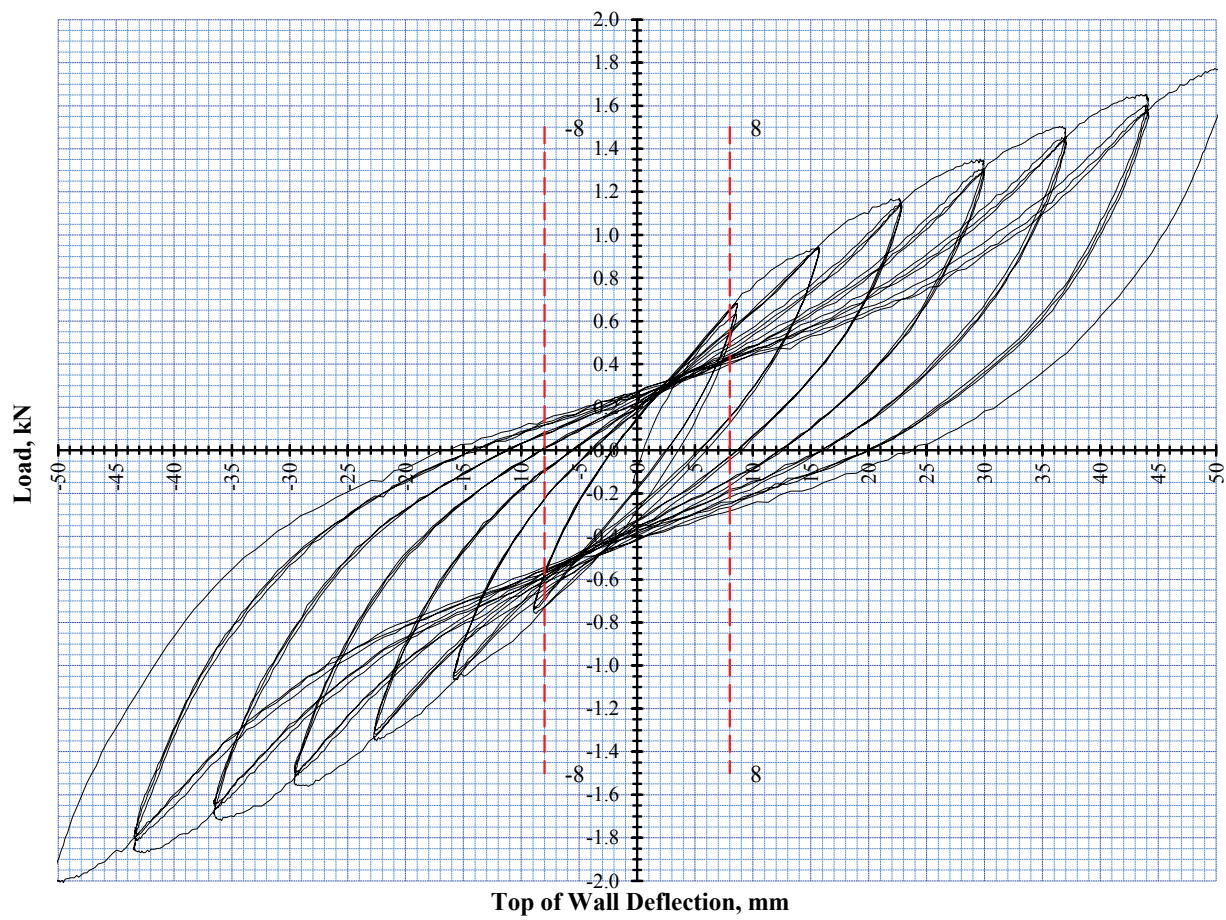


Figure 2: Wall 289143

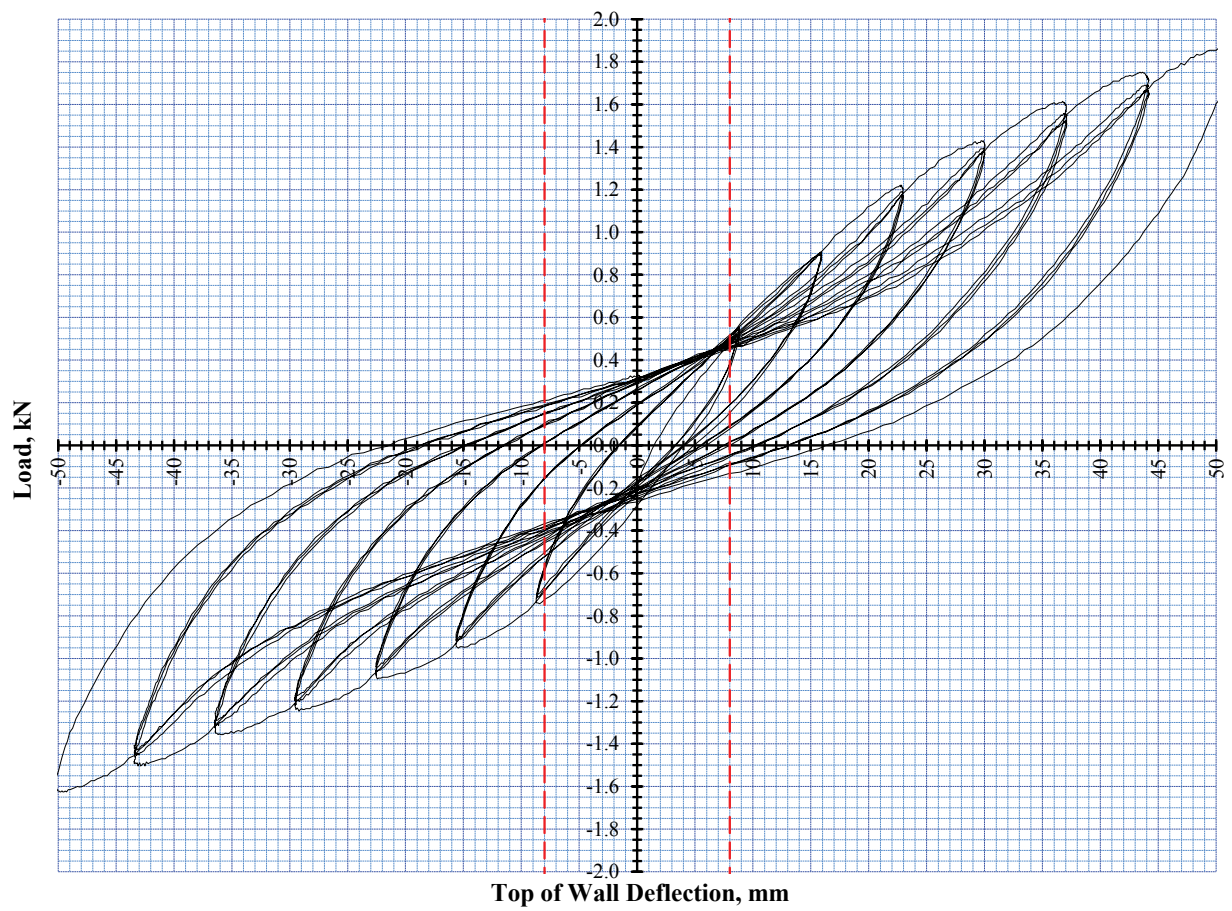


Figure 3: Wall 289144

P21:2010 BRACING RACKING TEST RESULT EVALUATION									
Wall Construction									
400mm, bbi AraucoPly DD F8 Structural Pine Plywood 7mm one side									
90x45 H1.2 SG8 framing, studs at 400mm centres, no nogs									
Plywood fixed 50mmx2.8mm Galv Steel Nails at 150mm centres to plates and external studs							Summary		
7mm min edge distances all around. GIB Handibracs used each end							Earthquake	58 (U)	BU/m
M12 hold down bolts to bottom plate & brackets							Wind	56 (S)	BU/m
P21 Supplementary restraints used									
Date of test:-		25-May-22	Ship No.	3251			Tested by	John Lee	
Date of calc's:-		30-May-22	Job No.	TE21-068			Analysed by	Doug Gaunt	
Calculated to BRANZ P21:2010, AS/NZS1170.2&5, NZS3604:2011 Scion, Private Bag 3020 Rotorua.									
		Serviceability Cycles		Ultimate Cycles					
Lab Number	Direction	Cycle to H/300 or DLQ or DLW		Cycle to Displacement		Wall dimensions			
		8.0	X mm	y=(mm)		L(mm)		H(mm)	
		Loads	Residual	Maximum		400		2410	
		(P ₈)	Defln, C	Load	def @ P	d at P/2	4th, R		
		kN	mm	P(kN)	y (mm)	P/2 (kN)	d mm	kN	
289142	+	0.58	2.70	1.55	36.0	0.78	11.6	1.44	
	-	0.73	1.80	1.53	36.0			1.45	
289143	+	0.67	2.40	1.50	36.0	0.75	9.7	1.40	
	-	0.73	2.00	1.72	36.0			1.65	
289144	+	0.52	3.20	1.60	36.0	0.80	13.3	1.47	
	-	0.72	1.60	1.35	36.0			1.27	
		(P ₈)	(C)	(P)	(y)	P/2 (kN)	(d)	(R _y)	
Averages		0.66	2.28	1.54	36.00	0.78	11.53	1.45	
Coefficient of Variation %		12.32	24.04	7.20	0.00	2.63	12.75	7.75	
y = average failure deflection or peak deflection of the three tests.									
d= average first cycle displacement at half peak, (the very first cycle wall reaches the load)									
R = Residual load, P = Peak Load, S = Serviceability load									
Displacement Recovery Factor (K1), (0.8 <= K1 <= 1.0)					Systems factor K2 = 1.2				
Average Structural Displacement Ductility factor					u = y/d 3.12				
Ductility Modification factor					K4 = 0.80				
DLW = Selected deflection limit for wind forces				DLQ = Selected deflection limit for earthquake forces					
P21:2010 BR Calc's		K1	EQ ultimate	EQ service	Wind Ultimate	Wind Service			
Lab Number		(= 1.4 - C/X)	BU's	BU's	BU's	BU's			
289142	(BU)	1.00	23.1	28.6	30.8	22.1			
	(BU/m)		58	71	77	55			
289143	(BU)	1.00	24.4	30.5	32.2	23.7			
	(BU/m)		61	76	81	59			
289144	(BU)	1.00	21.9	27.1	29.5	21.0			
	(BU/m)		55	68	74	52			
		289142	0% Ok result	-1% Ok result	0% Ok result	-1% Ok result			
<20% Result Check		289143	8% Ok result	9% Ok result	6% Ok result	9% Ok result			
		289144	-8% Ok result	-9% Ok result	-7% Ok result	-9% Ok result			
Note: Where the value of BR Wind or BR EQ for any specimen is more than 20% greater than either of the other two specimens, assign it a value of 1.2 times the lower value before averaging.									
Average Earthquake BR			Ultimate		Serviceability				
EQ (BU's)		20 x K4 x Ry =	23	(P8 x K1) x (K2/0.55) =		29			
			58 BU/m			Limited by	Ultimate limit state		
Average Wind BR			Ultimate		Serviceability				
Wind (BU's)		20 * P =	31	(P8 x K1) x (K2/0.71) =		22			
			56 BU/m			Limited by	Serviceability limit state		

Figure 4: P21:2010 calculations for 400mm x 2.40m bbi AraucoPly DD F8 Structural Pine Plywood 7mm one side wall

Please feel free to contact me to discuss this information.

Doug Gaunt

P21 Test Report

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bbi® AraucoPly®

**F8 Structural Pine Plywood
7mm 600mm Wall, Brackets**

Results

To:	Martin Wallace	From:	Doug Gaunt
Organisation:	bbi Wood Products	Subject:	P21:2010 bbi AraucoPly DD F8 Structural Pine Plywood 7mm 600mm Wall, Brackets
Location:	Hastings	Date:	30 May 2022
Fax No.:	021 745783	No. of	5
Tel No.:	06 8715539	Pages:	

Please find below the P21 bracing results for your three 600mm x 2.4m bbi AraucoPly DD F8 Structural Pine Plywood 7mm one side Walls with Brackets.

1. BU wind = 43 (72 BU/m) as limited by the serviceability load capacity.
2. BU Earthquake = 48 (80 BU/m) as limited by the ultimate load capacity.

Figures 1, 2 & 3 show the load deflection plots, Figure 4 shows the P21:2010 calculations.

Wall Construction

bbi AraucoPly DD F8 Structural Pine Plywood 7mm one side,
 90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs
 Plywood fixed with 50x2.8mm Galv clouts at 150 centres to end studs and plates,
 GIB Handibracs brackets used
 M12 hold down bolts to bottom plate and brackets
 P21 Supplementary restraints used.

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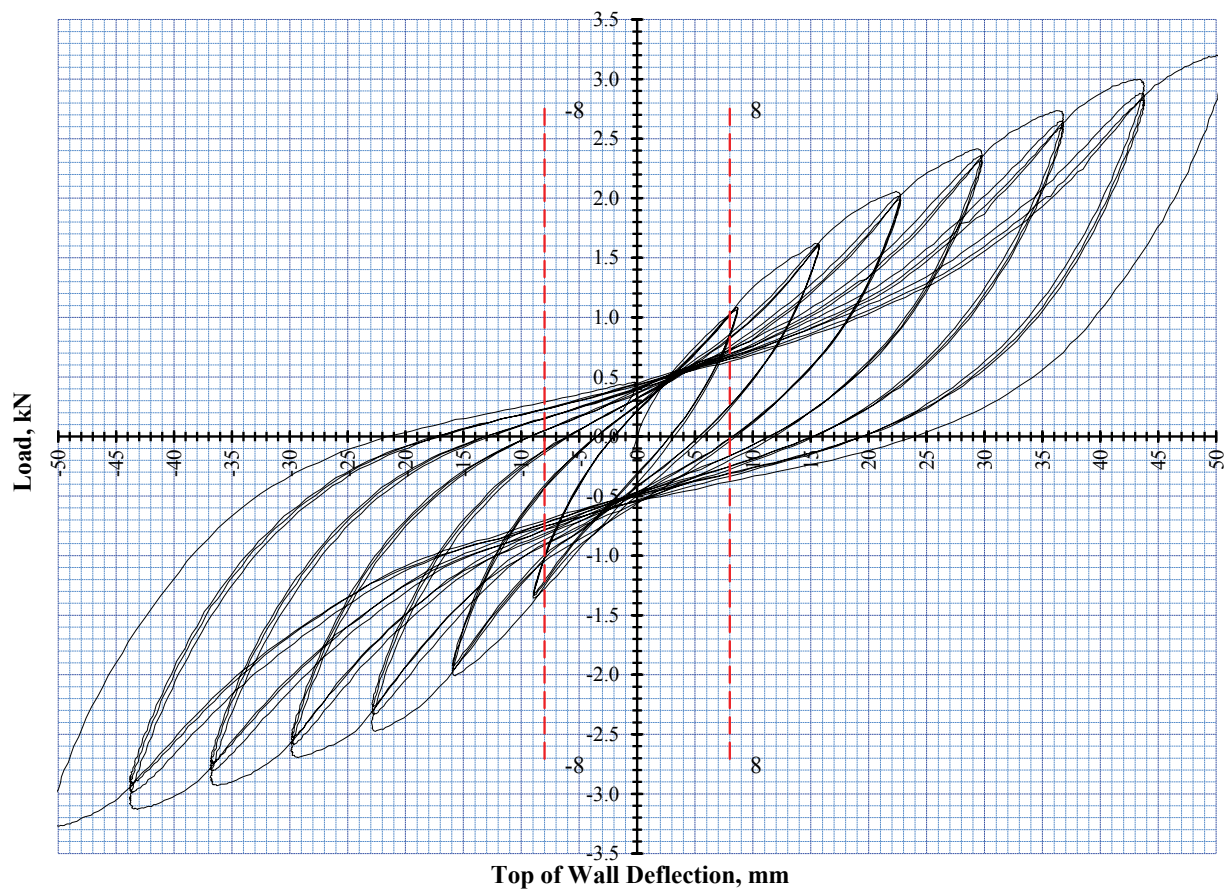


Figure 1: Wall 289139

Observations

No obvious signs of failure to framing or plywood

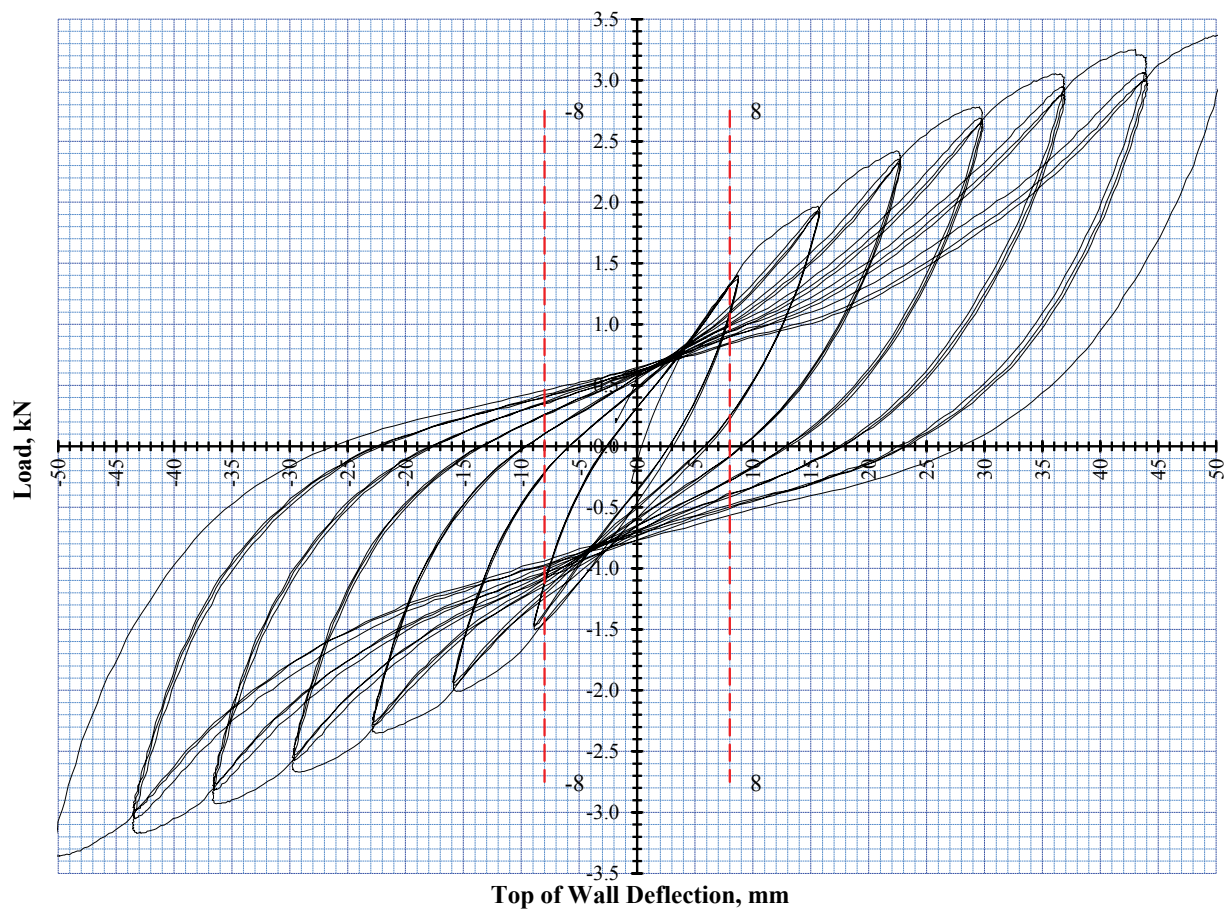


Figure 2: Wall 289140

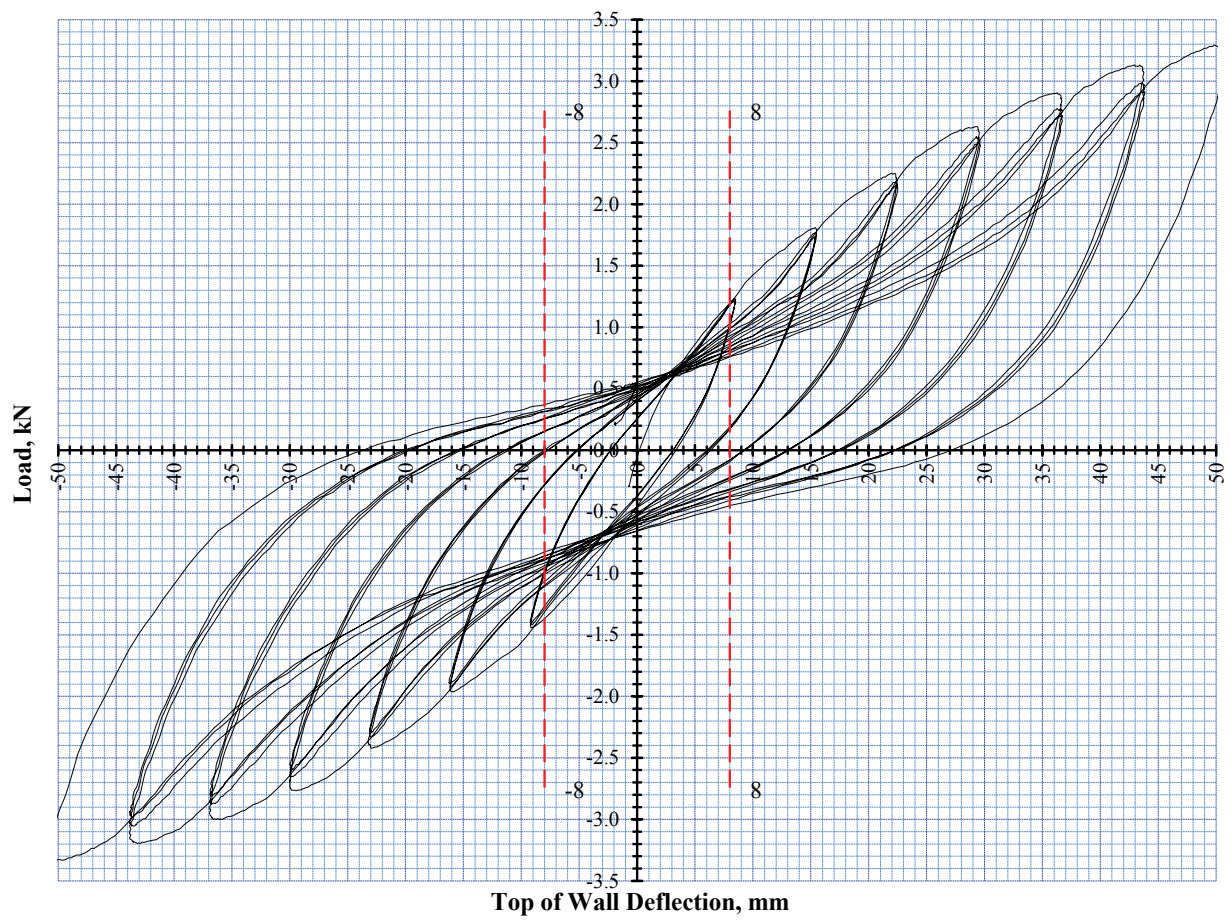


Figure 3: Wall 289141

P21:2010 BRACING RACKING TEST RESULT EVALUATION								
Wall Construction								
600mm, bbi AraucoPly DD F8 Structural Pine Plywood 7mm one side								
90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs								
Plywood fixed 50mmx2.8mm Galv Steel Nails at 150mm centres						Summary		
to plates and external studs						Earthquake	80 (U)	BU/m
7mm min edge distances all around. GIB Handibracs used each end						Wind	72 (S)	BU/m
M12 hold down bolts to bottom plate & brackets								
P21 Supplementary restraints used								
Date of test:-		25-May-22	Ship No.	3251		Tested by	John Lee	
Date of calc's:-		30-May-22	Job No.	TE21-068		Analysed by	Doug Gaunt	
Calculated to BRANZ P21:2010, AS/NZS1170.2&5, NZS3604:2011 Scion, Private Bag 3020 Rotorua.								
		Serviceability Cycles		Ultimate Cycles				
Lab Number	Direction	Cycle to H/300 or DLQ or DLW		Cycle to Displacement		Wall dimensions		
		8.0	X mm	y=(mm)		L(mm)	H(mm)	
		Loads	Residual	Maximum		600	2410	
		(P ₈)	Defln, C	Load	def @ P	d at P/2	4th, R	
		kN	mm	P(kN)	y (mm)	P/2 (kN)	d mm	kN
289139	+	1.03	2.80	2.73	36.0	1.37	11.7	2.55
	-	1.28	2.00	2.93	36.0			2.69
289140	+	1.34	2.80	3.05	36.0	1.53	9.4	2.83
	-	1.44	2.60	2.93	36.0			2.73
289141	+	1.20	3.00	2.80	36.0	1.40	9.6	2.69
	-	1.37	2.20	3.00	36.0			2.75
		(P ₈)	(C)	(P)	(y)	P/2 (kN)	(d)	(Ry)
Averages		1.28	2.57	2.91	36.00	1.43	10.23	2.71
Coefficient of Variation %		10.42	13.81	3.79	0.00	4.80	10.17	3.12
y = average failure deflection or peak deflection of the three tests.								
d= average first cycle displacement at half peak, (the very first cycle wall reaches the load)								
R = Residual load, P = Peak Load, S = Serviceability load								
Displacement Recovery Factor (K1), (0.8 <= K1 <= 1.0)						Systems factor K2 = 1.2		
Average Structural Displacement Ductility factor						u = y/d 3.52		
Ductility Modification factor						K4 = 0.88		
DLW = Selected deflection limit for wind forces				DLQ = Selected deflection limit for earthquake forces				
P21:2010 BR Calc's								
Lab Number		K1	EQ ultimate	EQ service	Wind Ultimate	Wind Service		
		(= 1.4 - C/X)	BU's	BU's	BU's	BU's		
289139	(BU)	1.00	46.2	50.4	56.6	39.0		
	(BU/m)		77	84	94	65		
289140	(BU)	1.00	49.0	60.7	59.8	47.0		
	(BU/m)		82	101	100	78		
289141	(BU)	1.00	48.0	56.1	58.0	43.4		
	(BU/m)		80	93	97	72		
		289139	-5% Ok result	-16% Ok result	-4% Ok result	-16% Ok result		
<20% Result Check		289140	4% Ok result	12% Ok result	4% Ok result	12% Ok result		
		289141	1% Ok result	1% Ok result	0% Ok result	1% Ok result		
Note: Where the value of BR Wind or BR EQ for any specimen is more than 20% greater than either of the other two specimens, assign it a value of 1.2 times the lower value before averaging.								
Average Earthquake BR								
EQ (BU's)		20 x K4 x Ry =	48	(P8 x K1) x (K2/0.55) =		56	Serviceability	
		80	BU/m	Limited by		Ultimate limit state		
Average Wind BR								
Wind (BU's)		20 * P =	58	(P8 x K1) x (K2/0.71) =		43	Serviceability	
		72	BU/m	Limited by		Serviceability limit state		

Figure 4: P21:2010 calculations for 600mm x 2.40m bbi AraucoPly DD F8 Structural Pine Plywood 7mm one side wall

Please feel free to contact me to discuss this information.

Doug Gaunt

P21 Test Report

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bbi® AraucoPly®

**F8 Structural Pine Plywood
7mm 1200mm Wall, Brackets**

Results

To:	Martin Wallace	From:	Doug Gaunt
Organisation:	bbi Wood Products	Subject:	P21:2010 bbi AraucoPly DD F8 Structural Pine Plywood 7mm 1200mm Wall, Brackets
Location:	Hastings	Date:	30 May 2022
Fax No.:	021 745783	No. of	5
Tel No.:	06 8715539	Pages:	

Please find below the P21 bracing results for your three 1200mm x 2.4m bbi AraucoPly DD F8 Structural Pine Plywood 7mm one side Walls with Brackets.

1. BU wind = 112 (93 BU/m) as limited by the serviceability load capacity.
2. BU Earthquake = 120 (100 BU/m) as limited by the ultimate load capacity.

Figures 1, 2 & 3 show the load deflection plots, Figure 4 shows the P21:2010 calculations.

Wall Construction

bbi AraucoPly DD F8 Structural Pine Plywood 7mm one side,
 90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs
 Plywood fixed with 50x2.8mm Galv clouts at 150 centres to end studs and plates, 300mm centres
 on internal stud
 GIB Handibracs brackets used
 M12 hold down bolts to bottom plate and brackets
 P21 Supplementary restraints used.

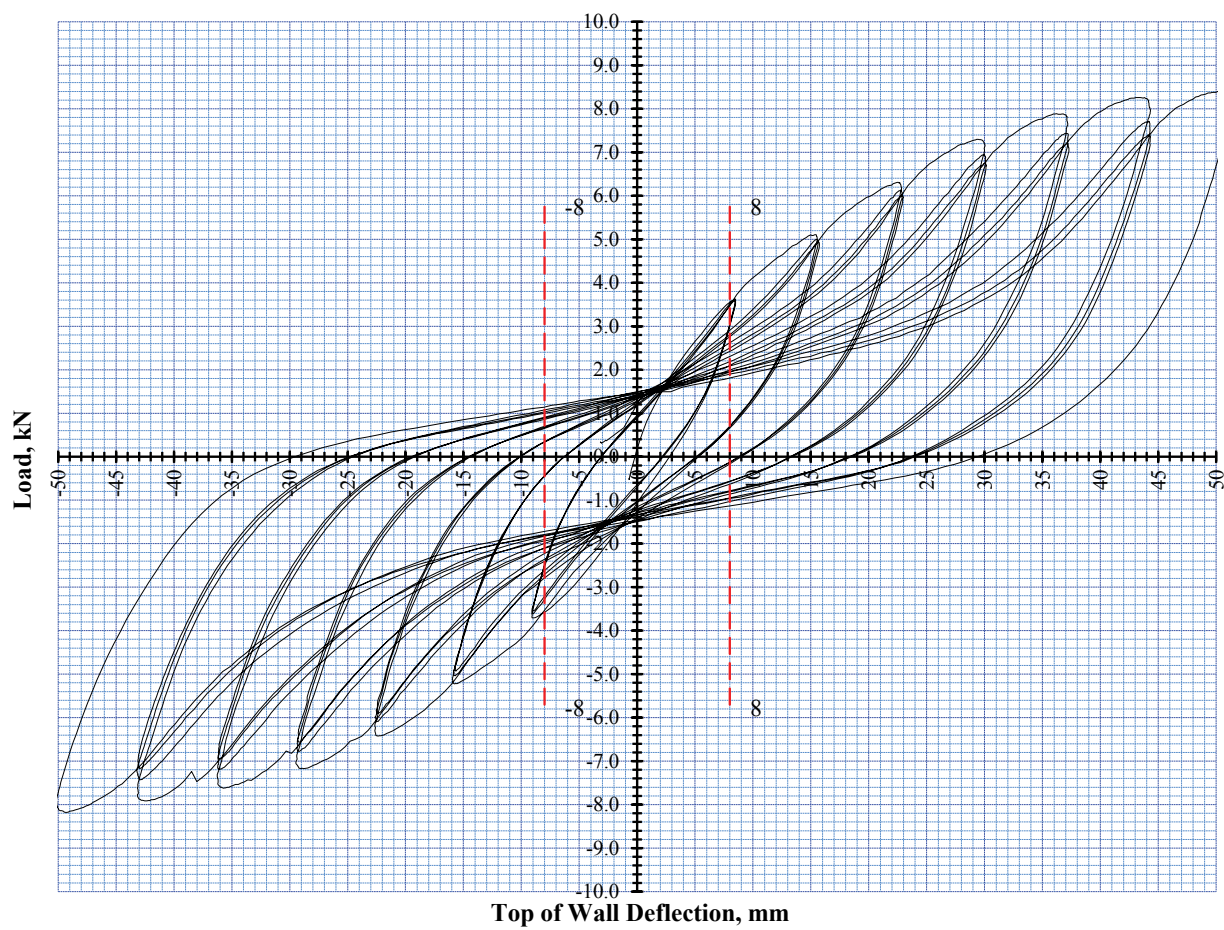
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USE OF NAME: The Client will not use Scion's name in association with the sale and/or marketing of any goods or services

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Top of Wall Deflection, mm

Figure 1: Wall 289133

Observations

No obvious signs of failure to framing or plywood
Plywood pulling on bottom plate nails.

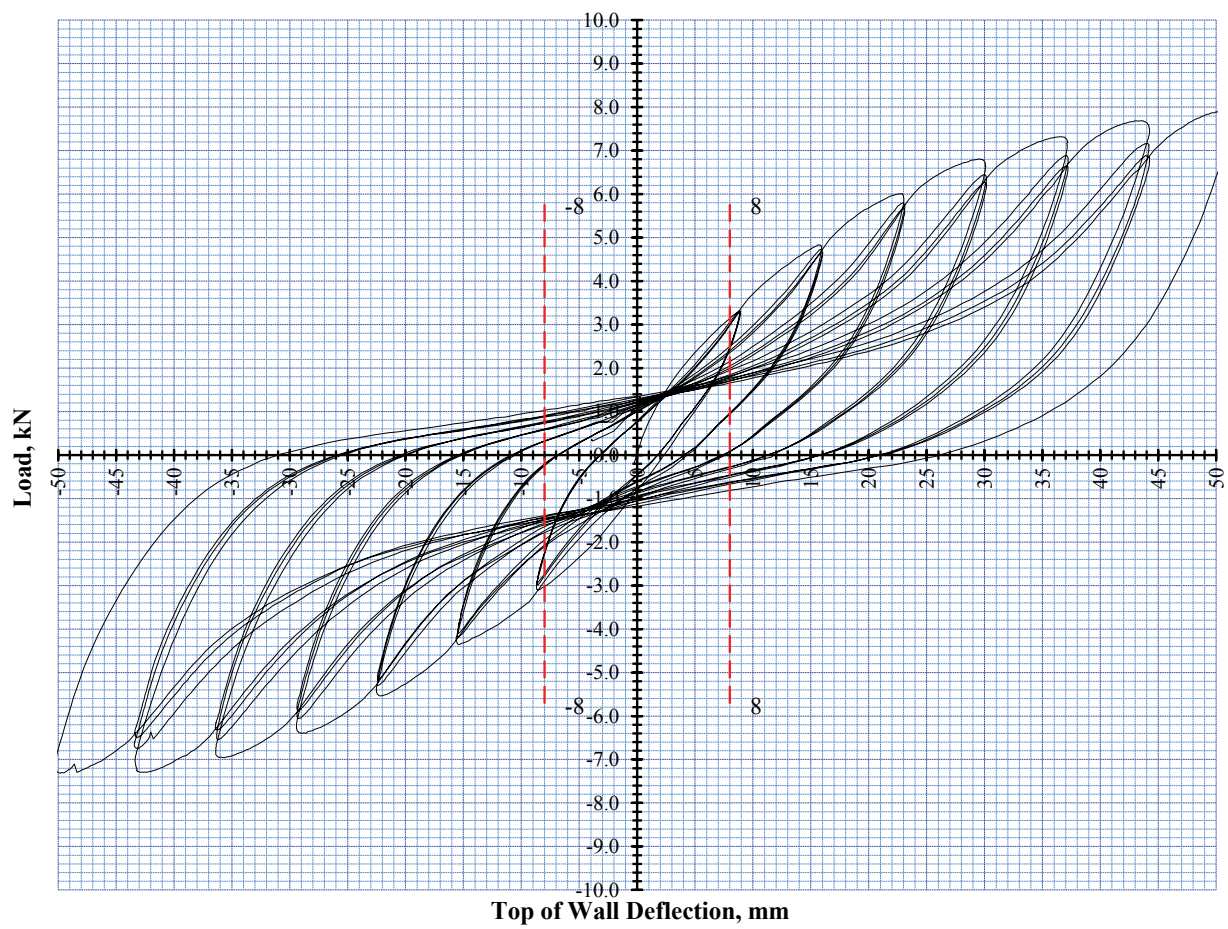


Figure 2: Wall 289134

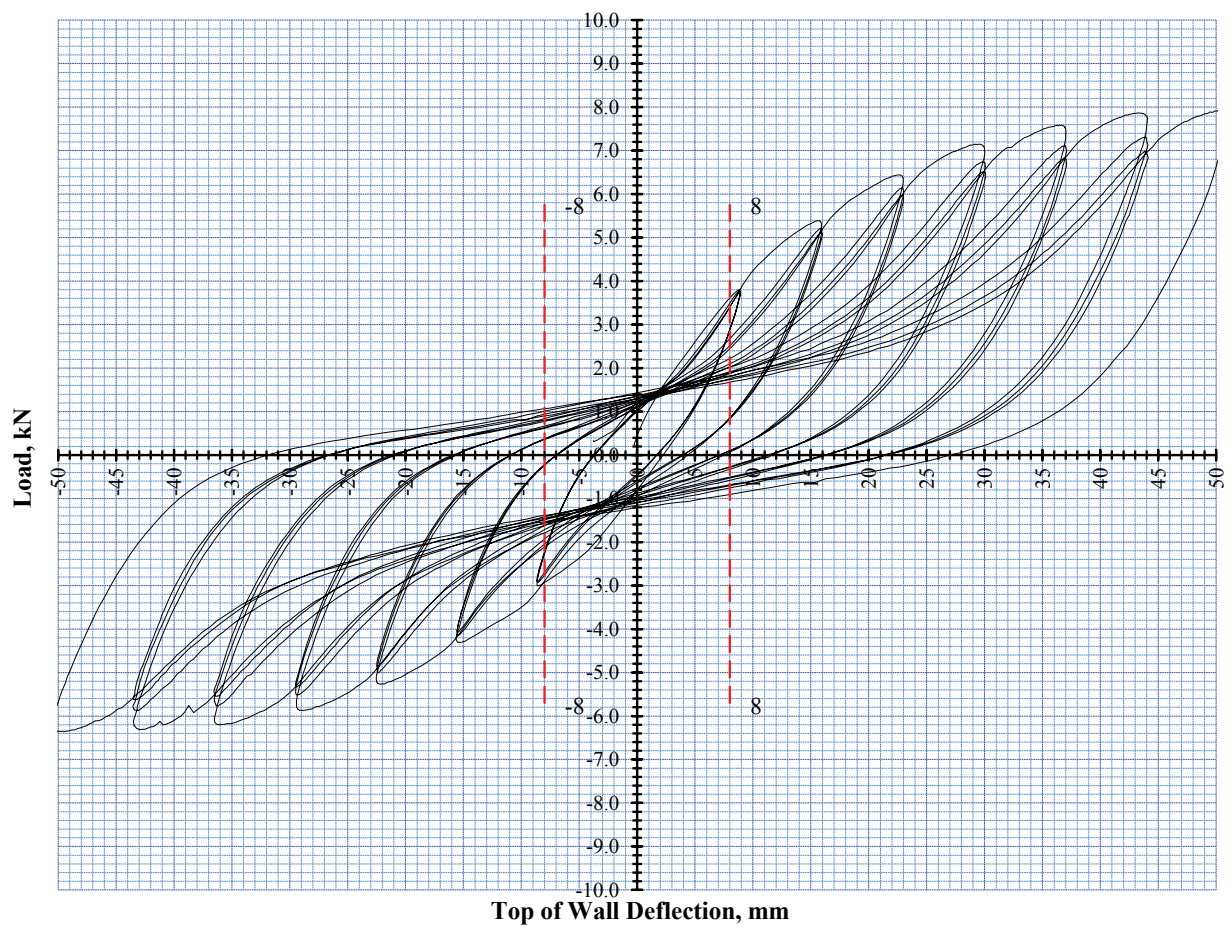


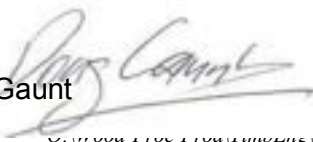
Figure 3: Wall 289135

P21:2010 BRACING RACKING TEST RESULT EVALUATION									
Wall Construction									
1200mm, bbi AraucoPly DD F8 Structural Pine Plywood 7mm one side									
90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs									
Plywood fixed 50mmx2.8mm Galv Steel Nails at 150mm centres							Summary		
to plates and external studs, 300mm to internal studs,							Earthquake	100 (U)	BU/m
7mm min edge distances all around. GIB Handibracs used each end							Wind	93 (S)	BU/m
M12 hold down bolts to bottom plate & brackets									
P21 Supplementary restraints used									
Date of test:-		25-May-22	Ship No.	3251		Tested by	John Lee		
Date of calc's:-		25-May-22	Job No.	TE21-068		Analysed by	Doug Gaunt		
Calculated to BRANZ P21:2010, AS/NZS1170.2&5, NZS3604:2011 Scion, Private Bag 3020 Rotorua.									
		Serviceability Cycles		Ultimate Cycles					
Lab Number	Direction	Cycle to H/300 or DLQ or DLW		Cycle to Displacement		Wall dimensions			
		8.0	X mm	y=(mm)		L(mm) H(mm)			
		Loads	Residual	Maximum		1200 2410			
		(P ₈)	Defln, C	Load	def @ P	d at P/2 4th, R			
		kN	mm	P(kN)	y (mm)	P/2 (kN)	d mm	kN	
289133	+	3.55	2.10	7.87	36.0	3.94	9.5	6.80	
	-	3.58	3.10	7.80	36.0			6.95	
289134	+	3.12	1.70	7.30	36.0	3.65	9.7	6.22	
	-	3.04	3.10	6.96	36.0			6.18	
289135	+	3.62	1.60	7.55	36.0	3.78	9.0	6.50	
	-	2.93	3.60	6.19	36.0			5.35	
		(P ₈)	(C)	(P)	(y)	P/2 (kN)	(d)	(R _y)	
Averages		3.31	2.53	7.28	36.00	3.79	9.40	6.33	
Coefficient of Variation %		8.55	30.29	7.90	0.00	3.08	3.13	8.23	
y = average failure deflection or peak deflection of the three tests.									
d= average first cycle displacement at half peak, (the very first cycle wall reaches the load)									
R = Residual load, P = Peak Load, S = Serviceability load									
Displacement Recovery Factor (K1), (0.8 <= K1 <= 1.0)					Systems factor K2 = 1.2				
Average Structural Displacement Ductility factor					u = y/d 3.83				
Ductility Modification factor					K4 = 0.95				
DLW = Selected deflection limit for wind forces				DLQ = Selected deflection limit for earthquake forces					
P21:2010 BR Calc's									
Lab Number		K1	EQ ultimate	EQ service	Wind Ultimate	Wind Service			
		(= 1.4 - C/X)	BU's	BU's	BU's	BU's			
289133	(BU)	1.00	130.1	155.6	156.7	120.5			
	(BU/m)		108	130	131	100			
289134	(BU)	1.00	117.3	134.4	142.6	104.1			
	(BU/m)		98	112	119	87			
289135	(BU)	1.00	112.1	142.9	137.4	110.7			
	(BU/m)		93	119	115	92			
		289133	12% Ok result	11% Ok result	11% Ok result	11% Ok result			
<20% Result Check		289134	-3% Ok result	-11% Ok result	-3% Ok result	-11% Ok result			
		289135	-10% Ok result	-1% Ok result	-9% Ok result	-1% Ok result			
Note: Where the value of BR Wind or BR EQ for any specimen is more than 20% greater than either of the other two specimens, assign it a value of 1.2 times the lower value before averaging.									
Average Earthquake BR									
EQ (BU's)		20 x K4 x R _y =	Ultimate	(P ₈ x K1) x (K2/0.55) =		Serviceability			
		100	BU/m	Limited by		Ultimate limit state			
Average Wind BR									
Wind (BU's)		20 * P =	Ultimate	(P ₈ x K1) x (K2/0.71) =		Serviceability			
		93	BU/m	Limited by		Serviceability limit state			

Figure 4: P21:2010 calculations for 1200mm x 2.40m bbi AraucoPly DD F8 Structural Pine Plywood 7mm one side wall

Please feel free to contact me to discuss this information.

Doug Gaunt



P21 Test Report

—

bbi® AraucoPly®

**F8 Structural Pine Plywood 7mm
1200mm Wall LVL, Brackets**

Results

To:	Martin Wallace	From:	Doug Gaunt
Organisation:	bbi Wood Products	Subject:	P21:2010 1200mm x 2.4m 7mm F8 pine plywood, LVL8 timber with Brackets
Location:	Hastings	Date:	16 January 2024
Mob No.:	021 745783	No. of	5
Tel No.:	06 8715539	Pages:	

Martin

Please find below your P21 bracing results for your three 1200mm x 2.4m walls with Aracuo 7mm F8 pine plywood one side using LVL8 timber and brackets.

1. BU wind = 138 (115 BU/m) as limited by the serviceability load capacity.
2. BU Earthquake = 141 (117 BU/m) as limited by the ultimate load capacity.

Figures 1, 2 & 3 show the load deflection plots, Figure 4 shows the P21:2010 calculations.

Wall Construction

- 90x45 H1.2 LVL8 framing, Studs at 600mm centres, no nogs
- Aracuo 7mm F8 pine plywood one side
- Plywood fixed with 50mm x 2.8mm Galv Steel Nails at 150mm centres, 300mm to central stud, 15mm end distance
- GIB Handibrac brackets each end
- M12 hold down rods to bottom plate and brackets
- P21 supplementary restraints used

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USE OF NAME: The Client will not use Scion's name in association with the sale and/or marketing of any goods or services

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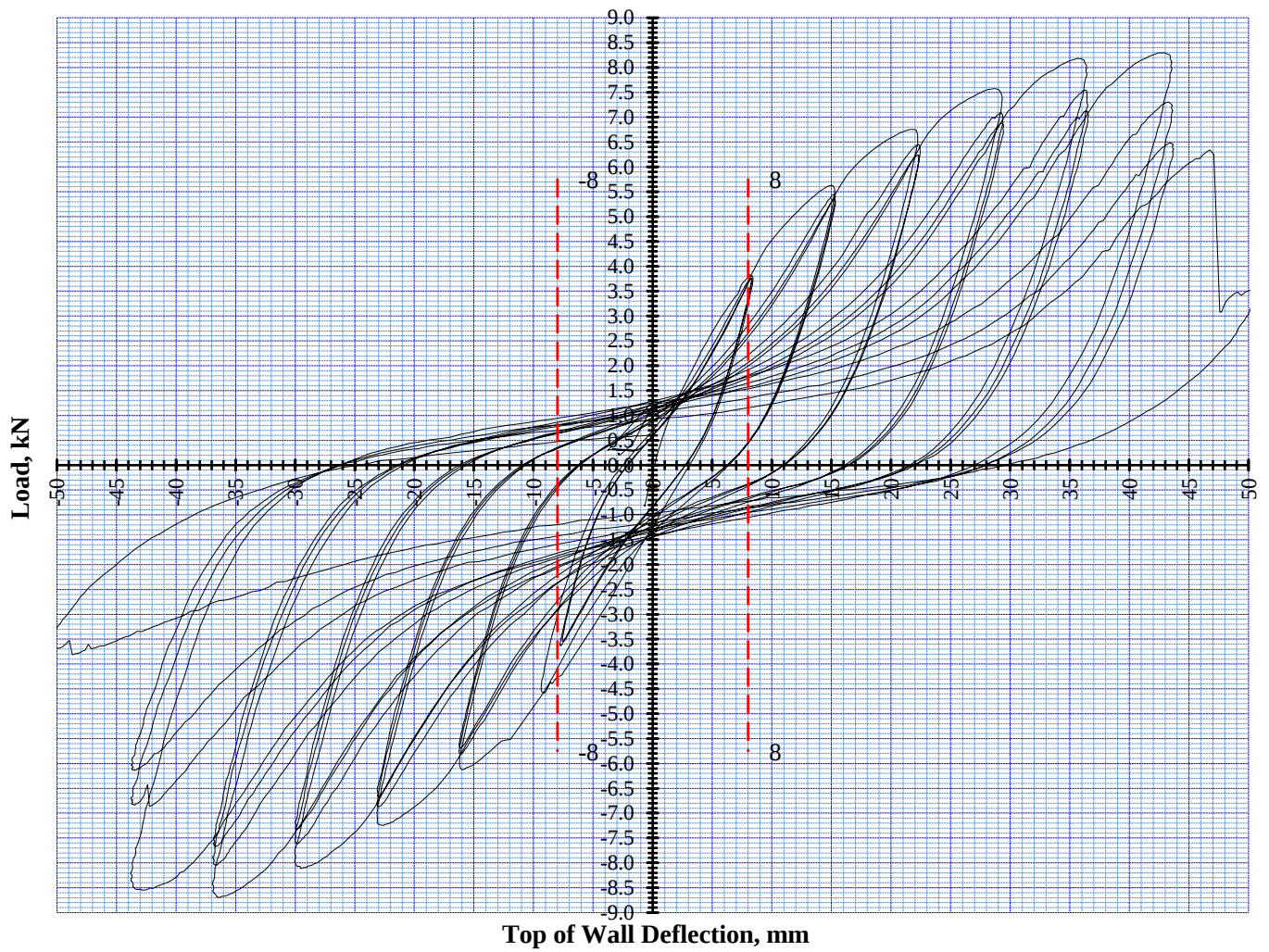
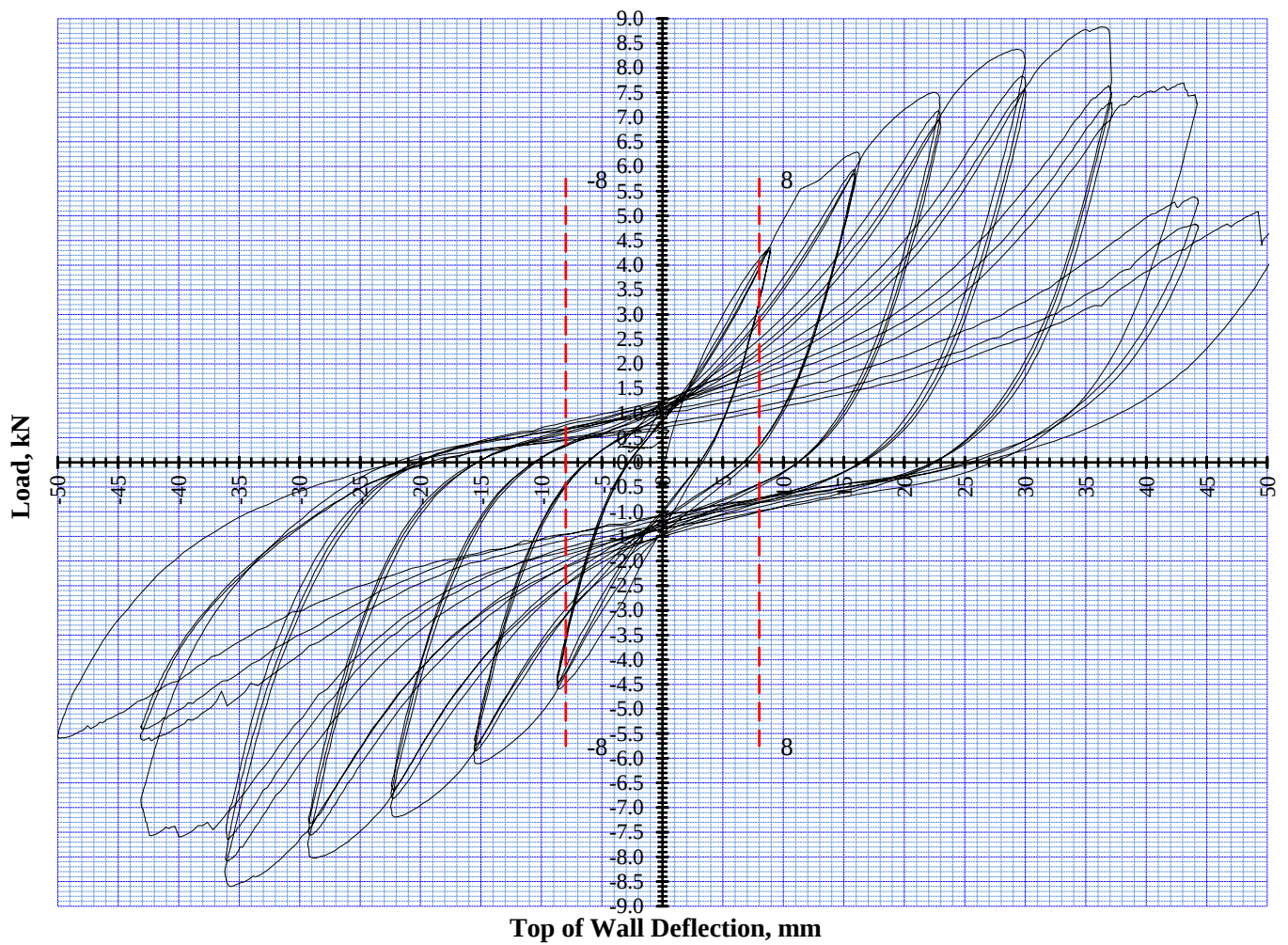


Figure 1: Wall 292790

Observations

- Pulling and snapping nails on bottom plate and then plywood pulling of bottom plate and up bottom of studs at end of test



Top of Wall Deflection, mm

Figure 2: Wall 292791

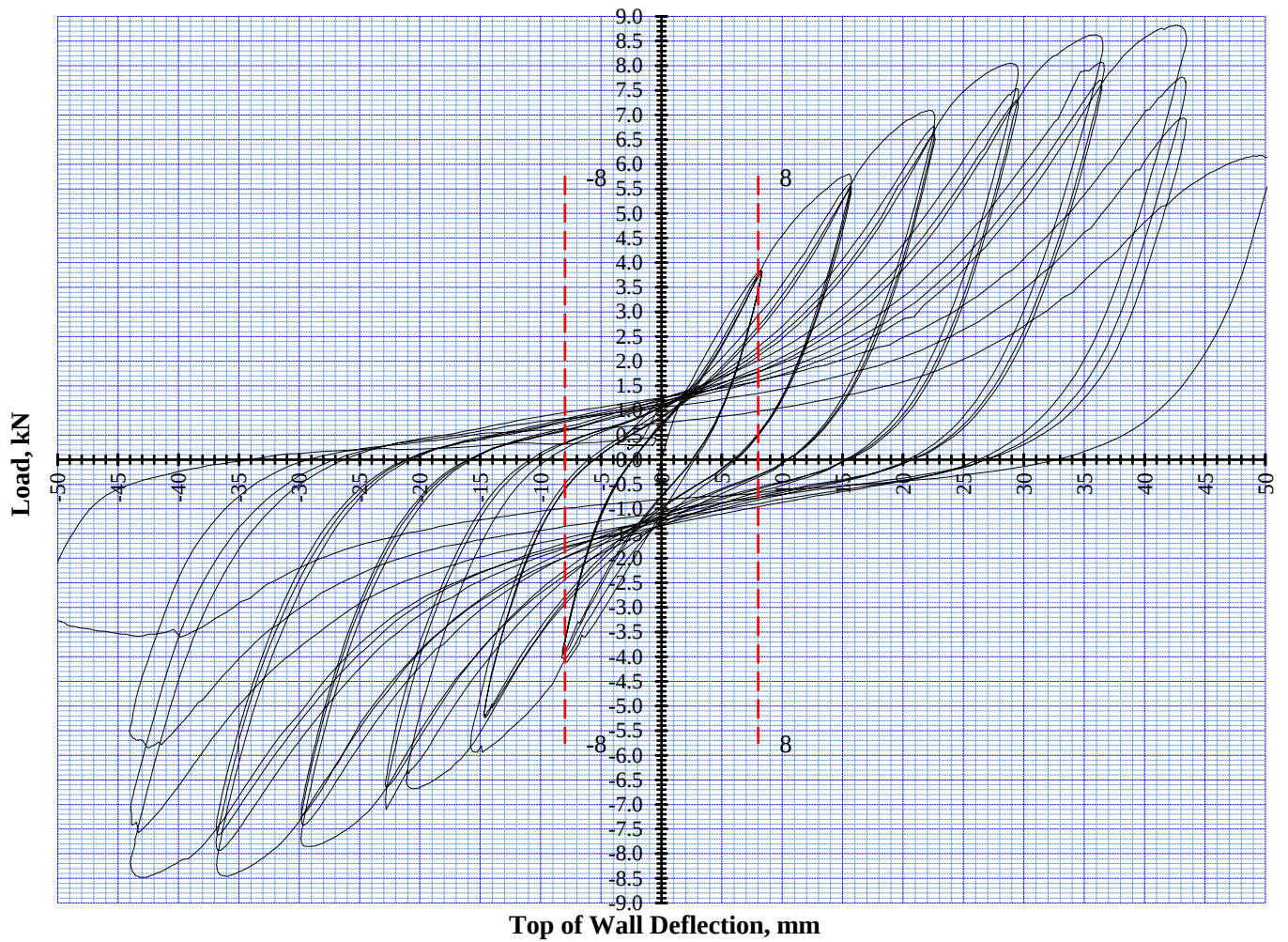


Figure 3: Wall 292792

P21:2010 BRACING RACKING TEST RESULT EVALUATION									
Wall Construction									
1200mm, Aracuo F8 9mm Plywood one side									
90x45 H1.2 LVL8 framing, studs at 600mm centres, no nogs									
Plywood fixed 50mmx2.8mm Galv Steel Nails at 150mm centres to plates and external studs, 300mm to internal stud, 15mm min edge distances all around. GIB Handibracs used each end							Summary		
M12 hold down bolts to bottom plate & brackets							Earthquake	117 (U)	BU/m
							Wind	115 (S)	BU/m
P21 Supplementary restraints used									
Date of test:-		8-Jan-24	Ship No.	3338		Tested by	Doug Gaunt		
Date of calc's:-		11-Jan-24	Job No.	TE23-026		Analysed by	Doug Gaunt		
Calculated to BRANZ P21:2010, AS/NZS1170.2&5, NZS3604:2011 Scion, Private Bag 3020 Rotorua.									
		Serviceability Cycles		Ultimate Cycles					
Lab Number	Direction	Cycle to H/300 or DLQ or DLW		Cycle to Displacement		Wall dimensions			
		8.0	X mm	y=(mm)		L(mm)	H(mm)		
		Loads	Residual	Maximum		1200	2410		
		(P ₈)	Defln, C	Load	def @ P	d at P/2	4th, R		
		kN	mm	P(kN)	y (mm)	P/2 (kN)	d mm	kN	
292790	+	3.77	2.60	8.16	36.0	4.08	8.7	6.90	
	-	4.26	2.00	8.68	36.0			7.17	
292791	+	4.13	3.00	8.80	36.0	4.40	8.9	6.70	
	-	4.50	2.70	8.60	36.0			6.82	
292792	+	3.80	2.56	8.62	36.0	4.31	9.3	7.48	
	-	4.02	2.30	8.45	36.0			7.20	
		(P ₈)	(C)	(P)	(y)	P/2 (kN)	(d)	(Ry)	
Averages		4.08	2.53	8.55	36.00	4.26	8.97	7.05	
Coefficient of Variation %		6.24	12.40	2.38	0.00	3.16	2.78	3.75	
y = average failure deflection or peak deflection of the three tests.									
d= average first cycle displacement at half peak, (the very first cycle wall reaches the load)									
R = Residual load, P = Peak Load, S = Serviceability load									
Displacement Recovery Factor (K1), (0.8 <= K1 <= 1.0)					Systems factor K2 = 1.2				
Average Structural Displacement Ductility factor					u = y/d 4.01				
Ductility Modification factor					K4 = 1.00				
DLW = Selected deflection limit for wind forces				DLQ = Selected deflection limit for earthquake forces					
P21:2010 BR Calc's									
Lab Number		K1	EQ ultimate	EQ service	Wind Ultimate	Wind Service			
		(= 1.4 - C/X)	BU's	BU's	BU's	BU's			
292790	(BU)	1.00	140.7	175.2	168.4	135.7			
	(BU/m)		117	146	140	113			
292791	(BU)	1.00	135.2	188.3	174.0	145.9			
	(BU/m)		113	157	145	122			
292792	(BU)	1.00	146.8	170.6	170.7	132.2			
	(BU/m)		122	142	142	110			
<20% Result Check		292790	0% Ok result	-2% Ok result	-2% Ok result	-2% Ok result			
		292791	-6% Ok result	8% Ok result	3% Ok result	8% Ok result			
		292792	6% Ok result	-7% Ok result	0% Ok result	-7% Ok result			
Note: Where the value of BR Wind or BR EQ for any specimen is more than 20% greater than either of the other two specimens, assign it a value of 1.2 times the lower value before averaging.									
Average Earthquake BR			Ultimate				Serviceability		
EQ (BU's)		20 x K4 x Ry =	141	(P8 x K1) x (K2/0.55) =		178			
			117 BU/m	Limited by		Ultimate limit state			
Average Wind BR			Ultimate				Serviceability		
Wind (BU's)		20 * P =	171	(P8 x K1) x (K2/0.71) =		138			
			115 BU/m	Limited by		Serviceability limit state			

Figure 4: P21:2010 calculations for the 1200mm x 2.4m, 7mm F8 pine plywood one side with brackets

Please feel free to contact me to discuss this information.

Doug Gaunt

P21 Test Report

—

bbi® AraucoPly®

**F8 Structural Pine Plywood
9mm 400mm Wall, Brackets**

Results

To:	Martin Wallace	From:	Doug Gaunt
Organisation:	bbi Wood Products	Subject:	P21:2010 400mm x 2.4m 9mm F8 pine plywood, SG8 timber with Brackets
Location:	Hastings	Date:	16 January 2024
Mob No.:	021 745783	No. of	5
Tel No.:	06 8715539	Pages:	

Martin

Please find below your P21 bracing results for your three 400mm x 2.4m walls with Aracuo 9mm F8 pine plywood one side using SG8 timber and brackets.

1. BU wind = 24 (61 BU/m) as limited by the serviceability load capacity.
2. BU Earthquake = 28 (70 BU/m) as limited by the ultimate load capacity.

Figures 1, 2 & 3 show the load deflection plots, Figure 4 shows the P21:2010 calculations.

Wall Construction

- 90x45 H1.2 SG8 framing, Studs at 400mm centres, no nogs
- Aracuo 9mm F8 pine plywood one side
- Plywood fixed with 50mm x 2.8mm Galv Steel Nails at 150mm centres, 15mm end distance
- GIB Handibrac brackets each end
- M12 hold down rods to bottom plate and brackets
- P21 supplementary restraints used

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USE OF NAME: The Client will not use Scion's name in association with the sale and/or marketing of any goods or services

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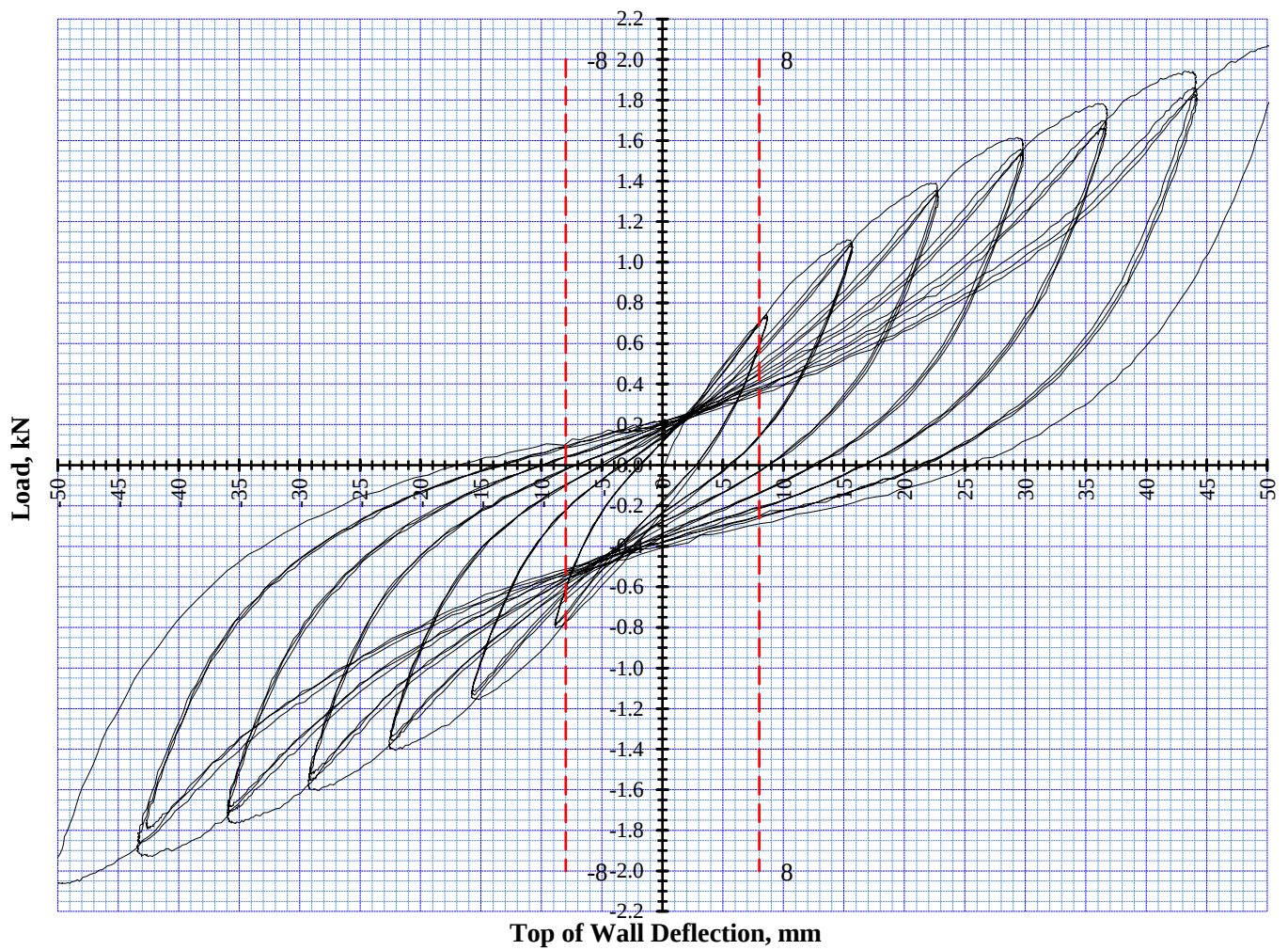


Figure 1: Wall 292796

Observations

- No obvious signs of damage

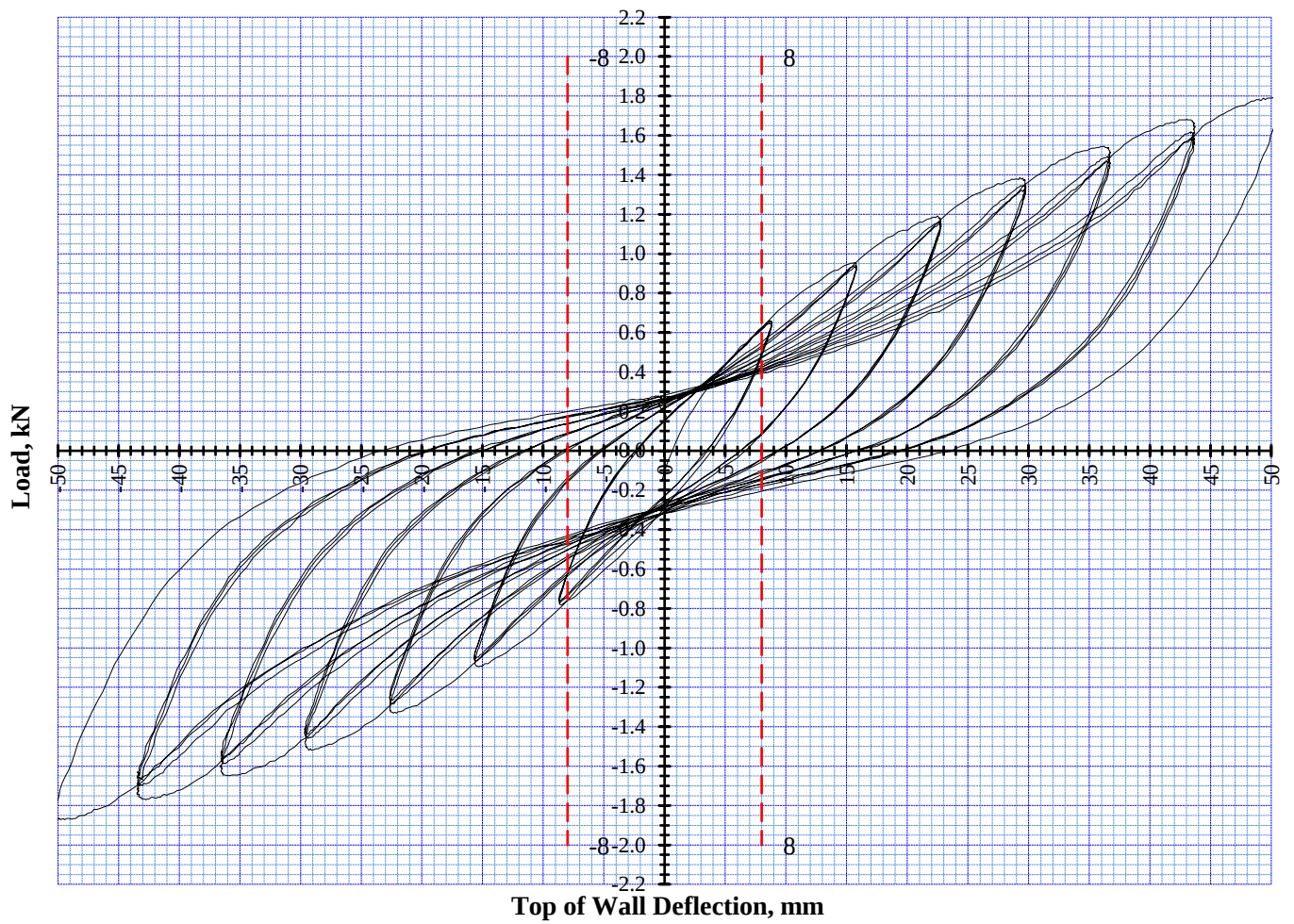


Figure 2: Wall 292797

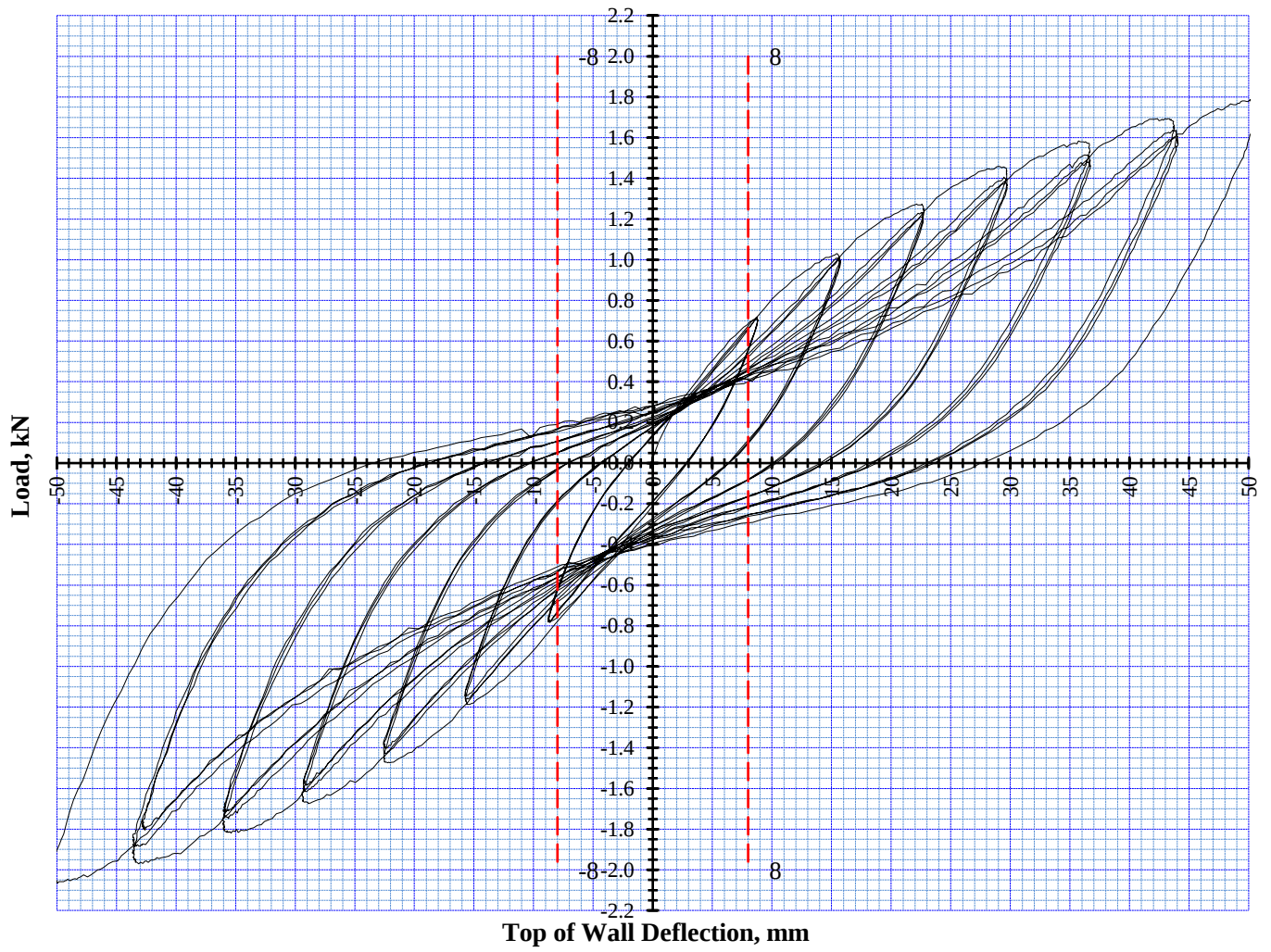


Figure 3: Wall 292798

P21:2010 BRACING RACKING TEST RESULT EVALUATION								
Wall Construction								
400mm, Aracuo F8 9mm Plywood one side								
90x45 H1.2 SG8 framing, studs at 400mm centres, no nogs								
Plywood fixed 50mmx2.8mm Galv Steel Nails at 150mm centres						Summary		
to plates and external studs						Earthquake	70 (U)	BU/m
15mm min edge distances all around. GIB Handibracs used each end						Wind	61 (S)	BU/m
M12 hold down bolts to bottom plate & brackets								
P21 Supplementary restraints used								
Date of test:-		15-Jan-24	Ship No.	3338		Tested by	Doug Gaunt	
Date of calc's:-		16-Jan-24	Job No.	TE23-026		Analysed by	Doug Gaunt	
Calculated to BRANZ P21:2010, AS/NZS1170.2&5, NZS3604:2011 Scion, Private Bag 3020 Rotorua.								
		Serviceability Cycles		Ultimate Cycles				
Lab Number	Direction	Cycle to H/300 or DLQ or DLW		Cycle to Displacement		Wall dimensions		
		8.0	X mm	y=(mm)		L(mm)	H(mm)	
		Loads	Residual	Maximum		400	2410	
		(P ₈)	Defln, C	Load	def @ P	d at P/2	4th, R	
		kN	mm	P(kN)	y (mm)	P/2 (kN)	d mm	kN
292796	+	0.70	2.70	1.78	36.0	0.89	10.5	1.64
	-	0.77	1.80	1.77	36.0			1.70
292797	+	0.63	3.40	1.54	36.0	0.77	10.4	1.45
	-	0.76	2.20	1.65	36.0			1.55
292798	+	0.67	3.00	1.58	36.0	0.79	10.1	1.45
	-	0.77	1.80	1.82	36.0			1.76
		(P ₈)	(C)	(P)	(y)	P/2 (kN)	(d)	(Ry)
Averages		0.72	2.48	1.69	36.00	0.82	10.33	1.59
Coefficient of Variation %		7.54	24.21	6.28	0.00	6.43	1.64	7.45
y = average failure deflection or peak deflection of the three tests.								
d= average first cycle displacement at half peak, (the very first cycle wall reaches the load)								
R = Residual load, P = Peak Load, S = Serviceability load								
Displacement Recovery Factor (K1), (0.8 <= K1 <= 1.0)					Systems factor K2 = 1.2			
Average Structural Displacement Ductility factor					u = y/d 3.48			
Ductility Modification factor					K4 = 0.87			
DLW = Selected deflection limit for wind forces				DLQ = Selected deflection limit for earthquake forces				
P21:2010 BR Calc's								
Lab Number		K1	EQ ultimate	EQ service	Wind Ultimate	Wind Service		
		(= 1.4 - C/X)	BU's	BU's	BU's	BU's		
292796	(BU)	1.00	29.2	32.1	35.5	24.8		
	(BU/m)		73	80	89	62		
292797	(BU)	1.00	26.2	30.3	31.9	23.5		
	(BU/m)		66	76	80	59		
292798	(BU)	1.00	28.1	31.4	34.0	24.3		
	(BU/m)		70	79	85	61		
<20%Result Check		292796	7% Ok result	4% Ok result	7% Ok result	4% Ok result		
		292797	-9% Ok result	-5% Ok result	-9% Ok result	-5% Ok result		
		292798	1% Ok result	1% Ok result	1% Ok result	1% Ok result		
Note: Where the value of BR Wind or BR EQ for any specimen is more than 20% greater than either of the other two specimens, assign it a value of 1.2 times the lower value before averaging.								
Average Earthquake BR			Ultimate	Serviceability				
EQ (BU's)	20 x K4 x Ry =	28	(P8 x K1) x (K2/0.55) =		31			
	70	BU/m	Limited by		Ultimate limit state			
Average Wind BR			Ultimate	Serviceability				
Wind (BU's)	20 * P =	34	(P8 x K1) x (K2/0.71) =		24			
	61	BU/m	Limited by		Serviceability limit state			

Figure 4: P21:2010 calculations for the 400mm x 2.4m, 9mm F8 pine plywood one side with brackets

Please feel free to contact me to discuss this information.

Doug Gaunt

P21 Test Report

—

bbi® AraucoPly®

**F8 Structural Pine Plywood
9mm 600mm Wall, Brackets**

Results

To:	Martin Wallace	From:	Doug Gaunt
Organisation:	bbi Wood Products	Subject:	P21:2010 600mm x 2.4m 9mm F8 pine plywood, SG8 timber with Brackets
Location:	Hastings	Date:	16 January 2024
Mob No.:	021 745783	No. of	5
Tel No.:	06 8715539	Pages:	

Martin

Please find below your P21 bracing results for your three 600mm x 2.4m walls with Aracuo 9mm F8 pine plywood one side using SG8 timber and brackets.

1. BU wind = 45 (75 BU/m) as limited by the serviceability load capacity.
2. BU Earthquake = 50 (83 BU/m) as limited by the ultimate load capacity.

Figures 1, 2 & 3 show the load deflection plots, Figure 4 shows the P21:2010 calculations.

Wall Construction

- 90x45 H1.2 SG8 framing, Studs at 600mm centres, no nogs
- Aracuo 9mm F8 pine plywood one side
- Plywood fixed with 50mm x 2.8mm Galv Steel Nails at 150mm centres, 15mm end distance
- GIB Handibrac brackets each end
- M12 hold down rods to bottom plate and brackets
- P21 supplementary restraints used

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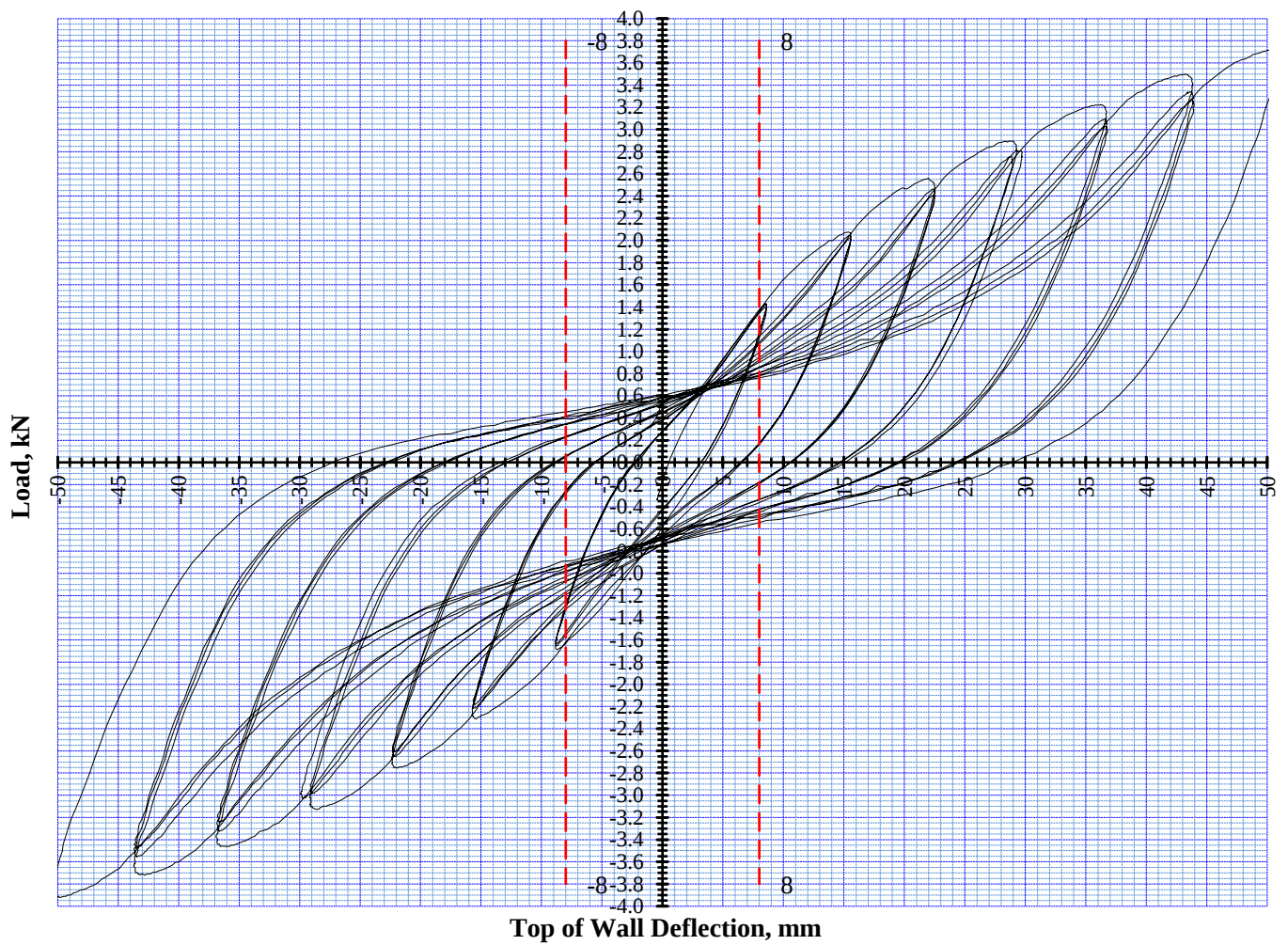


Figure 1: Wall 292793

Observations

- No obvious signs of damage

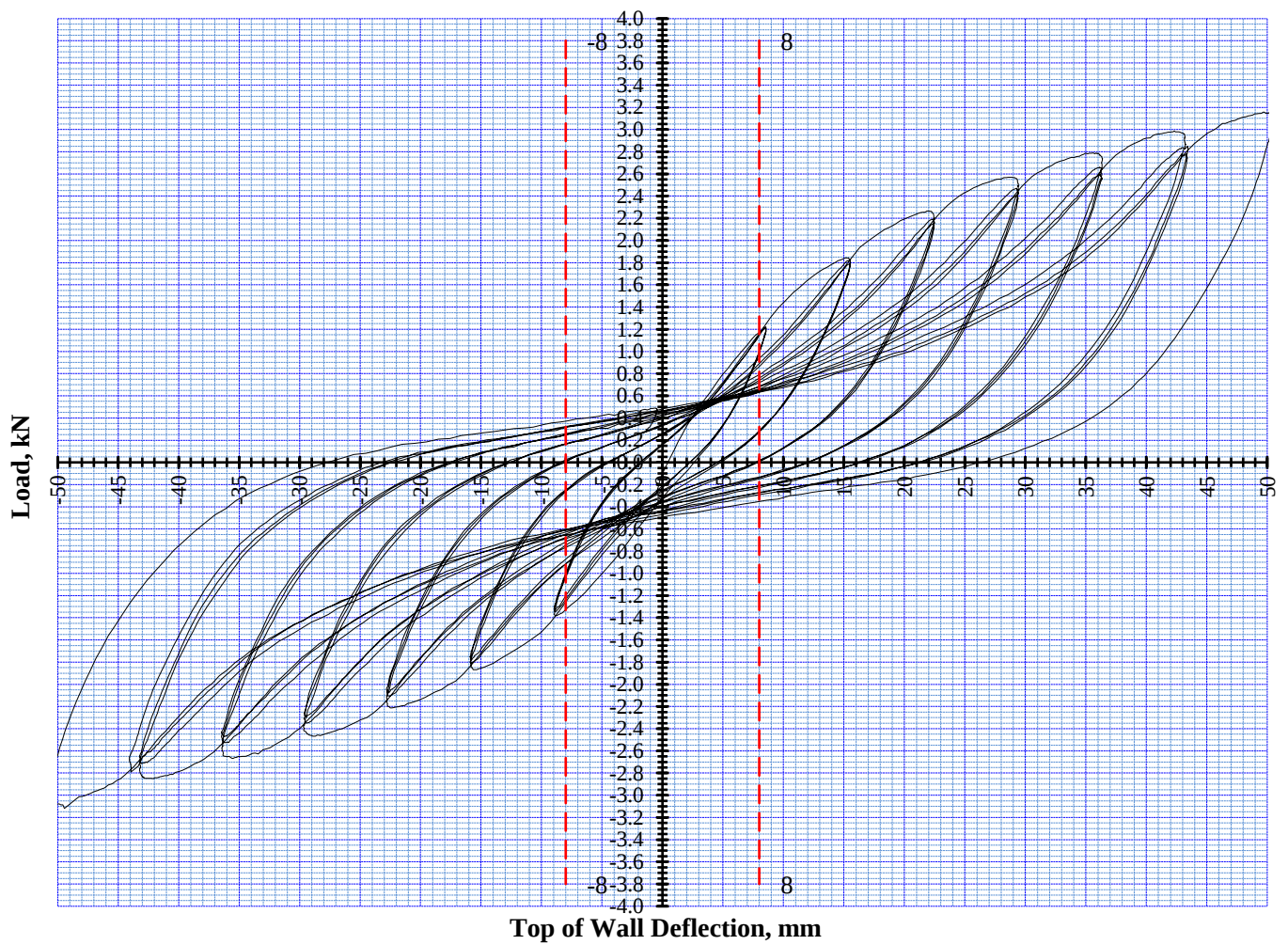


Figure 2: Wall 292794

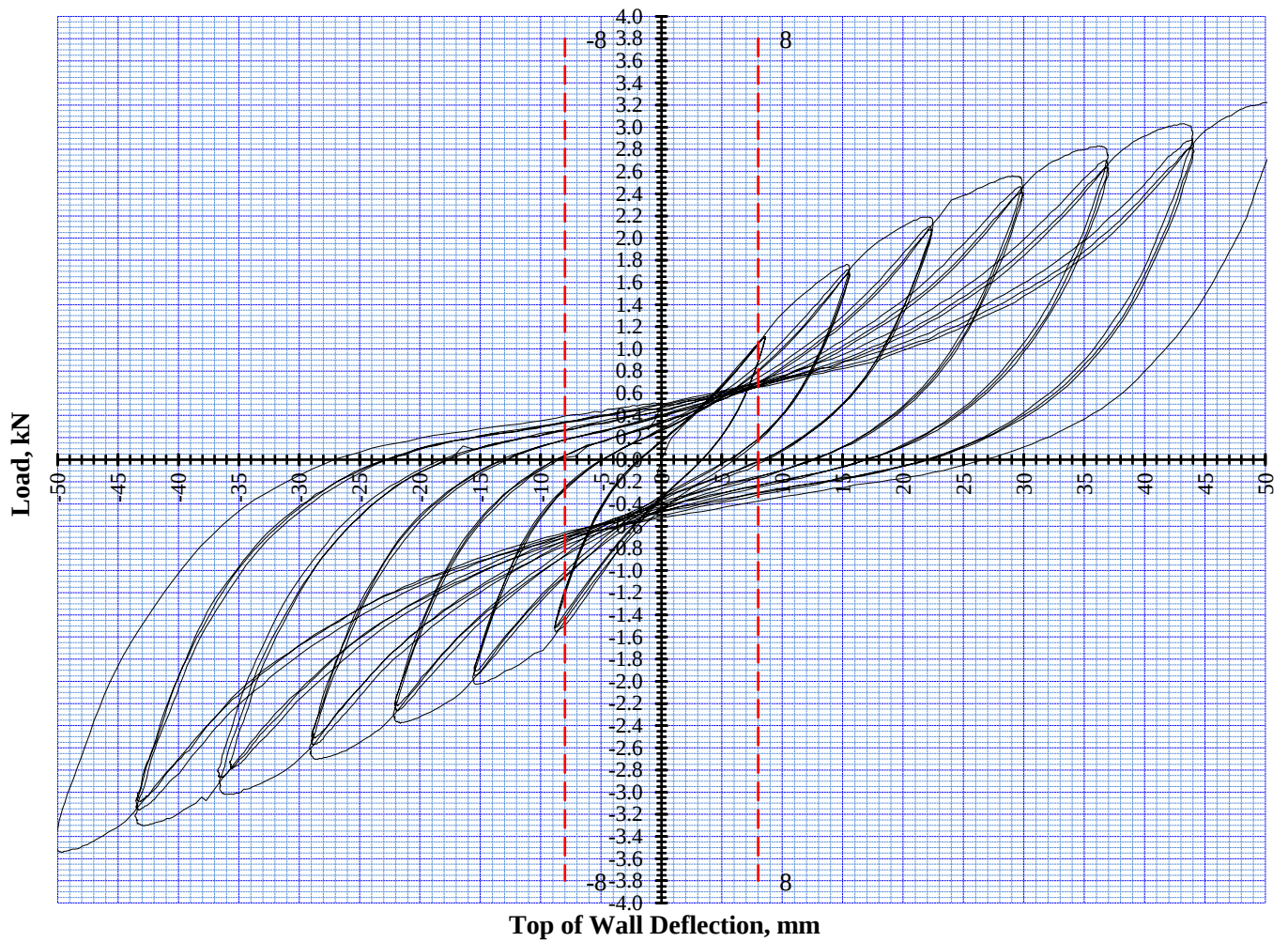


Figure 3: Wall 292795

P21:2010 BRACING RACKING TEST RESULT EVALUATION								
Wall Construction								
600mm, Aracuo F8 9mm Plywood one side								
90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs								
Plywood fixed 50mmx2.8mm Galv Steel Nails at 150mm centres						Summary		
to plates and external studs						Earthquake	83 (U)	BU/m
15mm min edge distances all around. GIB Handibracs used each end						Wind	75 (S)	BU/m
M12 hold down bolts to bottom plate & brackets								
P21 Supplementary restraints used								
Date of test:-		11-Jan-24	Ship No.	3338		Tested by	Doug Gaunt	
Date of calc's:-		15-Jan-24	Job No.	TE23-026		Analysed by	Doug Gaunt	
Calculated to BRANZ P21:2010, AS/NZS1170.2&5, NZS3604:2011 Scion, Private Bag 3020 Rotorua.								
		Serviceability Cycles		Ultimate Cycles				
Lab Number	Direction	Cycle to H/300 or DLQ or DLW		Cycle to Displacement		Wall dimensions		
		8.0	X mm	y=(mm)		L(mm)	H(mm)	
		Loads	Residual	Maximum		600	2410	
		(P ₈)	Defln, C	Load	def @ P	d at P/2	4th, R	
		kN	mm	P(kN)	y (mm)	P/2 (kN)	d mm	kN
292793	+	1.37	3.10	3.23	36.0	1.61	9.6	2.96
	-	1.62	2.10	3.46	36.0			3.20
292794	+	1.17	2.30	2.78	36.0	1.39	9.6	2.58
	-	1.33	1.80	2.65	36.0			2.49
292795	+	1.06	3.30	2.83	36.0	1.42	10.7	2.54
	-	1.48	1.90	3.02	36.0			2.83
		(P ₈)	(C)	(P)	(y)	P/2 (kN)	(d)	(Ry)
Averages		1.34	2.42	2.99	36.00	1.47	9.97	2.77
Coefficient of Variation %		13.85	23.94	9.27	0.00	6.76	5.20	9.24
y = average failure deflection or peak deflection of the three tests.								
d= average first cycle displacement at half peak, (the very first cycle wall reaches the load)								
R = Residual load, P = Peak Load, S = Serviceability load								
Displacement Recovery Factor (K1), (0.8 <= K1 <= 1.0)					Systems factor K2 = 1.2			
Average Structural Displacement Ductility factor					u = y/d 3.61			
Ductility Modification factor					K4 = 0.90			
DLW = Selected deflection limit for wind forces				DLQ = Selected deflection limit for earthquake forces				
P21:2010 BR Calc's		K1	EQ ultimate	EQ service	Wind Ultimate	Wind Service		
Lab Number		(= 1.4 - C/X)	BU's	BU's	BU's	BU's		
292793	(BU)	1.00	55.5	65.2	66.9	50.5		
	(BU/m)		93	109	111	84		
292794	(BU)	1.00	45.7	54.5	54.3	42.3		
	(BU/m)		76	91	91	70		
292795	(BU)	1.00	48.4	55.4	58.5	42.9		
	(BU/m)		81	92	98	72		
		292793	15% Ok result	16% Ok result	16% Ok result	16% Ok result		
<20% Result Check		292794	-14% Ok result	-11% Ok result	-15% Ok result	-11% Ok result		
		292795	-5% Ok result	-8% Ok result	-4% Ok result	-8% Ok result		
Note: Where the value of BR Wind or BR EQ for any specimen is more than 20% greater than either of the other two specimens, assign it a value of 1.2 times the lower value before averaging.								
Average Earthquake BR			Ultimate				Serviceability	
EQ (BU's)	20 x K4 x Ry =		50	(P8 x K1) x (K2/0.55) =		58		
	83		BU/m	Limited by		Ultimate limit state		
Average Wind BR			Ultimate				Serviceability	
Wind (BU's)	20 * P =		60	(P8 x K1) x (K2/0.71) =		45		
	75		BU/m	Limited by		Serviceability limit state		

Figure 4: P21:2010 calculations for the 600mm x 2.4m, 9mm F8 pine plywood one side with brackets

Please feel free to contact me to discuss this information.

Doug Gaunt

P21 Test Report

—

bbi® AraucoPly®

**F8 Structural Pine Plywood
9mm 1200mm Wall, Brackets**

Results

To:	Martin Wallace	From:	Doug Gaunt
Organisation:	bbi Wood Products	Subject:	P21:2010 1200mm x 2.4m 9mm F8 pine plywood, SG8 timber with Brackets
Location:	Hastings	Date:	16 January 2024
Mob No.:	021 745783	No. of	5
Tel No.:	06 8715539	Pages:	

Martin

Please find below your P21 bracing results for your three 1200mm x 2.4m walls with Aracuo 9mm F8 pine plywood one side using SG8 timber and brackets.

1. BU wind = 122 (102 BU/m) as limited by the serviceability load capacity.
2. BU Earthquake = 127 (106 BU/m) as limited by the ultimate load capacity.

Figures 1, 2 & 3 show the load deflection plots, Figure 4 shows the P21:2010 calculations.

Wall Construction

- 90x45 H1.2 SG8 framing, Studs at 600mm centres, no nogs
- Aracuo 9mm F8 pine plywood one side
- Plywood fixed with 50mm x 2.8mm Galv Steel Nails at 150mm centres, 300mm to central stud, 15mm end distance
- GIB Handibrac brackets each end
- M12 hold down rods to bottom plate and brackets
- P21 supplementary restraints used

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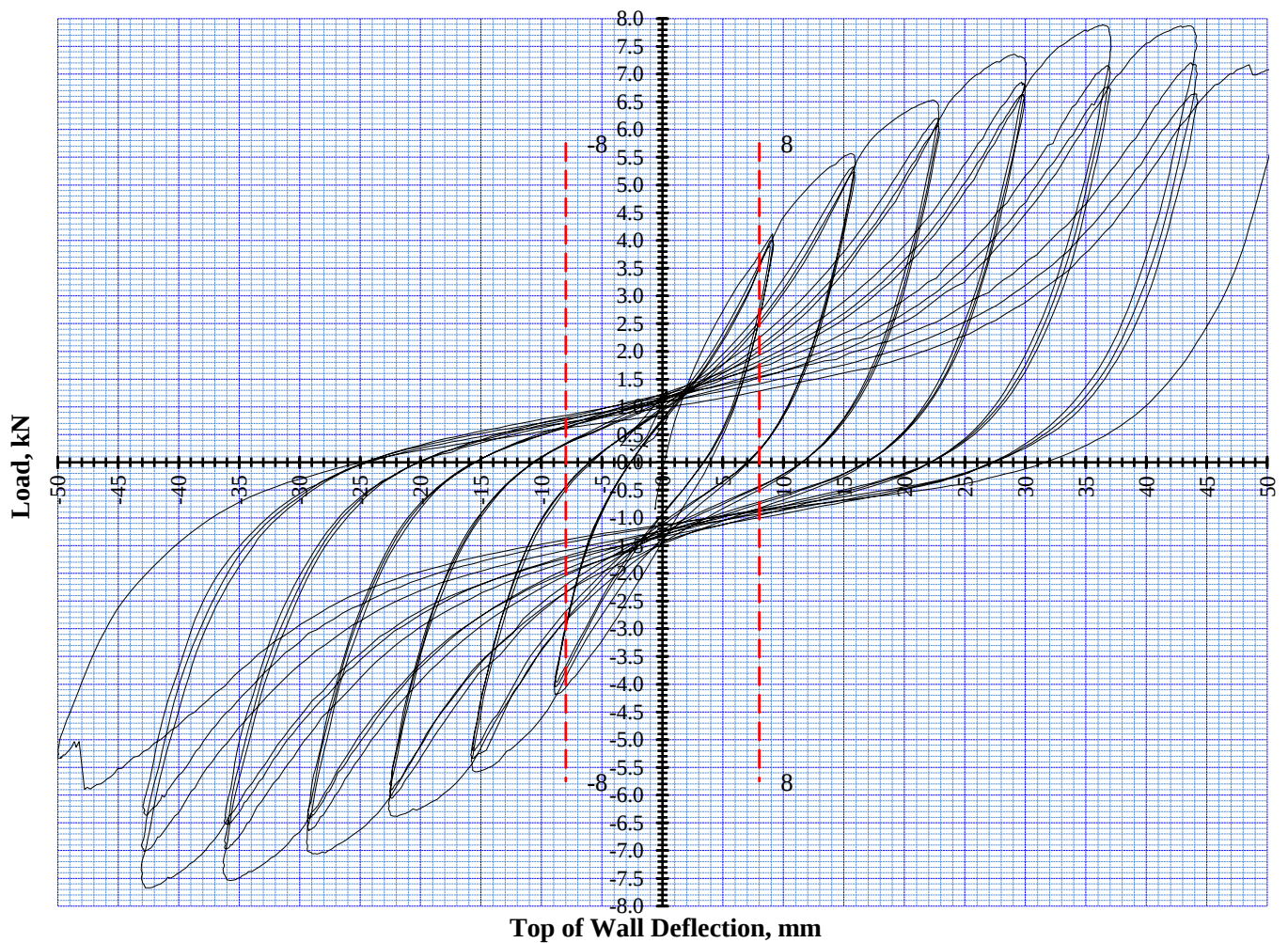


Figure 1: Wall 292787

Observations

- Pulling and snapping nails on bottom plate and then plywood pulling of bottom plate and up bottom of studs at end of test

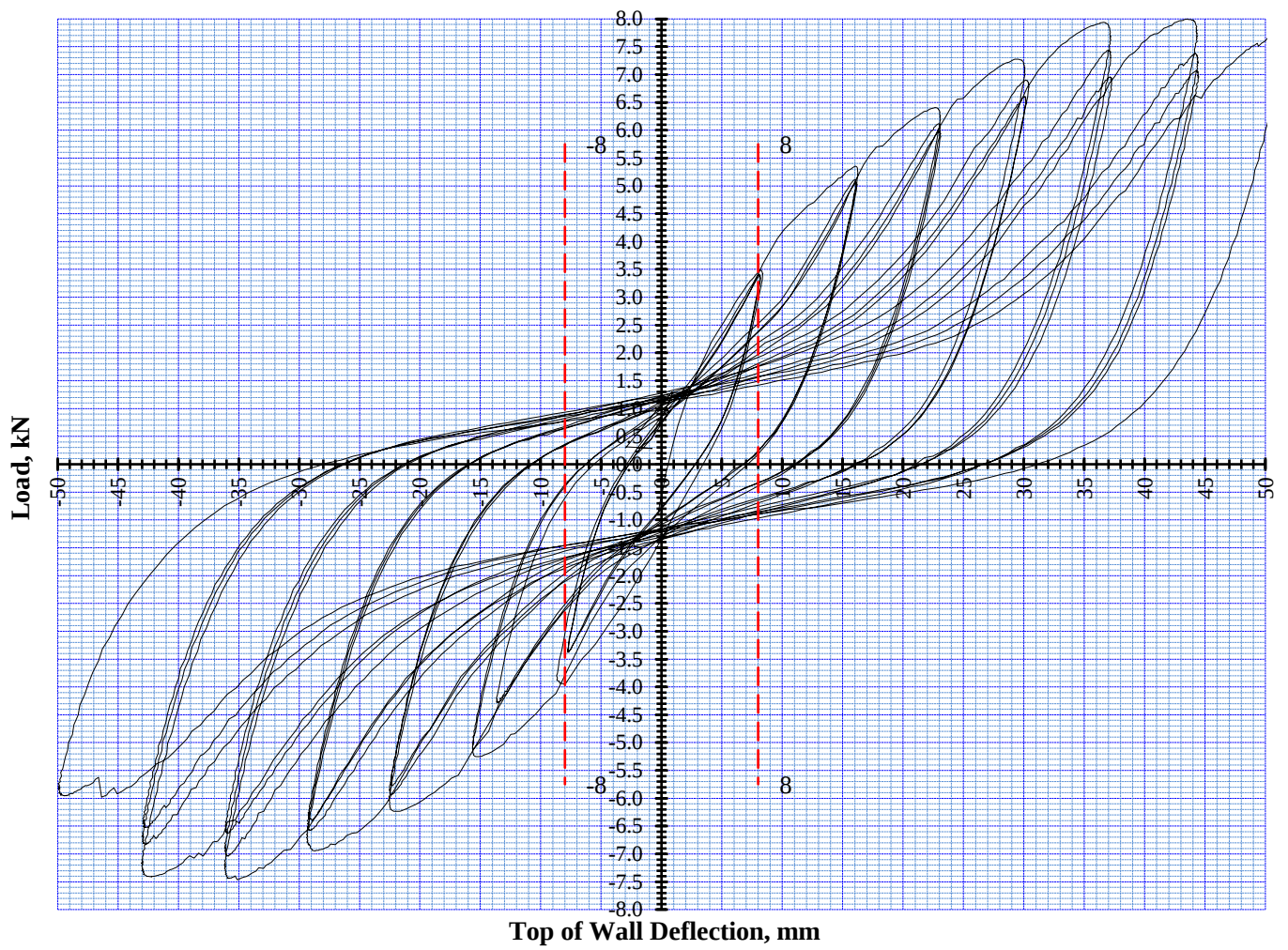
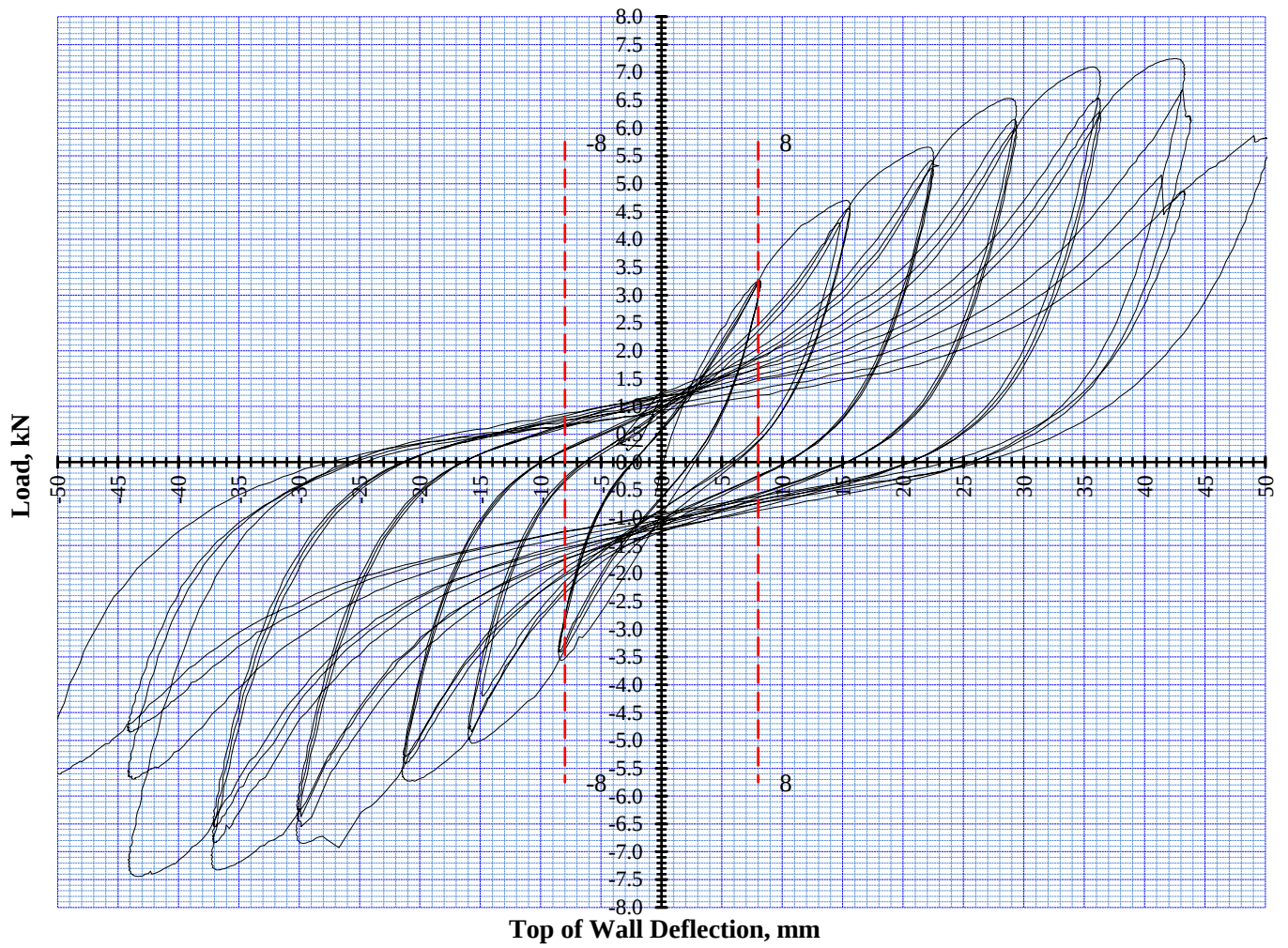


Figure 2: Wall 292788



Top of Wall Deflection, mm

Figure 3: Wall 292789

P21:2010 BRACING RACKING TEST RESULT EVALUATION								
Wall Construction								
1200mm, Aracuo F8 9mm Plywood one side								
90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs								
Plywood fixed 50mmx2.8mm Galv Steel Nails at 150mm centres to plates and external studs, 300mm to internal stud, 15mm min edge distances all around. GIB Handibracs used each end							Summary	
M12 hold down bolts to bottom plate & brackets							Earthquake	106 (U) BU/m
P21 Supplementary restraints used							Wind	102 (S) BU/m
Date of test:-		13-Dec-23	Ship No.	3338		Tested by	Doug Gaunt	
Date of calc's:-		11-Jan-24	Job No.	TE23-026		Analysed by	Doug Gaunt	
Calculated to BRANZ P21:2010, AS/NZS1170.2&5, NZS3604:2011 Scion, Private Bag 3020 Rotorua.								
		Serviceability Cycles		Ultimate Cycles				
Lab Number	Direction	Cycle to H/300 or DLQ or DLW		Cycle to Displacement		Wall dimensions		
		8.0	X mm	y=(mm)		L(mm)	H(mm)	
		Loads	Residual	Maximum		1200	2410	
		(P ₈)	Defln, C	Load	def @ P	d at P/2	4th, R	
		kN	mm	P(kN)	y (mm)	P/2 (kN)	d mm	kN
292787	+	3.75	3.30	7.86	36.0	3.93	8.6	6.43
	-	4.07	3.60	7.50	36.0			6.37
292788	+	3.45	2.80	7.90	36.0	3.95	9.3	6.50
	-	3.93	2.60	7.40	36.0			6.50
292789	+	3.25	2.40	7.10	36.0	3.55	8.7	6.15
	-	3.51	2.30	7.30	36.0			6.05
		(P ₈)	(C)	(P)	(y)	P/2 (kN)	(d)	(Ry)
Averages		3.66	2.83	7.51	36.00	3.81	8.87	6.33
Coefficient of Variation %		7.76	16.64	3.84	0.00	4.83	3.49	2.74
y = average failure deflection or peak deflection of the three tests.								
d= average first cycle displacement at half peak, (the very first cycle wall reaches the load)								
R = Residual load, P = Peak Load, S = Serviceability load								
Displacement Recovery Factor (K1), (0.8 <= K1 <= 1.0)					Systems factor K2 = 1.2			
Average Structural Displacement Ductility factor					u = y/d 4.06			
Ductility Modification factor					K4 = 1.00			
DLW = Selected deflection limit for wind forces				DLQ = Selected deflection limit for earthquake forces				
P21:2010 BR Calc's		K1	EQ ultimate	EQ service	Wind Ultimate	Wind Service		
Lab Number		(= 1.4 - C/X)	BU's	BU's	BU's	BU's		
292787	(BU)	0.97	128.0	165.6	153.6	128.3		
	(BU/m)		107	138	128	107		
292788	(BU)	1.00	130.0	161.0	153.0	124.7		
	(BU/m)		108	134	128	104		
292789	(BU)	1.00	122.0	147.5	144.0	114.3		
	(BU/m)		102	123	120	95		
<20%Result Check		292787	2% Ok result	7% Ok result	3% Ok result	7% Ok result		
		292788	4% Ok result	3% Ok result	3% Ok result	3% Ok result		
		292789	-6% Ok result	-11% Ok result	-6% Ok result	-11% Ok result		
Note: Where the value of BR Wind or BR EQ for any specimen is more than 20% greater than either of the other two specimens, assign it a value of 1.2 times the lower value before averaging.								
Average Earthquake BR		Ultimate				Serviceability		
EQ (BU's)	20 x K4 x Ry =	127	(P8 x K1) x (K2/0.55) =		158			
		106 BU/m	Limited by		Ultimate limit state			
Average Wind BR		Ultimate				Serviceability		
Wind (BU's)	20 * P =	150	(P8 x K1) x (K2/0.71) =		122			
		102 BU/m	Limited by		Serviceability limit state			

Figure 4: P21:2010 calculations for the 1200mm x 2.4m, 9mm F8 pine plywood one side with brackets

Please feel free to contact me to discuss this information.

Doug Gaunt

P21 Test Report

—

bbi® Blondeline®

Birch Poplar Core Plywood
9mm 1200mm Wall, Brackets

Results

To:	Martin Wallace	From:	Doug Gaunt
Organisation:	bbi Wood Products	Subject:	P21:2010 bbi BlondeLine Birch Poplar Core Plywood 9mm 1200mm Wall, Brackets
Location:	Hastings	Date:	30 May 2022
Fax No.:	021 745783	No. of	5
Tel No.:	06 8715539	Pages:	

Please find below the P21 bracing results for your three 1200mm x 2.4m bbi BlondeLine Birch Poplar Core Plywood 9mm one side Walls with Brackets.

1. BU wind = 123 (102 BU/m) as limited by the serviceability load capacity.
2. BU Earthquake = 137 (114 BU/m) as limited by the ultimate load capacity.

Figures 1, 2 & 3 show the load deflection plots, Figure 4 shows the P21:2010 calculations.

Wall Construction

bbi BlondeLine Birch Poplar Core Plywood 9mm one side,
 90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs
 Plywood fixed with 50x2.8mm Galv clouts at 150 centres to end studs and plates, 300mm centres
 on internal stud
 GIB Handibracs brackets used
 M12 hold down bolts to bottom plate and brackets
 P21 Supplementary restraints used.

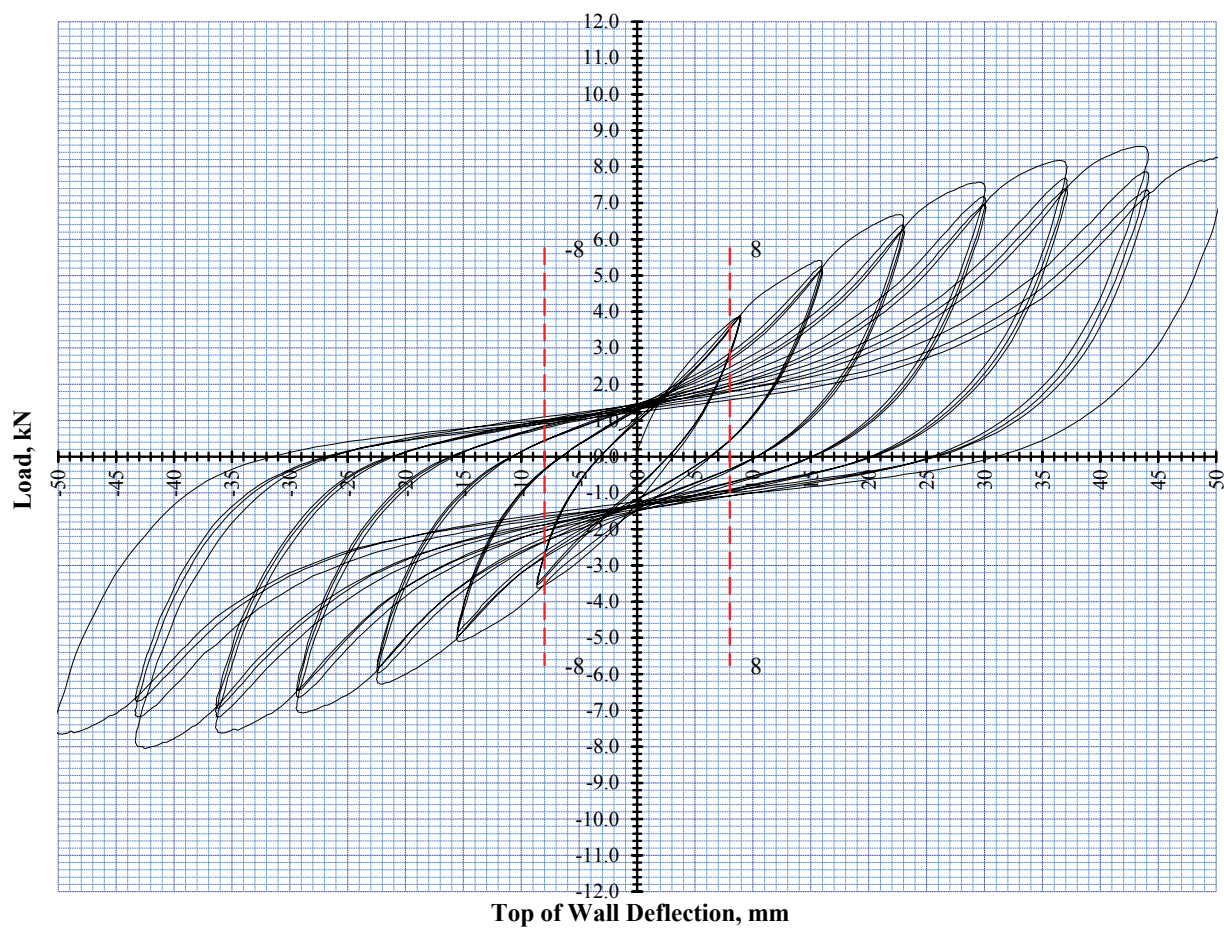
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Top of Wall Deflection, mm

Figure 1: Wall 289130

Observations

No obvious signs of failure to framing or plywood
Plywood pulling on bottom plate nails.

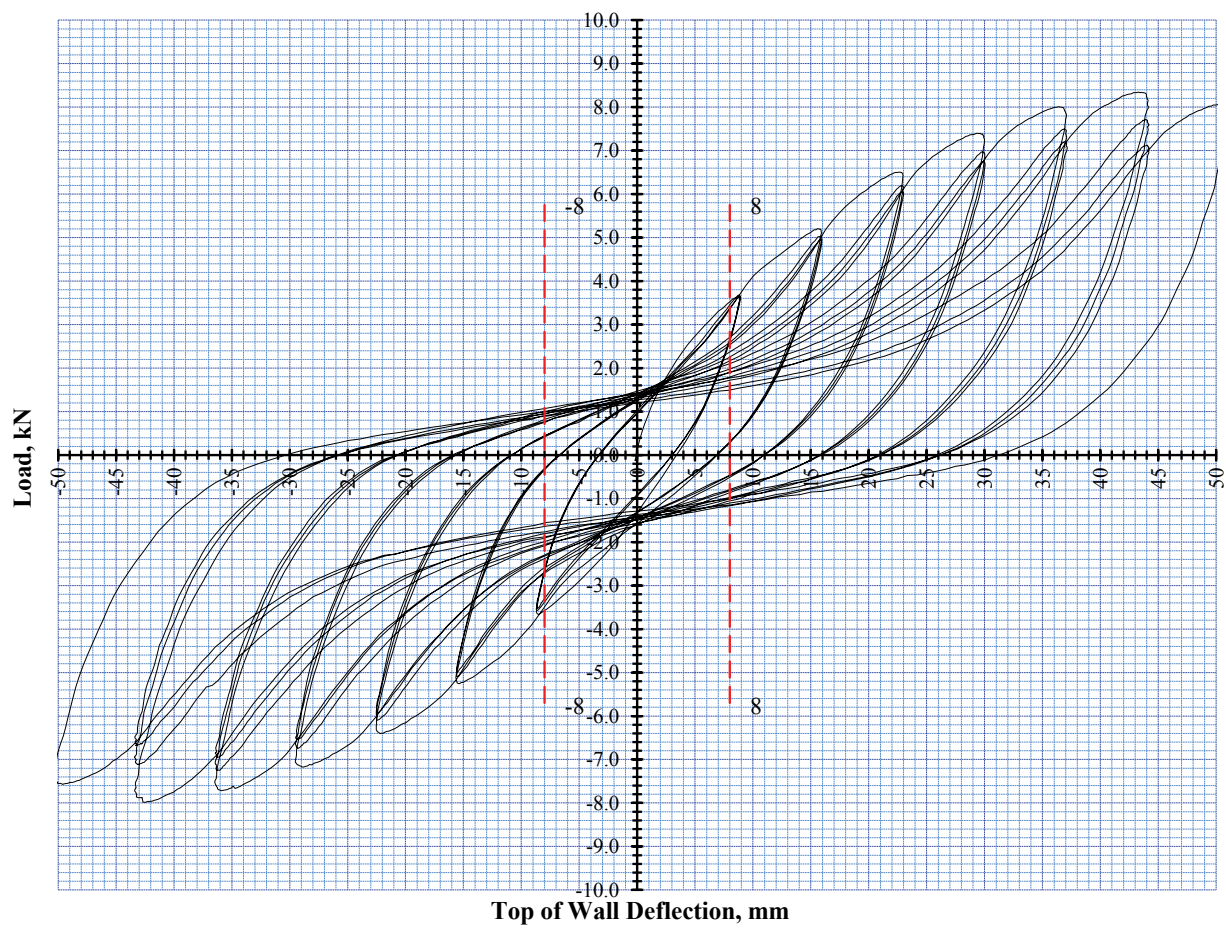


Figure 2: Wall 289131

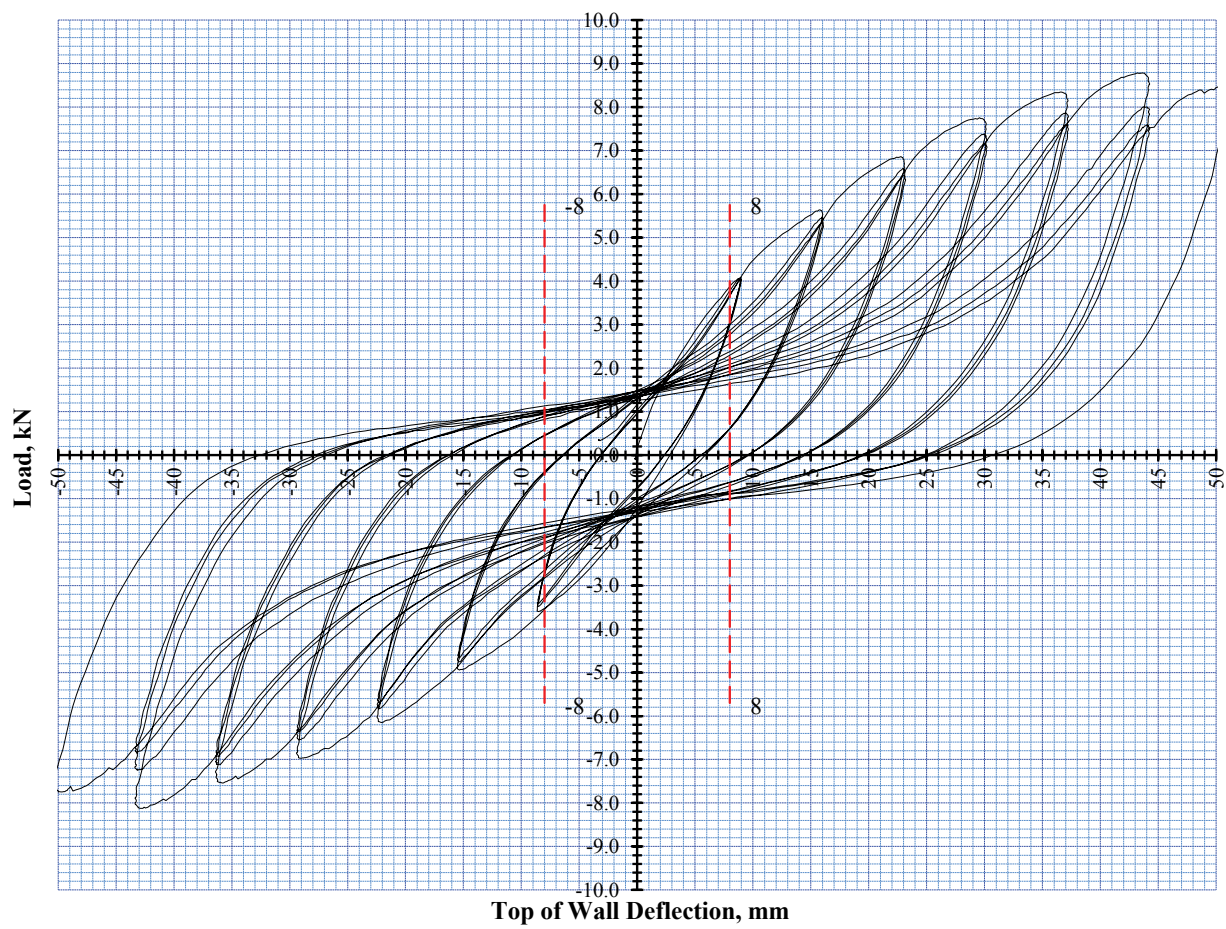


Figure 3: Wall 289132

1200mm, bbi BlondeLine Birch Poplar Core Plywood 9mm one side								
90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs								
Plywood fixed 50mmx2.8mm Galv Steel Nails at 150mm centres							Summary	
to plates and external studs, 300mm to internal studs,							Earthquake	114 (U) BU/m
7mm min edge distances all around. GIB Handibracs used each end							Wind	102 (S) BU/m
M12 hold down bolts to bottom plate & brackets								
P21 Supplementary restraints used								
Date of test:-		25-May-22	Ship No.	3251		Tested by	John Lee	
Date of calc's:-		25-May-22	Job No.	TE21-068		Analysed by	Doug Gaunt	
Calculated to BRANZ P21:2010, AS/NZS1170.2&5, NZS3604:2011							Scion, Private Bag 3020 Rotorua.	
		Serviceability Cycles		Ultimate Cycles				
Lab Number	Direction	Cycle to H/300 or DLQ or DLW		Cycle to Displacement			Wall dimensions	
		8.0	X mm	y=(mm)			L(mm)	H(mm)
		Loads	Residual	Maximum			1200	2410
		(P ₈)	Defln, C	Load	def @ P		d at P/2	4th, R
		kN	mm	P(kN)	y (mm)	P/2 (kN)	d mm	kN
289130	+	3.70	2.60	8.17	36.0	4.09	7.4	7.00
	-	3.70	3.20	7.61	36.0			6.75
289131	+	3.50	3.00	8.00	36.0	4.00	9.6	6.80
	-	3.55	2.30	7.72	36.0			6.80
289132	+	3.85	2.30	8.33	36.0	4.17	9.1	7.20
	-	3.52	3.20	7.53	36.0			6.58
		(P ₈)	(C)	(P)	(y)	P/2 (kN)	(d)	(Ry)
Averages		3.64	2.77	7.89	36.00	4.08	8.70	6.86
Coefficient of Variation %		3.43	13.95	3.73	0.00	1.65	10.82	2.87
y = average failure deflection or peak deflection of the three tests.								
d= average first cycle displacement at half peak, (the very first cycle wall reaches the load)								
R = Residual load, P = Peak Load, S = Serviceability load								
Displacement Recovery Factor (K1), (0.8 <= K1 <= 1.0)					Systems factor K2 = 1.2			
Average Structural Displacement Ductility factor					u = y/d 4.14			
Ductility Modification factor					K4 = 1.00			
DLW = Selected deflection limit for wind forces				DLQ = Selected deflection limit for earthquake forces				
P21:2010 BR Calc's								
Lab Number		K1	EQ ultimate	EQ service	Wind Ultimate	Wind Service		
		(= 1.4 - C/X)	BU's	BU's	BU's	BU's		
289130	(BU)	1.00	137.5	161.5	157.8	125.1		
	(BU/m)		115	135	132	104		
289131	(BU)	1.00	136.0	153.8	157.2	119.2		
	(BU/m)		113	128	131	99		
289132	(BU)	1.00	137.8	160.8	158.6	124.6		
	(BU/m)		115	134	132	104		
<20% Result Check		289130	0% Ok result	3% Ok result	0% Ok result	3% Ok result		
		289131	-1% Ok result	-5% Ok result	-1% Ok result	-5% Ok result		
		289132	1% Ok result	2% Ok result	1% Ok result	2% Ok result		
Note: Where the value of BR Wind or BR EQ for any specimen is more than 20% greater than either of the other two specimens, assign it a value of 1.2 times the lower value before averaging.								
Average Earthquake BR			Ultimate	Serviceability				
EQ (BU's)	20 x K4 x Ry =	137	(P8 x K1) x (K2/0.55) =			159		
	114	BU/m	Limited by			Ultimate limit state		
Average Wind BR	Ultimate	Serviceability						
Wind (BU's)	20 * P =	158	(P8 x K1) x (K2/0.71) =			123		
	102	BU/m	Limited by			Serviceability limit state		

Figure 4: P21:2010 calculations for 1200mm x 2.40m bbi BlondeLine Birch Poplar Core Plywood 9mm one side wall

Please feel free to contact me to discuss this information.

Doug Gaunt

P21 Test Report

—

bbi® Blondeline®

Birch Poplar Core Plywood

12mm 1200mm Wall, Brackets

Results

To:	Martin Wallace	From:	Doug Gaunt
Organisation:	bbi Wood Products	Subject:	P21:2010 bbi BlondeLine Birch Poplar Core Plywood 12mm 1200mm Wall, Brackets
Location:	Hastings	Date:	30 May 2022
Fax No.:	021 745783	No. of	5
Tel No.:	06 8715539	Pages:	

Please find below the P21 bracing results for your three 1200mm x 2.4m bbi BlondeLine Birch Poplar Core Plywood 12mm one side Walls with Brackets.

1. BU wind = 127 (106 BU/m) as limited by the serviceability load capacity. 127
2. BU Earthquake = (106 BU/m) as limited by the ultimate load capacity.

Figures 1, 2 & 3 show the load deflection plots, Figure 4 shows the P21:2010 calculations. Wall

Construction

bbi BlondeLine Birch Poplar Core Plywood 12mm one side,
 90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs
 Plywood fixed with 50x2.8mm Galv clouts at 150 centres to end studs and plates, 300mm centres on
 internal stud
 GIB Handibracs brackets used
 M12 hold down bolts to bottom plate and brackets
 P21 Supplementary restraints used.

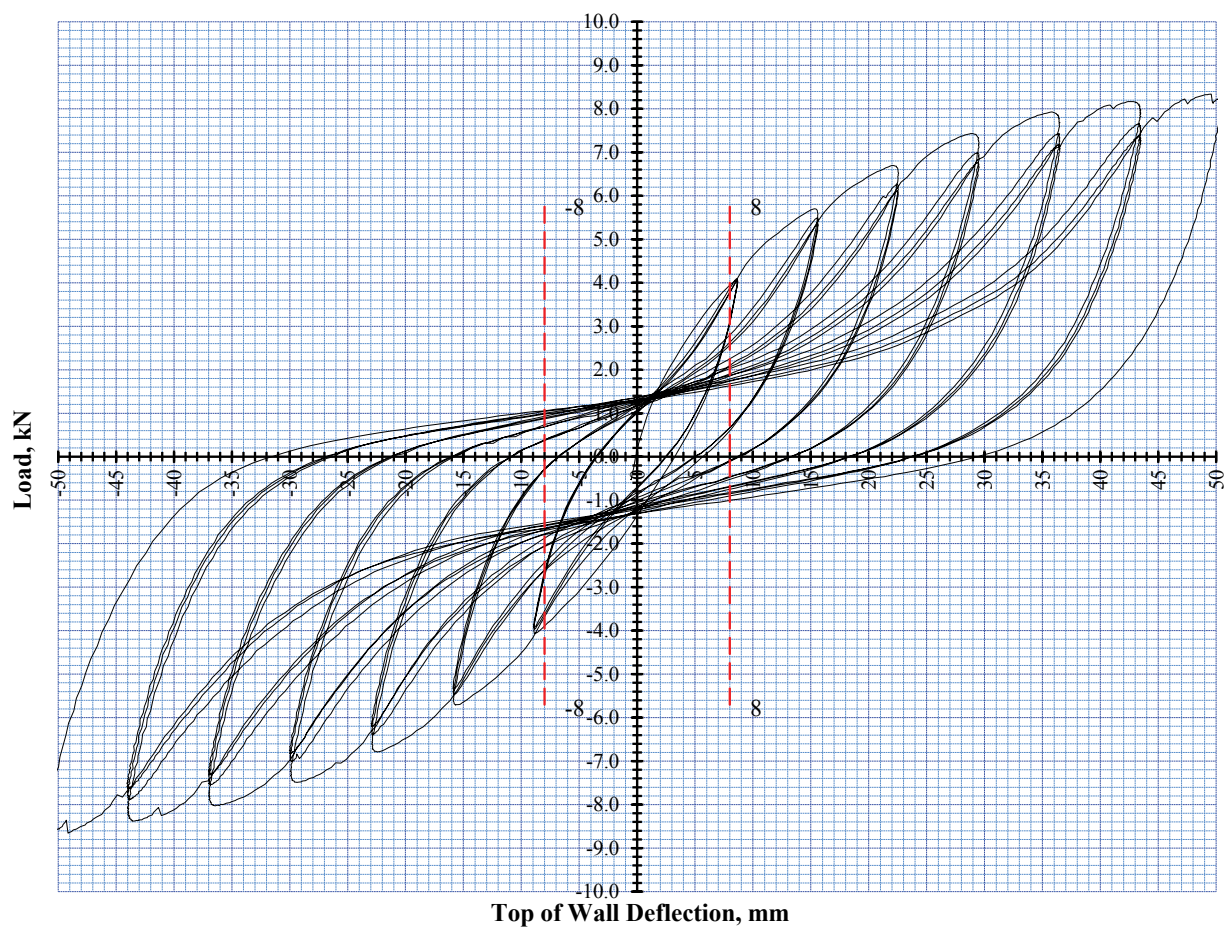
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Top of Wall Deflection, mm

Figure 1: Wall 289127

Observations

No obvious signs of failure to framing or plywood
Plywood pulling on bottom plate nails.

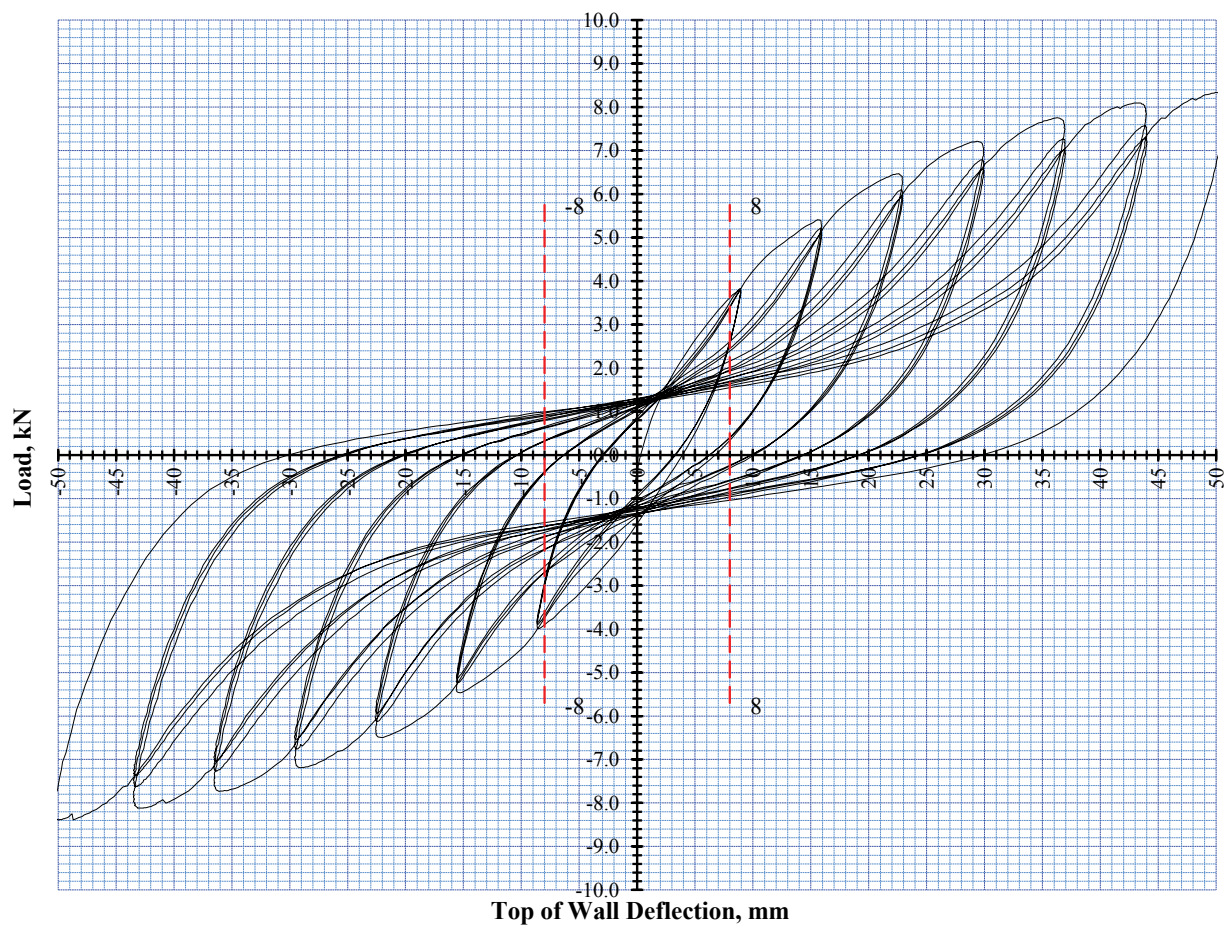


Figure 2: Wall 289128

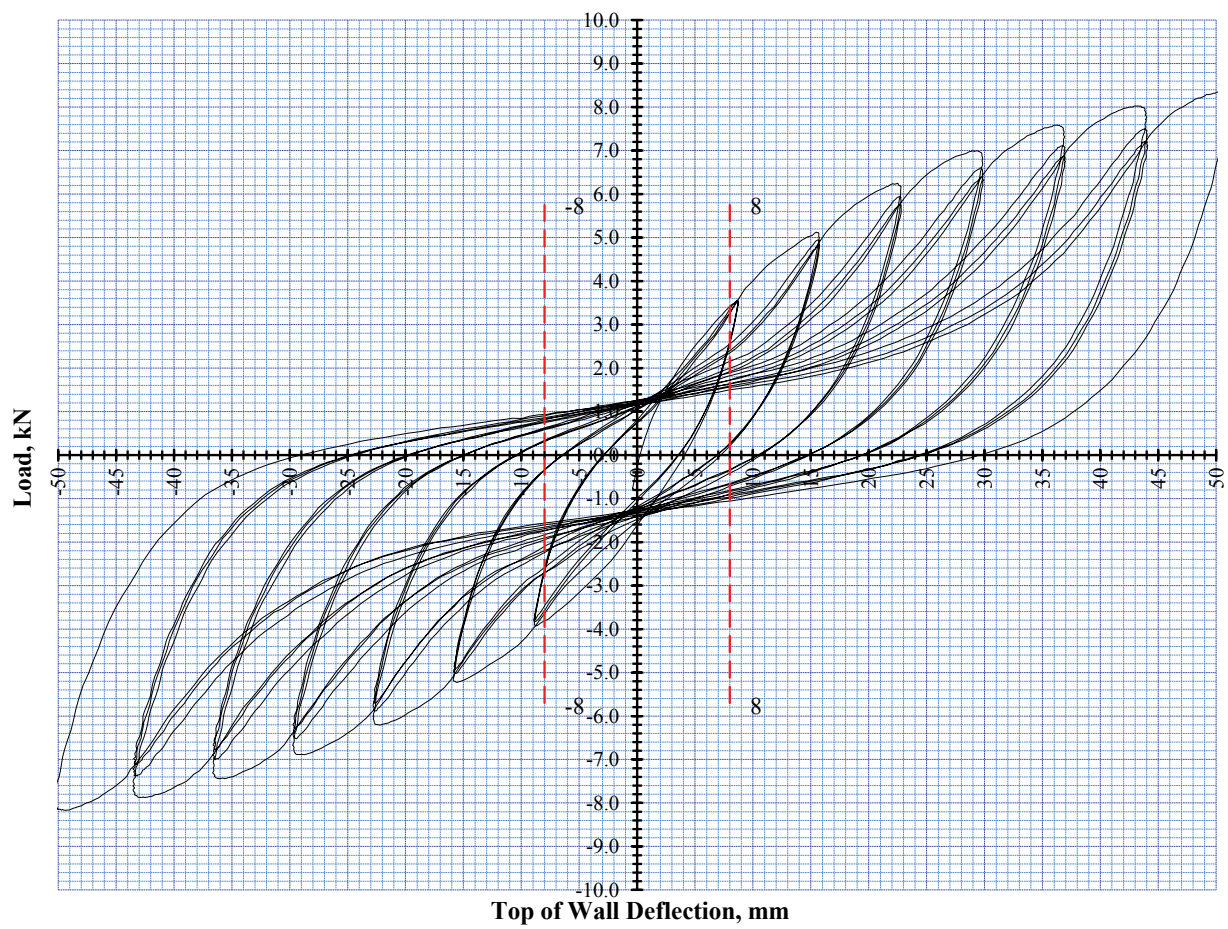


Figure 3: Wall 289129

P21:2010 BRACING RACKING TEST RESULT EVALUATION									
Wall Construction									
1200mm, bbi BlondeLine Birch Poplar Core Plywood 12mm one side									
90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs									
Plywood fixed 50mmx2.8mm Galv Steel Nails at 150mm centres							Summary		
to plates and external studs, 300mm to internal studs,							Earthquake	106 (U)	BU/m
7mm min edge distances all around. GIB Handibracs used each end							Wind	106 (S)	BU/m
M12 hold down bolts to bottom plate & brackets									
P21 Supplementary restraints used									
Date of test:-		25-May-22	Ship No.	3251		Tested by	John Lee		
Date of calc's:-		25-May-22	Job No.	TE21-068		Analysed by	Doug Gaunt		
Calculated to BRANZ P21:2010, AS/NZS1170.2&5, NZS3604:2011 Scion, Private Bag 3020 Rotorua.									
		Serviceability Cycles		Ultimate Cycles					
Lab Number	Direction	Cycle to H/300 or DLQ or DLW		Cycle to Displacement		Wall dimensions			
		8.0	X mm	y=(mm)		L(mm) H(mm)			
		Loads	Residual	Maximum		1200 2410			
		(P ₈)	Defln, C	Load	def @ P	d at P/2 4th, R			
		kN	mm	P(kN)	y (mm)	P/2 (kN)	d mm	kN	
289127	+	3.92	2.40	7.90	36.0	3.95	8.2	7.05	
	-	3.90	3.50	8.00	36.0			7.05	
289128	+	3.62	3.30	7.75	36.0	3.88	12.2	6.70	
	-	3.88	3.00	7.72	36.0			6.96	
289129	+	3.52	3.00	7.55	36.0	3.78	8.7	6.80	
	-	3.75	3.30	7.45	36.0			6.80	
		(P ₈)	(C)	(P)	(y)	P/2 (kN)	(d)	(Ry)	
Averages		3.77	3.08	7.73	36.00	3.87	9.70	6.89	
Coefficient of Variation %		4.01	11.45	2.44	0.00	1.85	18.35	1.95	
y = average failure deflection or peak deflection of the three tests.									
d= average first cycle displacement at half peak, (the very first cycle wall reaches the load)									
R = Residual load, P = Peak Load, S = Serviceability load									
Displacement Recovery Factor (K1), (0.8 <= K1 <= 1.0)					Systems factor K2 = 1.2				
Average Structural Displacement Ductility factor					u = y/d 3.71				
Ductility Modification factor					K4 = 0.92				
DLW = Selected deflection limit for wind forces				DLQ = Selected deflection limit for earthquake forces					
P21:2010 BR Calc's									
Lab Number		K1	EQ ultimate	EQ service	Wind Ultimate	Wind Service			
		(= 1.4 - C/X)	BU's	BU's	BU's	BU's			
289127	(BU)	1.00	130.0	170.6	159.0	132.2			
	(BU/m)		108	142	133	110			
289128	(BU)	1.00	125.9	163.6	154.7	126.8			
	(BU/m)		105	136	129	106			
289129	(BU)	1.00	125.4	158.6	150.0	122.9			
	(BU/m)		104	132	125	102			
		289127	3% Ok result	6% Ok result	4% Ok result	6% Ok result			
<20% Result Check		289128	-1% Ok result	-1% Ok result	0% Ok result	-1% Ok result			
		289129	-2% Ok result	-5% Ok result	-5% Ok result	-5% Ok result			
Note: Where the value of BR Wind or BR EQ for any specimen is more than 20% greater than either of the other two specimens, assign it a value of 1.2 times the lower value before averaging.									
Average Earthquake BR									
EQ (BU's)		20 x K4 x Ry =	Ultimate	(P8 x K1) x (K2/0.55) =		Serviceability			
		106	BU/m	Limited by		Ultimate limit state			
Average Wind BR									
Wind (BU's)		20 * P =	Ultimate	(P8 x K1) x (K2/0.71) =		Serviceability			
		106	BU/m	Limited by		Serviceability limit state			

Figure 4: P21:2010 calculations for 1200mm x 2.40m bbi BlondeLine Birch Poplar Core Plywood 12mm one side wall

Please feel free to contact me to discuss this information.

Doug Gaunt

P21 Test Report

—

bbi® Blondeline® Lite

Birch Falcata Plywood 9mm
1200mm Wall, Brackets

Results

To:	Martin Wallace	From:	Doug Gaunt
Organisation:	bbi Wood Products	Subject:	P21:2010 1200mm x 2.4m 9mm Blondeline lite plywood, SG8 timber with Brackets
Location:	Hastings	Date:	16 January 2024
Mob No.:	021 745783	No. of	5
Tel No.:	06 8715539	Pages:	

Please find below your P21 bracing results for your three 1200mm x 2.4m walls with 9mm Blondeline lite plywood one side using SG8 timber and brackets.

1. BU wind = 131 (109 BU/m) as limited by the serviceability load capacity.
2. BU Earthquake = 137 (114 BU/m) as limited by the ultimate load capacity.

Figures 1, 2 & 3 show the load deflection plots, Figure 4 shows the P21:2010 calculations.

Wall Construction

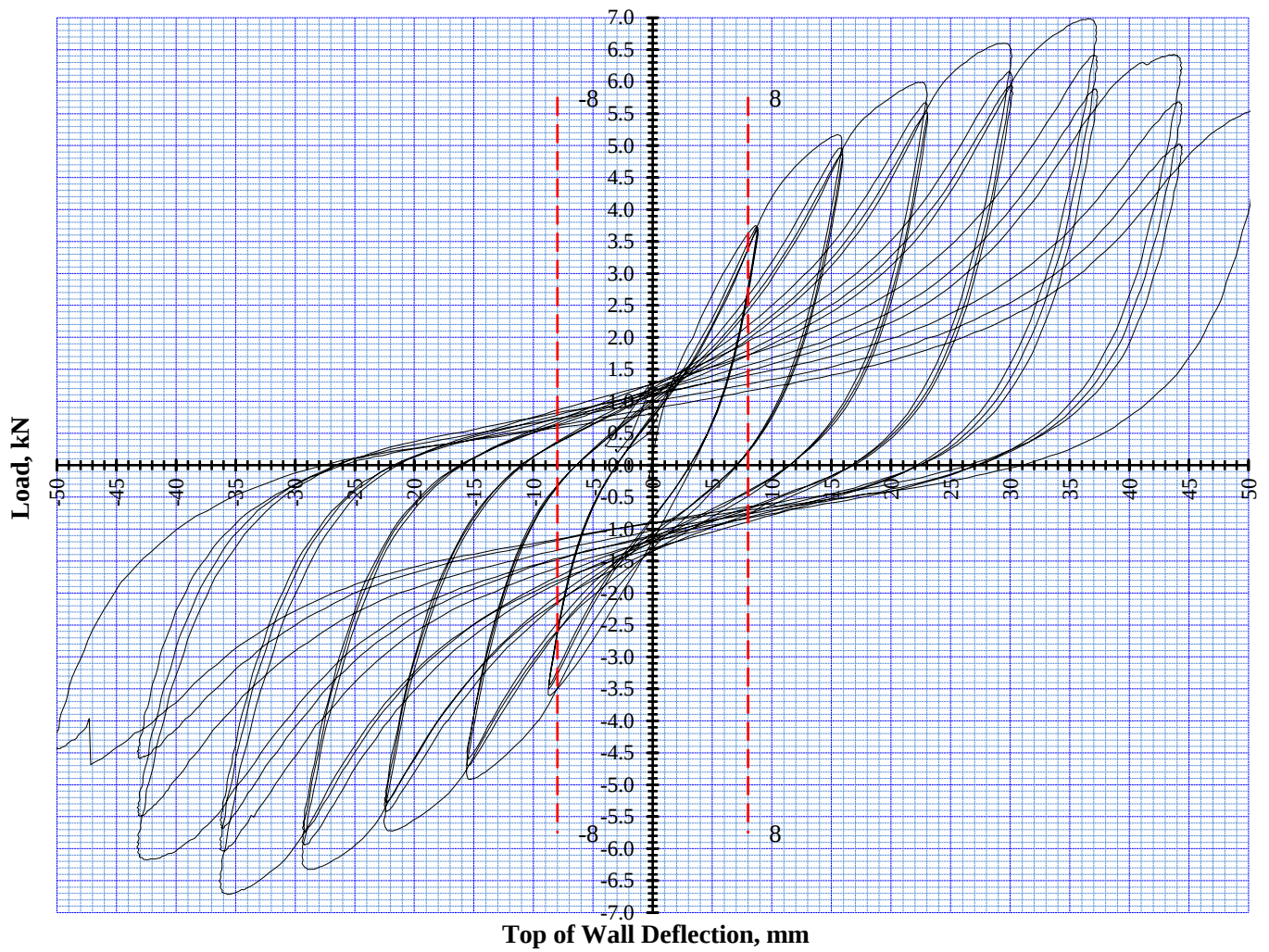
- 90x45 H1.2 SG8 framing, Studs at 600mm centres, no nogs
- 9mm Blondeline lite plywood one side
- Plywood fixed with 50mm x 2.8mm Galv Steel Nails at 150mm centres, 300mm to central stud, 15mm end distance
- GIB Handibrac brackets each end
- M12 hold down rods to bottom plate and brackets
- P21 supplementary restraints used

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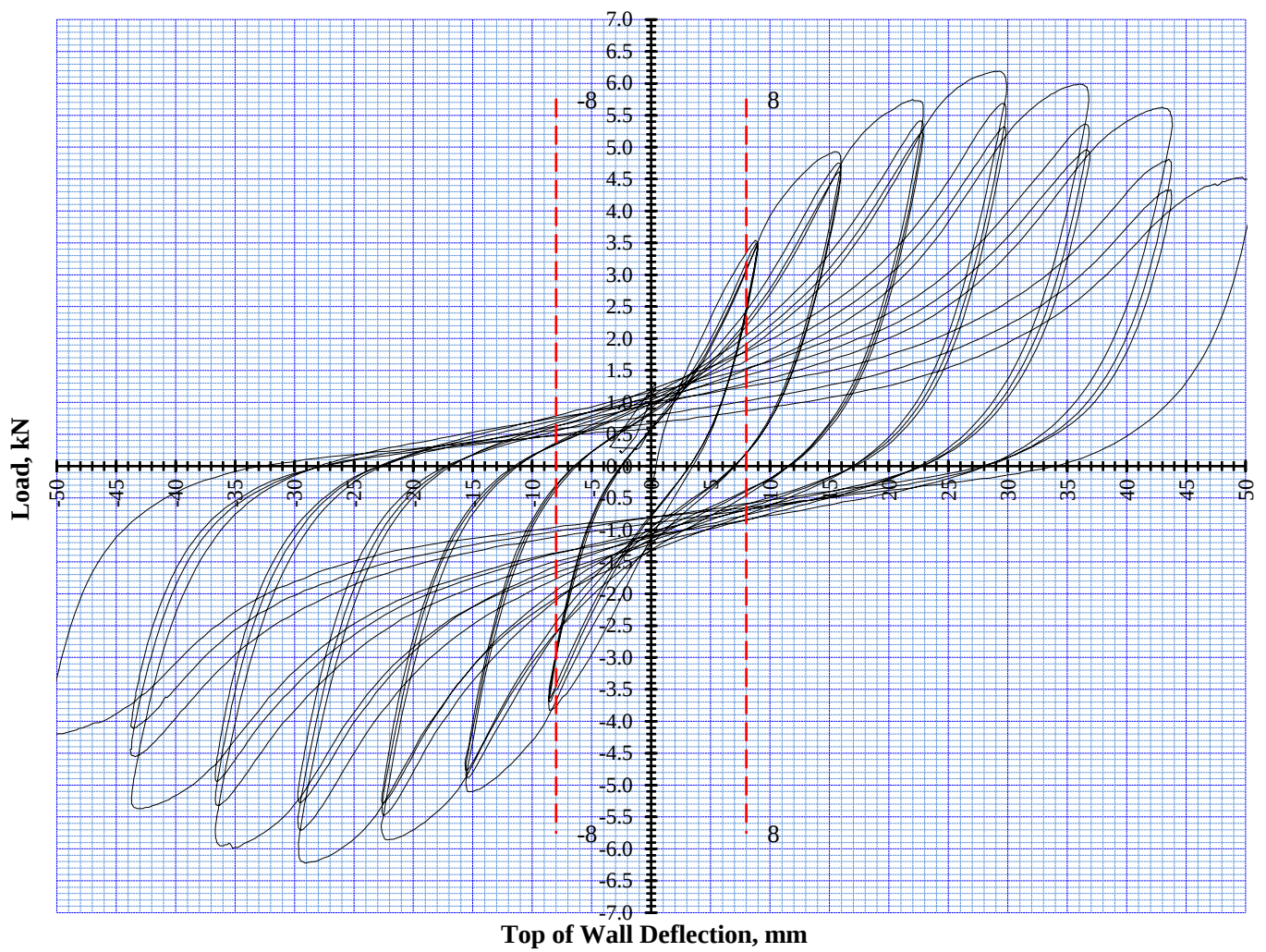


Top of Wall Deflection, mm

Figure 1: Wall 292784

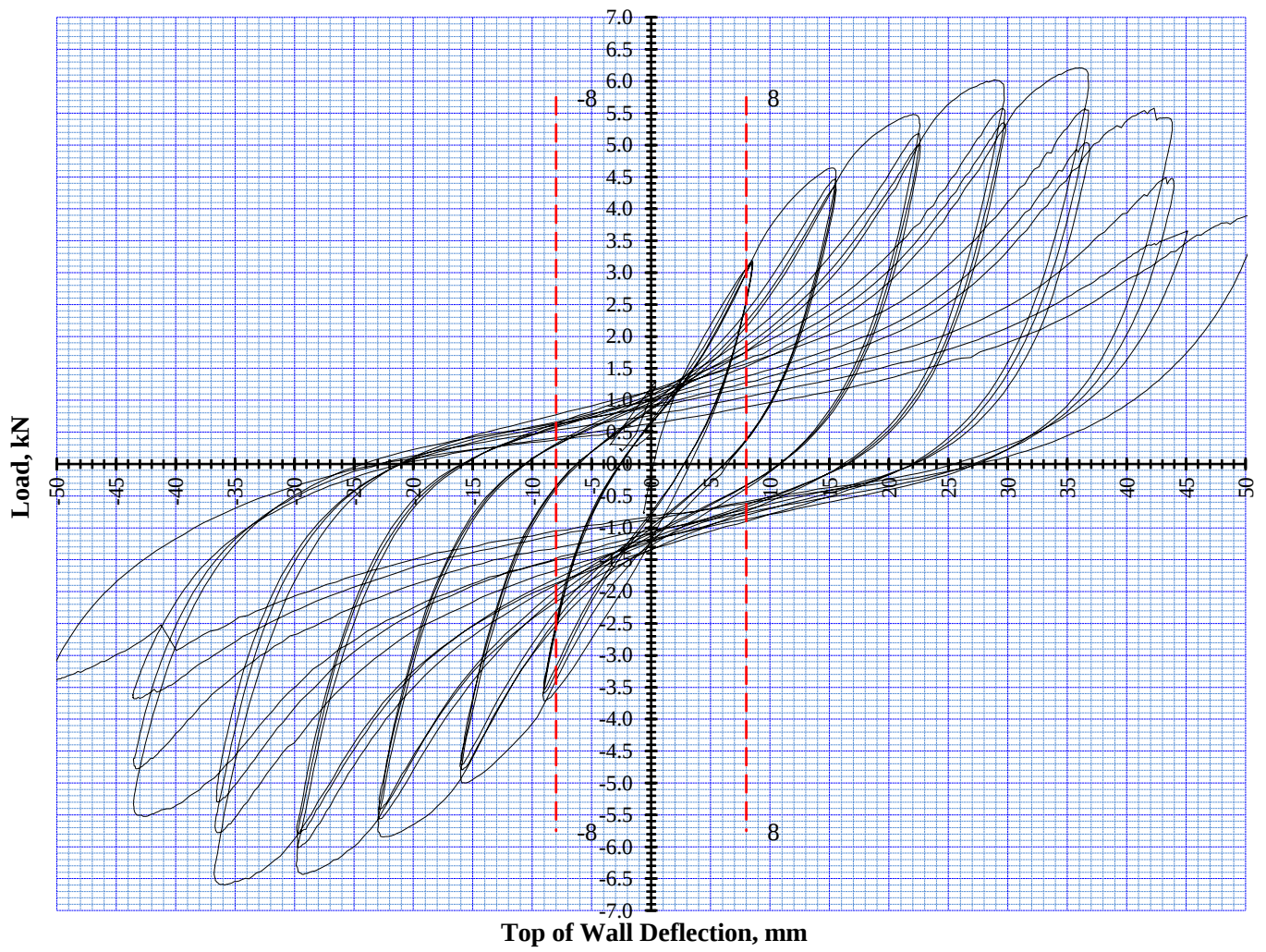
Observations

- Pulling and snapping nails on bottom plate and then plywood pulling of bottom plate and up bottom of studs at end of test



Top of Wall Deflection, mm

Figure 2: Wall 292785



Top of Wall Deflection, mm

Figure 3: Wall 292786

P21:2010 BRACING RACKING TEST RESULT EVALUATION								
Wall Construction								
1200mm, bbi BlondeLine Lite 9mm Plywood one side								
90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs								
Plywood fixed 50mmx2.8mm Galv Steel Nails at 150mm centres						Summary		
to plates and external studs, 300mm to internal stud,						Earthquake	82 (U)	BU/m
15mm min edge distances all around. GIB Handibracs used each end						Wind	98 (S)	BU/m
M12 hold down bolts to bottom plate & brackets								
P21 Supplementary restraints used								
Date of test:-		13-Dec-23	Ship No.	3338		Tested by	Doug Gaunt	
Date of calc's:-		14-Dec-23	Job No.	TE23-026		Analysed by	Doug Gaunt	
Calculated to BRANZ P21:2010, AS/NZS1170.2&5, NZS3604:2011 Scion, Private Bag 3020 Rotorua.								
		Serviceability Cycles		Ultimate Cycles				
Lab Number	Direction	Cycle to H/300 or DLQ or DLW		Cycle to Displacement		Wall dimensions		
		8.0	X mm	y=(mm)		L(mm)	H(mm)	
		Loads	Residual	Maximum		1200	2410	
		(P ₈)	Defln, C	Load	def @ P	d at P/2	4th, R	
		kN	mm	P(kN)	y (mm)	P/2 (kN)	d mm	kN
292784	+	3.63	3.10	6.97	36.0	3.49	7.5	5.31
	-	3.50	2.90	6.70	36.0			5.35
292785	+	3.34	3.20	5.98	36.0	2.99	6.8	4.71
	-	3.78	2.40	5.94	36.0			4.54
292786	+	3.10	2.70	6.10	36.0	3.05	8.0	4.67
	-	3.56	2.60	6.60	36.0			4.77
		(P ₈)	(C)	(P)	(y)	P/2 (kN)	(d)	(Ry)
Averages		3.49	2.82	6.38	36.00	3.18	7.43	4.89
Coefficient of Variation %		6.23	9.92	6.17	0.00	6.95	6.62	6.50
y = average failure deflection or peak deflection of the three tests.								
d= average first cycle displacement at half peak, (the very first cycle wall reaches the load)								
R = Residual load, P = Peak Load, S = Serviceability load								
Displacement Recovery Factor (K1), (0.8 <= K1 <= 1.0)					Systems factor K2 = 1.2			
Average Structural Displacement Ductility factor					u = y/d 4.84			
Ductility Modification factor					K4 = 1.00			
DLW = Selected deflection limit for wind forces				DLQ = Selected deflection limit for earthquake forces				
P21:2010 BR Calc's		K1	EQ ultimate	EQ service	Wind Ultimate	Wind Service		
Lab Number		(= 1.4 - C/X)	BU's	BU's	BU's	BU's		
292784	(BU)	1.00	106.6	155.6	136.7	120.5		
	(BU/m)		89	130	114	100		
292785	(BU)	1.00	92.5	155.3	119.2	120.3		
	(BU/m)		77	129	99	100		
292786	(BU)	1.00	94.4	145.3	127.0	112.6		
	(BU/m)		79	121	106	94		
<20% Result Check		292784	12% Ok result	3% Ok result	10% Ok result	3% Ok result		
		292785	-9% Ok result	3% Ok result	-11% Ok result	3% Ok result		
		292786	-5% Ok result	-7% Ok result	-1% Ok result	-7% Ok result		
Note: Where the value of BR Wind or BR EQ for any specimen is more than 20% greater than either of the other two specimens, assign it a value of 1.2 times the lower value before averaging.								
Average Earthquake BR			Ultimate		Serviceability			
EQ (BU's)		20 x K4 x Ry =	98	(P8 x K1) x (K2/0.55) =		152		
		82	BU/m	Limited by		Ultimate limit state		
Average Wind BR			Ultimate		Serviceability			
Wind (BU's)		20 * P =	128	(P8 x K1) x (K2/0.71) =		118		
		98	BU/m	Limited by		Serviceability limit state		

Figure 4: P21:2010 calculations for the 1200mm x 2.4m, 9mm Blondeline lite plywood one side with brackets

Please feel free to contact me to discuss this information.

Doug Gaunt

P21 Test Report

—

bbi® Blondeline® Lite

**Birch Falcata Plywood 12mm
1200mm Wall, Brackets**

Results

To:	Martin Wallace	From:	Doug Gaunt
Organisation:	bbi Wood Products	Subject:	P21:2010 1200mm x 2.4m 12mm Blondeline lite plywood, SG8 timber with Brackets
Location:	Hastings	Date:	16 January 2024
Mob No.:	021 745783	No. of	5
Tel No.:	06 8715539	Pages:	

Please find below your P21 bracing results for your three 1200mm x 2.4m walls with 12mm Blondeline lite plywood one side using SG8 timber and brackets.

1. BU wind = 131 (109 BU/m) as limited by the serviceability load capacity.
2. BU Earthquake = 137 (114 BU/m) as limited by the ultimate load capacity.

Figures 1, 2 & 3 show the load deflection plots, Figure 4 shows the P21:2010 calculations.

Wall Construction

- 90x45 H1.2 SG8 framing, Studs at 600mm centres, no nogs
- 12mm Blondeline lite plywood one side
- Plywood fixed with 50mm x 2.8mm Galv Steel Nails at 150mm centres, 300mm to central stud, 15mm edge distance.
- GIB Handibrac brackets each end
- M12 hold down rods to bottom plate and brackets
- P21 supplementary restraints used

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USE OF NAME: The Client will not use Scion's name in association with the sale and/or marketing of any goods or services

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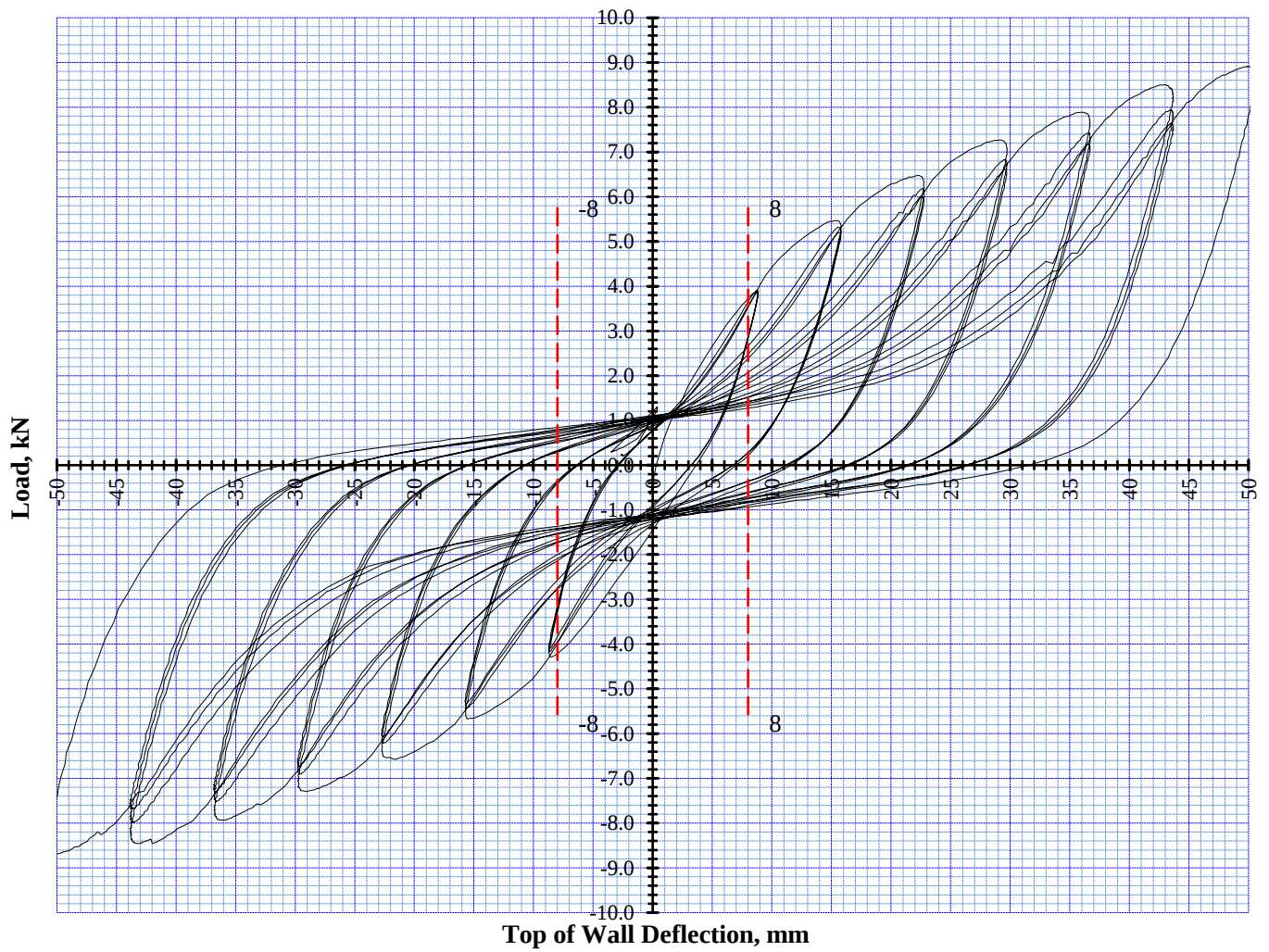


Figure 1: Wall 292781

Observations

- Pulling of plywood fixing nails at bottom plate

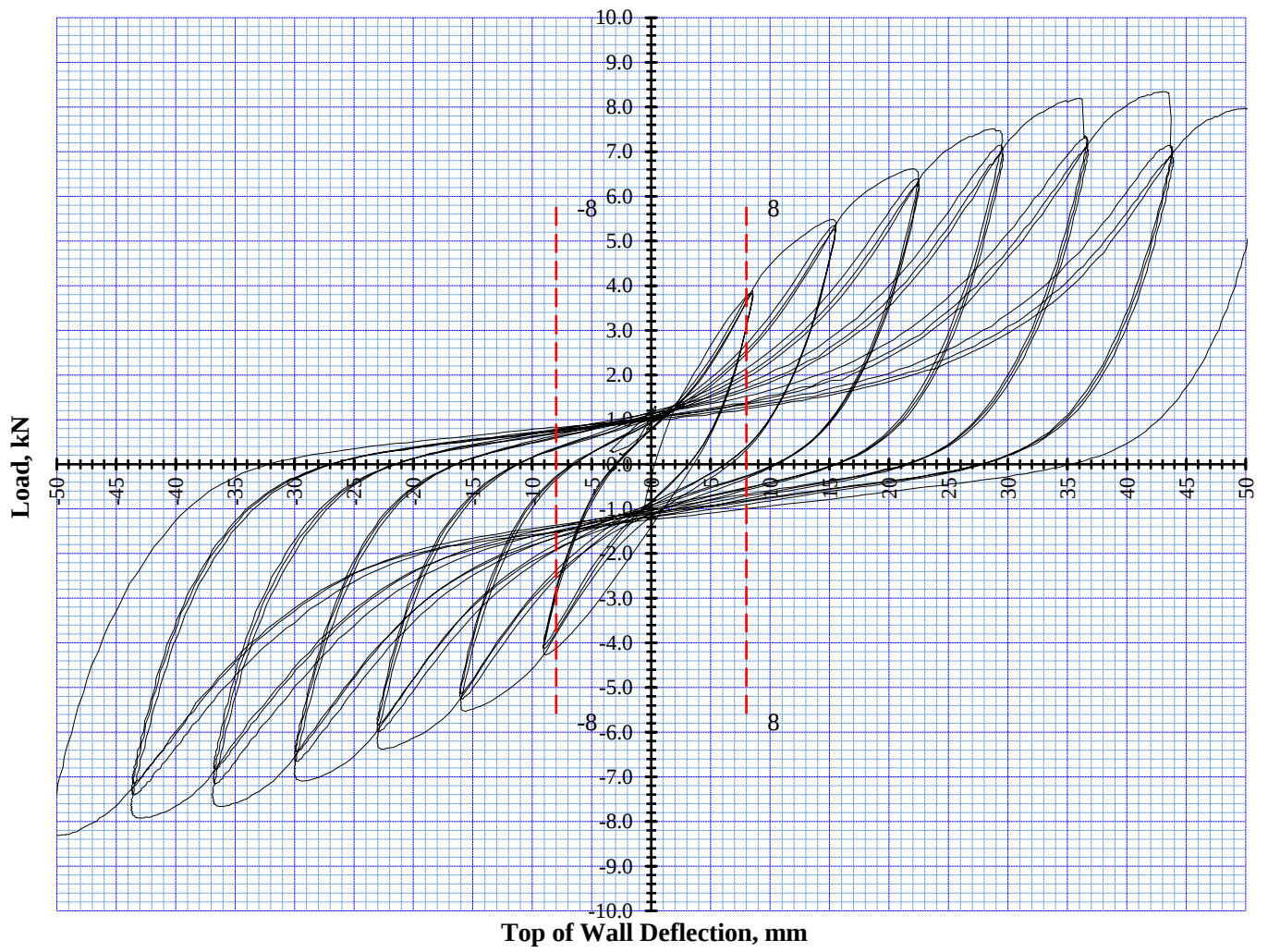


Figure 2: Wall 292782

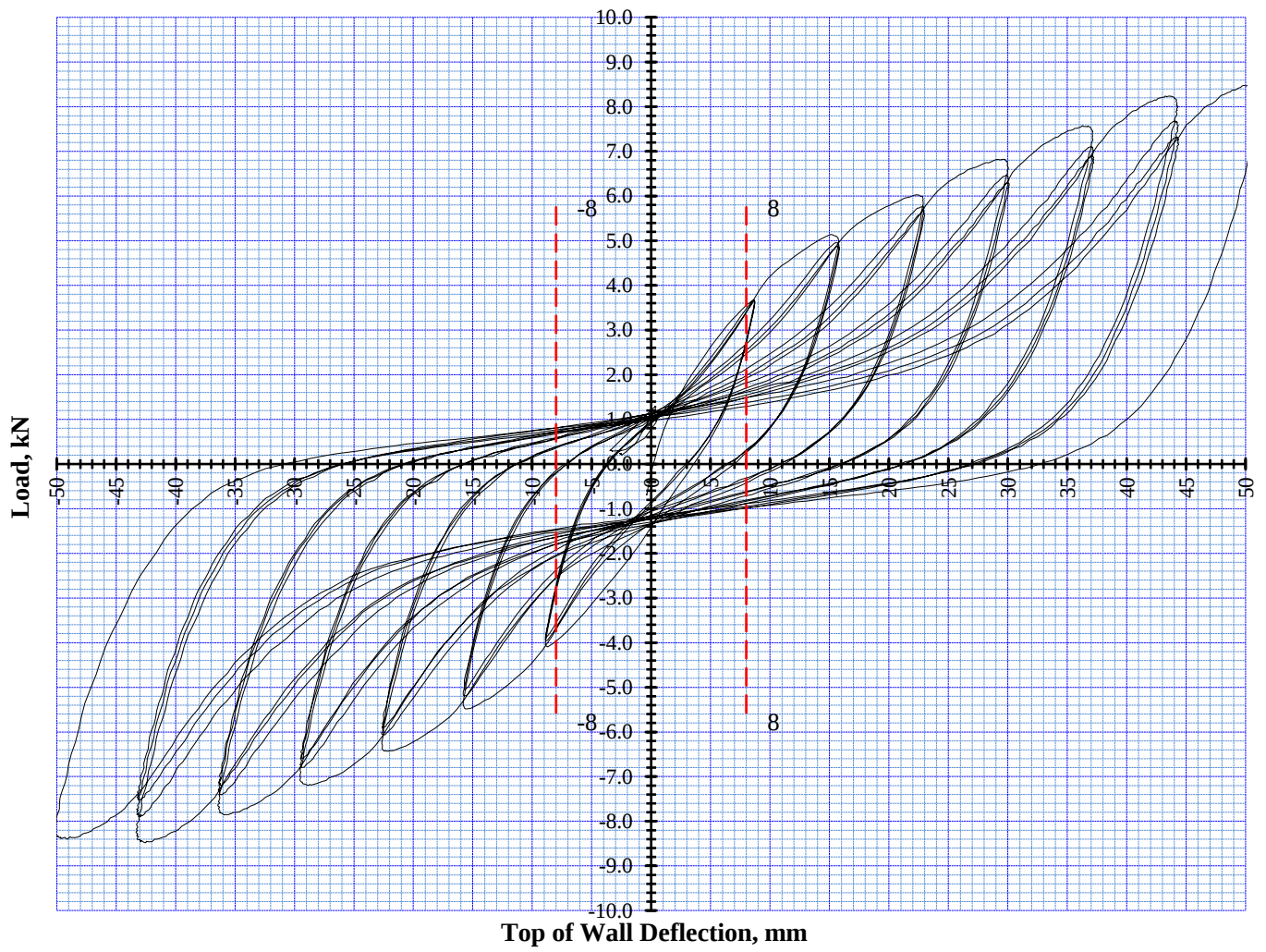


Figure 3: Wall 292783

P21:2010 BRACING RACKING TEST RESULT EVALUATION								
Wall Construction								
1200mm, bbi BlondeLine Lite 12mm Plywood one side								
90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs								
Plywood fixed 50mmx2.8mm Galv Steel Nails at 150mm centres							Summary	
to plates and external studs, 300mm to internal stud,							Earthquake	114 (U) BU/m
15mm min edge distances all around. GIB Handibracs used each end							Wind	109 (S) BU/m
M12 hold down bolts to bottom plate & brackets								
P21 Supplementary restraints used								
Date of test:-		13-Dec-23	Ship No.	3338		Tested by	Doug Gaunt	
Date of calc's:-		13-Dec-23	Job No.	TE23-026		Analysed by	Doug Gaunt	
Calculated to BRANZ P21:2010, AS/NZS1170.2&5, NZS3604:2011 Scion, Private Bag 3020 Rotorua.								
		Serviceability Cycles		Ultimate Cycles				
Lab Number	Direction	Cycle to H/300 or DLQ or DLW		Cycle to Displacement		Wall dimensions		
		8.0	X mm	y=(mm)		L(mm)	H(mm)	
		Loads	Residual	Maximum		1200	2410	
		(P ₈)	Defln, C	Load	def @ P	d at P/2	4th, R	
		kN	mm	P(kN)	y (mm)	P/2 (kN)	d mm	kN
292781	+	3.70	3.10	7.88	36.0	3.94	8.8	7.03
	-	4.20	2.90	7.93	36.0			7.00
292782	+	3.75	3.10	8.20	36.0	4.10	9.0	6.90
	-	4.13	2.90	7.65	36.0			6.60
292783	+	3.56	2.90	7.53	36.0	3.77	8.8	6.48
	-	3.97	3.50	7.83	36.0			7.18
		(P ₈)	(C)	(P)	(y)	P/2 (kN)	(d)	(Ry)
Averages		3.89	3.07	7.84	36.00	3.94	8.87	6.87
Coefficient of Variation %		5.99	6.96	2.71	0.00	3.48	1.06	3.59
y = average failure deflection or peak deflection of the three tests.								
d= average first cycle displacement at half peak, (the very first cycle wall reaches the load)								
R = Residual load, P = Peak Load, S = Serviceability load								
Displacement Recovery Factor (K1), (0.8 <= K1 <= 1.0)					Systems factor K2 = 1.2			
Average Structural Displacement Ductility factor					u = y/d 4.06			
Ductility Modification factor					K4 = 1.00			
DLW = Selected deflection limit for wind forces				DLQ = Selected deflection limit for earthquake forces				
P21:2010 BR Calc's		K1	EQ ultimate	EQ service	Wind Ultimate	Wind Service		
Lab Number		(= 1.4 - C/X)	BU's	BU's	BU's	BU's		
292781	(BU)	1.00	140.3	172.4	158.1	133.5		
	(BU/m)		117	144	132	111		
292782	(BU)	1.00	135.0	171.9	158.5	133.2		
	(BU/m)		113	143	132	111		
292783	(BU)	1.00	136.6	164.3	153.6	127.3		
	(BU/m)		114	137	128	106		
<20%Result Check		292781	3% Ok result	2% Ok result	1% Ok result	2% Ok result		
		292782	-3% Ok result	2% Ok result	2% Ok result	2% Ok result		
		292783	-1% Ok result	-5% Ok result	-3% Ok result	-5% Ok result		
Note: Where the value of BR Wind or BR EQ for any specimen is more than 20% greater than either of the other two specimens, assign it a value of 1.2 times the lower value before averaging.								
Average Earthquake BR			Ultimate				Serviceability	
EQ (BU's)	20 x K4 x Ry =		137	(P8 x K1) x (K2/0.55) =		170		
	114		BU/m	Limited by		Ultimate limit state		
Average Wind BR			Ultimate				Serviceability	
Wind (BU's)	20 * P =		157	(P8 x K1) x (K2/0.71) =		131		
	109		BU/m	Limited by		Serviceability limit state		

Figure 4: P21:2010 calculations for the 1200mm x 2.4m, 12mm Blondeline lite plywood one side with brackets

Please feel free to contact me to discuss this information.

Doug Gaunt

P21 Test Report

—

bbi® Redline®

Poplar Core Plywood 9mm
1200mm Wall, Brackets

Results

To:	Martin Wallace	From:	Doug Gaunt
Organisation:	bbi Wood Products	Subject:	P21:2010 bbi RedLine Poplar Core Plywood 9mm 1200mm Wall, Brackets
Location:	Hastings	Date:	30 May 2022
Fax No.:	021 745783	No. of	5
Tel No.:	06 8715539	Pages:	

Please find below the P21 bracing results for your three 1200mm x 2.4mm bbi RedLine Poplar Core Plywood 9mm one side Walls with Brackets.

1. BU wind = 130 (109 BU/m) as limited by the serviceability load capacity.
2. BU Earthquake = 133 (111 BU/m) as limited by the ultimate load capacity.

Figures 1, 2 & 3 show the load deflection plots, Figure 4 shows the P21:2010 calculations.

Wall Construction

bbi RedLine Poplar Core Plywood 9mm one side,
 90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs
 Plywood fixed with 50x2.8mm Galv clouts at 150 centres to end studs and plates, 300mm centres
 on internal stud
 GIB Handibracs brackets used
 M12 hold down bolts to bottom plate and brackets
 P21 Supplementary restraints used.

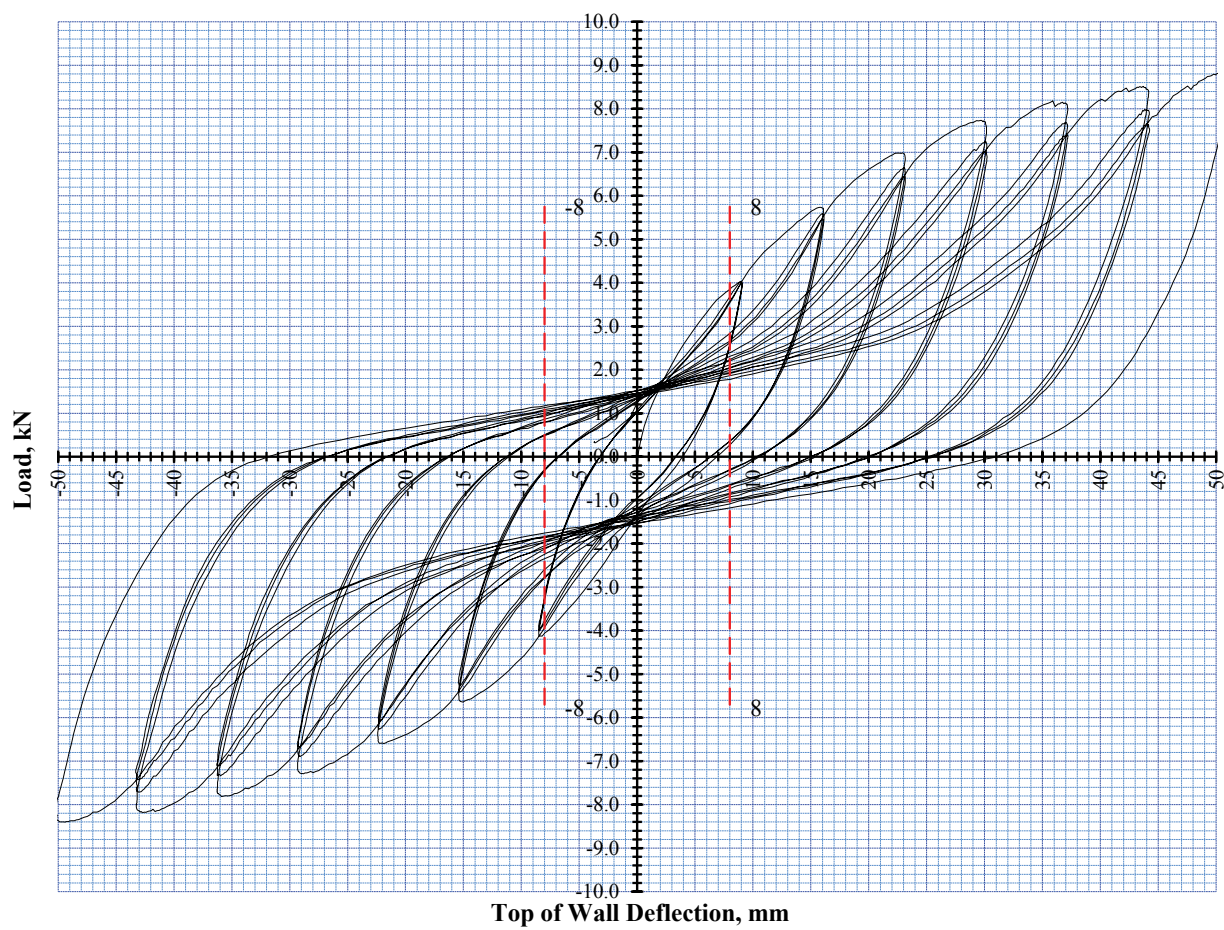
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Top of Wall Deflection, mm

Figure 1: Wall 289136

Observations

No obvious signs of failure to framing or plywood
Plywood pulling on bottom plate nails.

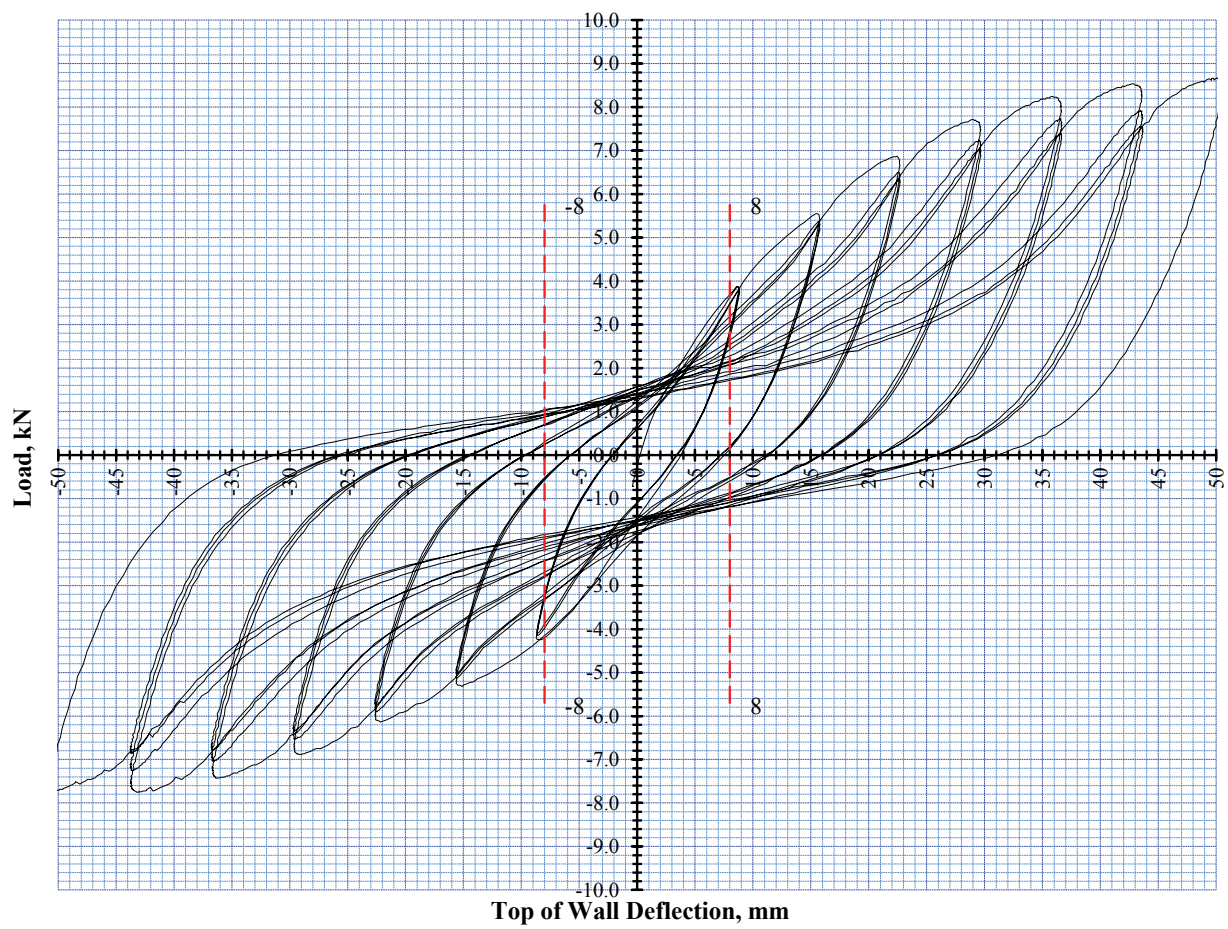


Figure 2: Wall 289137

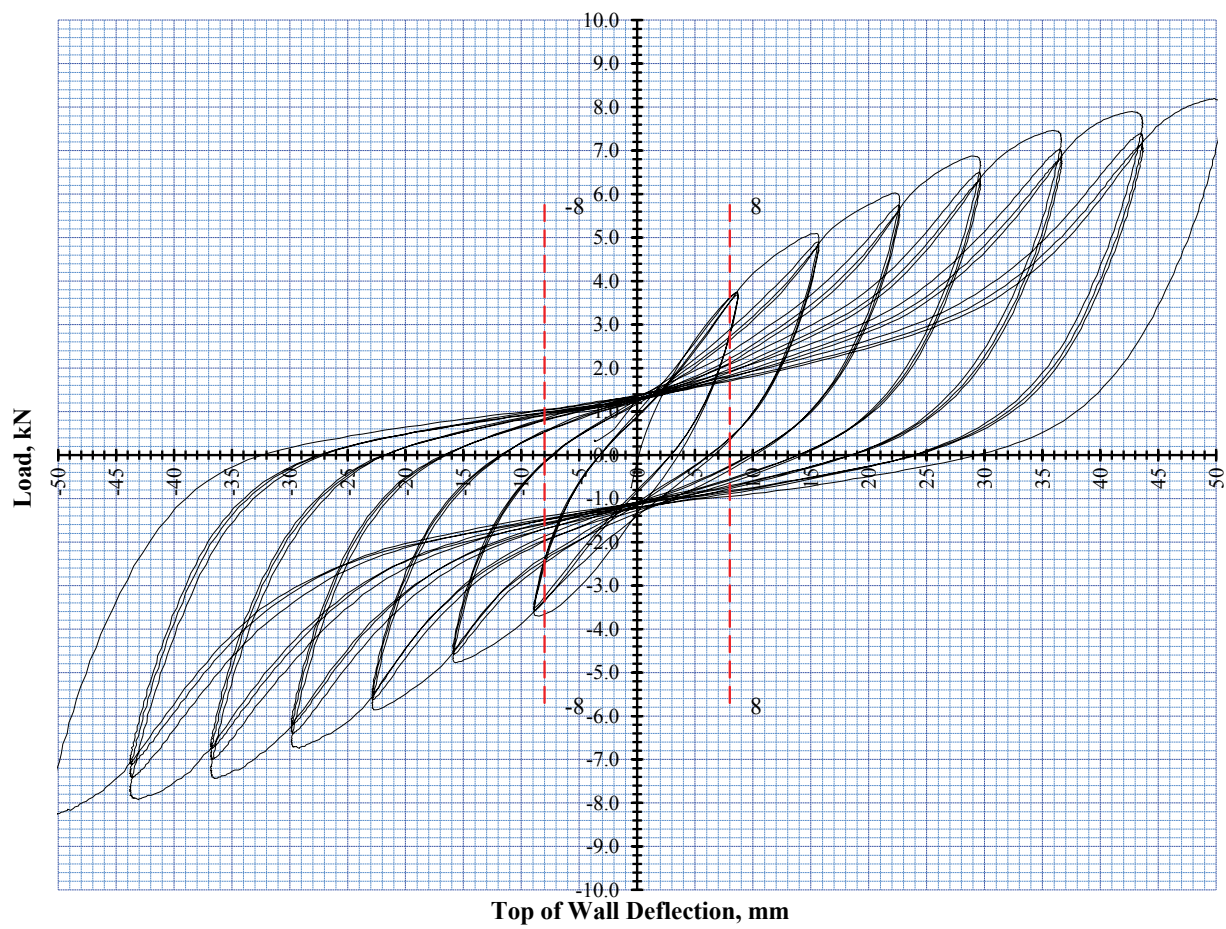


Figure 3: Wall 289138

P21:2010 BRACING RACKING TEST RESULT EVALUATION									
Wall Construction									
1200mm, bbi RedLine Poplar Core Plywood 9mm one side									
90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs									
Plywood fixed 50mmx2.8mm Galv Steel Nails at 150mm centres							Summary		
to plates and external studs, 300mm to internal studs,							Earthquake	111 (U)	BU/m
7mm min edge distances all around. GIB Handibracs used each end							Wind	109 (S)	BU/m
M12 hold down bolts to bottom plate & brackets									
P21 Supplementary restraints used									
Date of test:-		25-May-22	Ship No.	3251			Tested by John Lee		
Date of calc's:-		26-May-22	Job No.	TE21-068			Analysed by Doug Gaunt		
Calculated to BRANZ P21:2010, AS/NZS1170.2&5, NZS3604:2011 Scion, Private Bag 3020 Rotorua.									
		Serviceability Cycles			Ultimate Cycles				
Lab Number	Direction	Cycle to H/300 or DLQ or DLW		Cycle to Displacement				Wall dimensions	
		8.0	X mm	y=(mm)				L(mm)	H(mm)
		Loads	Residual	Maximum				1200	2410
		(P ₈)	Defln, C	Load		def @ P		d at P/2	4th, R
		kN	mm	P(kN)	y (mm)	P/2 (kN)	d mm	kN	
289136	+	3.83	3.30	8.10	36.0	4.05	9.1	6.97	
	-	4.07	3.20	7.80	36.0			7.00	
289137	+	3.85	2.90	8.22	36.0	4.11	9.5	7.20	
	-	4.08	2.50	7.41	36.0			6.60	
289138	+	3.65	2.80	7.45	36.0	3.73	8.5	6.62	
	-	3.67	3.10	7.40	36.0			6.45	
		(P ₈)	(C)	(P)	(y)	P/2 (kN)	(d)	(Ry)	
Averages		3.86	2.97	7.73	36.00	3.96	9.03	6.81	
Coefficient of Variation %		4.41	9.06	4.33	0.00	4.27	4.55	3.90	
y = average failure deflection or peak deflection of the three tests.									
d= average first cycle displacement at half peak, (the very first cycle wall reaches the load)									
R = Residual load, P = Peak Load, S = Serviceability load									
Displacement Recovery Factor (K1), (0.8 <= K1 <= 1.0) Systems factor K2 = 1.2									
Average Structural Displacement Ductility factor u = y/d 3.99									
Ductility Modification factor K4 = 0.98									
DLW = Selected deflection limit for wind forces DLQ = Selected deflection limit for earthquake forces									
P21:2010 BR Calc's									
Lab Number		K1 (= 1.4 - C/X)	EQ ultimate BU's	EQ service BU's	Wind Ultimate BU's	Wind Service BU's			
289136	(BU)	1.00	136.7	171.6	159.0	132.9			
	(BU/m)		114	143	133	111			
289137	(BU)	1.00	135.0	173.0	156.3	134.0			
	(BU/m)		113	144	130	112			
289138	(BU)	1.00	127.9	159.7	148.5	123.7			
	(BU/m)		107	133	124	103			
<20% Result Check		289136	4% Ok result	3% Ok result	4% Ok result	3% Ok result			
		289137	2% Ok result	4% Ok result	2% Ok result	4% Ok result			
		289138	-6% Ok result	-8% Ok result	-6% Ok result	-8% Ok result			
Note: Where the value of BR Wind or BR EQ for any specimen is more than 20% greater than either of the other two specimens, assign it a value of 1.2 times the lower value before averaging.									
Average Earthquake BR									
EQ (BU's)	20 x K4 x Ry =	133	Ultimate	(P8 x K1) x (K2/0.55) =	Serviceability				
		111	BU/m	Limited by	Ultimate limit state				
Average Wind BR									
Wind (BU's)	20 * P =	155	Ultimate	(P8 x K1) x (K2/0.71) =	Serviceability				
		109	BU/m	Limited by	Serviceability limit state				

P21 Test Report

—

bbi® Redline®

Poplar Core Plywood 12mm
1200mm Wall, Brackets

Results

To:	Martin Wallace	From:	Doug Gaunt
Organisation:	bbi Wood Products	Subject:	P21:2010 bbi RedLine Poplar Core Plywood 12mm 1200mm Wall, Brackets
Location:	Hastings	Date:	30 May 2022
Fax No.:	021 745783	No. of	5
Tel No.:	06 8715539	Pages:	

Please find below the P21 bracing results for your three 1200mm x 2.4m bbi RedLine Poplar Core Plywood 12mm one side Walls with Brackets.

1. BU wind = 121 (101 BU/m) as limited by the serviceability load capacity.
2. BU Earthquake = 130 (108 BU/m) as limited by the ultimate load capacity.

Figures 1, 2 & 3 show the load deflection plots, Figure 4 shows the P21:2010 calculations.

Wall Construction

bbi RedLine Poplar Core Plywood 12mm one side,
 90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs
 Plywood fixed with 50x2.8mm Galv clouts at 150 centres to end studs and plates, 300mm centres on internal stud
 GIB Handibracs brackets used
 M12 hold down bolts to bottom plate and brackets
 P21 Supplementary restraints used.

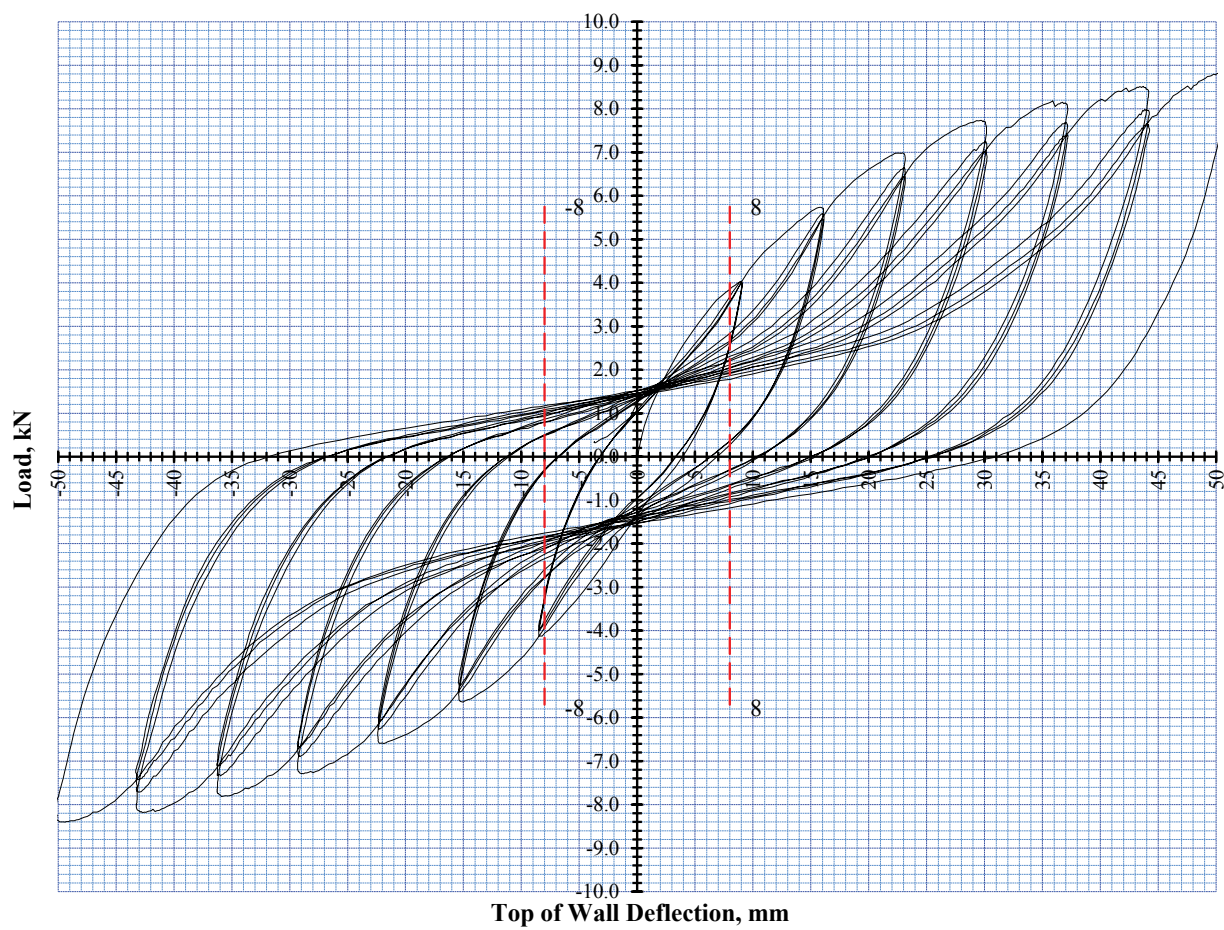
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Top of Wall Deflection, mm

Figure 1: Wall 289136

Observations

No obvious signs of failure to framing or plywood
Plywood pulling on bottom plate nails.

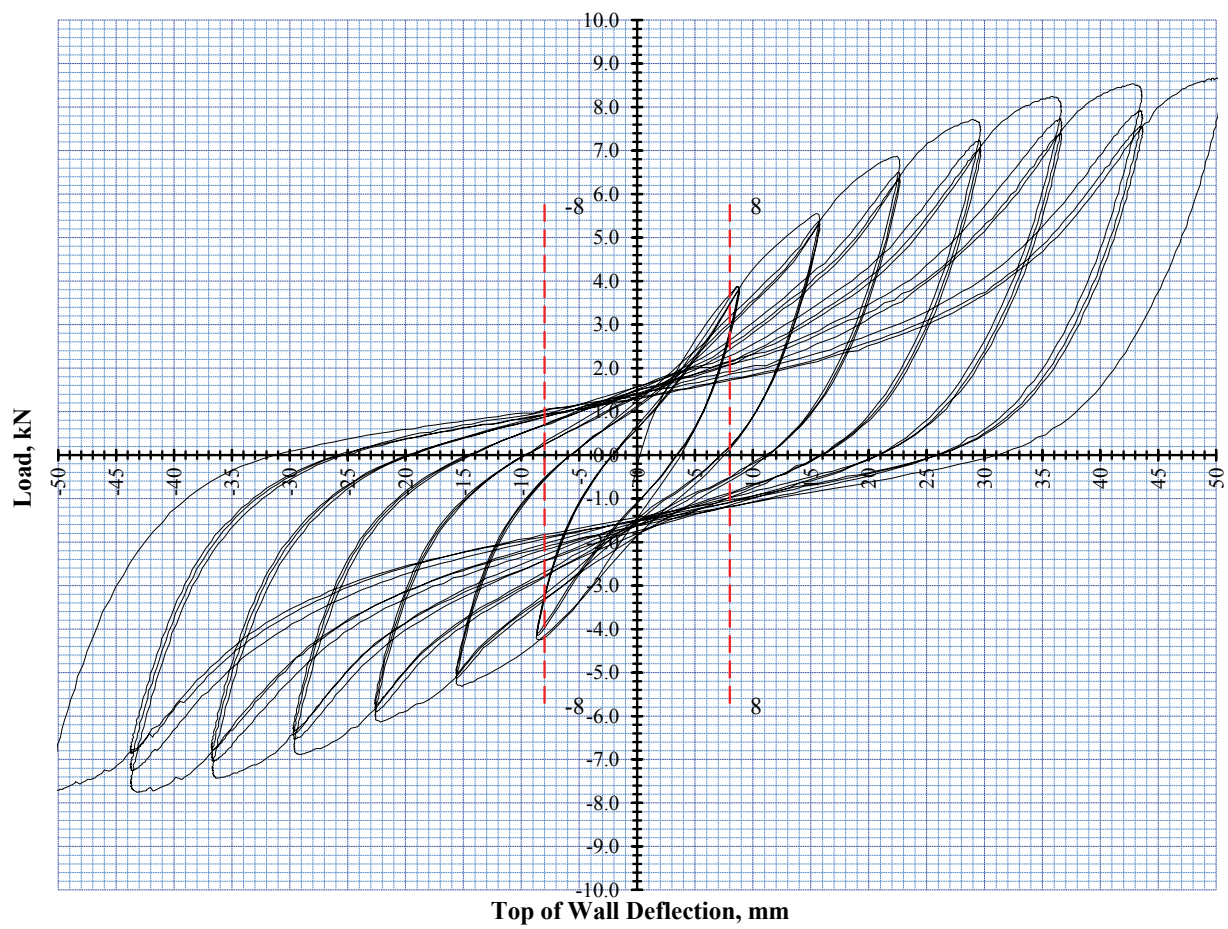


Figure 2: Wall 289137

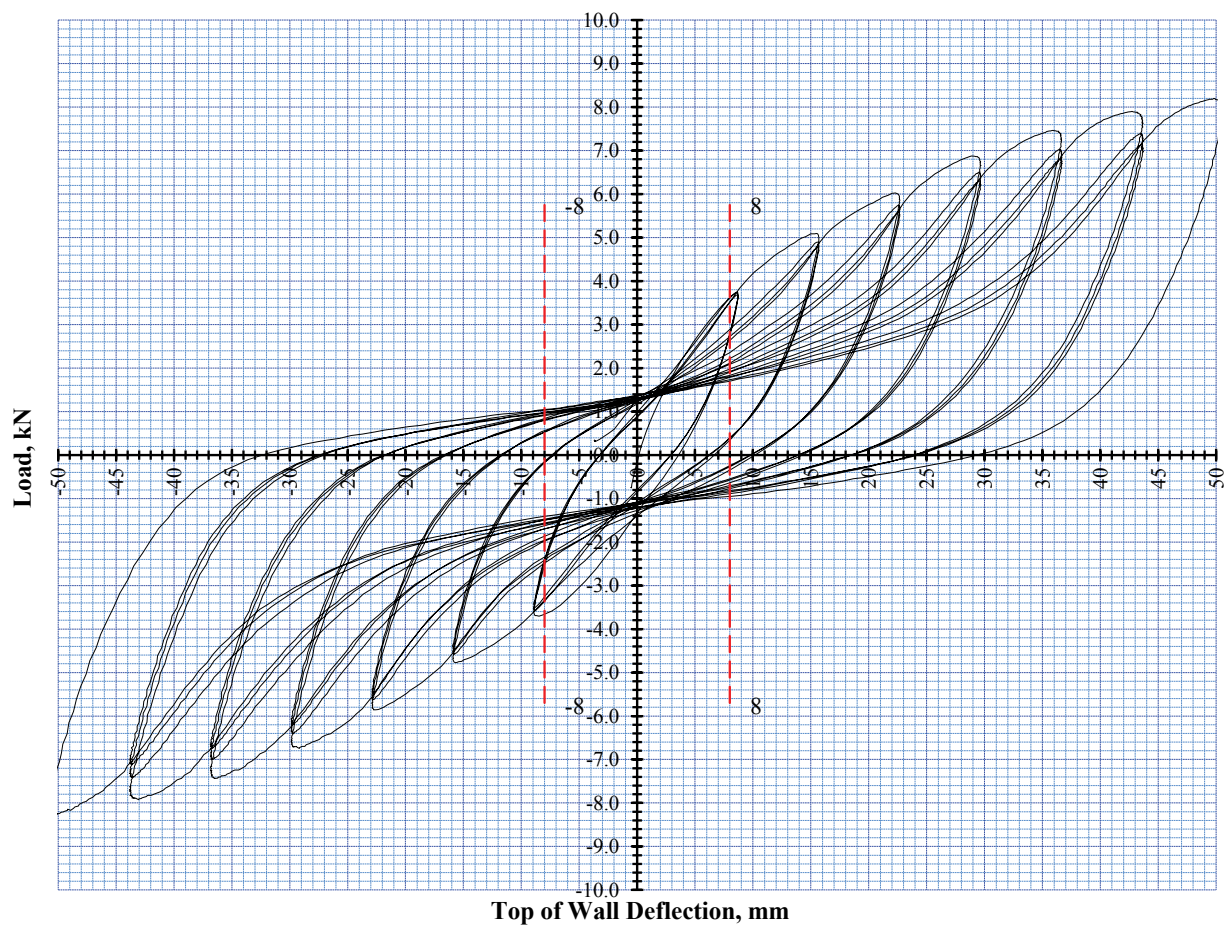


Figure 3: Wall 289138

P21:2010 BRACING RACKING TEST RESULT EVALUATION									
Wall Construction									
1200mm, bbi RedLine Poplar Core Plywood 9mm one side									
90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs									
Plywood fixed 50mmx2.8mm Galv Steel Nails at 150mm centres							Summary		
to plates and external studs, 300mm to internal studs,							Earthquake	111 (U)	BU/m
7mm min edge distances all around. GIB Handibracs used each end							Wind	109 (S)	BU/m
M12 hold down bolts to bottom plate & brackets									
P21 Supplementary restraints used									
Date of test:-		25-May-22	Ship No.	3251			Tested by	John Lee	
Date of calc's:-		26-May-22	Job No.	TE21-068			Analysed by	Doug Gaunt	
Calculated to BRANZ P21:2010, AS/NZS1170.2&5, NZS3604:2011 Scion, Private Bag 3020 Rotorua.									
		Serviceability Cycles			Ultimate Cycles				
Lab Number	Direction	Cycle to H/300 or DLQ or DLW		Cycle to Displacement				Wall dimensions	
		8.0	X mm	y=(mm)				L(mm)	H(mm)
		Loads	Residual	Maximum				1200	2410
		(P ₈)	Defln, C	Load	def @ P			d at P/2	4th, R
		kN	mm	P(kN)	y (mm)	P/2 (kN)	d mm	kN	
289136	+	3.83	3.30	8.10	36.0	4.05	9.1	6.97	
	-	4.07	3.20	7.80	36.0			7.00	
289137	+	3.85	2.90	8.22	36.0	4.11	9.5	7.20	
	-	4.08	2.50	7.41	36.0			6.60	
289138	+	3.65	2.80	7.45	36.0	3.73	8.5	6.62	
	-	3.67	3.10	7.40	36.0			6.45	
		(P ₈)	(C)	(P)	(y)	P/2 (kN)	(d)	(Ry)	
Averages		3.86	2.97	7.73	36.00	3.96	9.03	6.81	
Coefficient of Variation %		4.41	9.06	4.33	0.00	4.27	4.55	3.90	
y = average failure deflection or peak deflection of the three tests.									
d= average first cycle displacement at half peak, (the very first cycle wall reaches the load)									
R = Residual load, P = Peak Load, S = Serviceability load									
Displacement Recovery Factor (K1), (0.8 <= K1 <= 1.0)						Systems factor K2 = 1.2			
Average Structural Displacement Ductility factor						u = y/d 3.99			
Ductility Modification factor						K4 = 0.98			
DLW = Selected deflection limit for wind forces				DLQ = Selected deflection limit for earthquake forces					
P21:2010 BR Calc's									
Lab Number		K1	EQ ultimate	EQ service	Wind Ultimate	Wind Service			
		(= 1.4 - C/X)	BU's	BU's	BU's	BU's			
289136	(BU)	1.00	136.7	171.6	159.0	132.9			
	(BU/m)		114	143	133	111			
289137	(BU)	1.00	135.0	173.0	156.3	134.0			
	(BU/m)		113	144	130	112			
289138	(BU)	1.00	127.9	159.7	148.5	123.7			
	(BU/m)		107	133	124	103			
		289136	4% Ok result	3% Ok result	4% Ok result	3% Ok result			
<20% Result Check		289137	2% Ok result	4% Ok result	2% Ok result	4% Ok result			
		289138	-6% Ok result	-8% Ok result	-6% Ok result	-8% Ok result			
Note: Where the value of BR Wind or BR EQ for any specimen is more than 20% greater than either of the other two specimens, assign it a value of 1.2 times the lower value before averaging.									
Average Earthquake BR									
EQ (BU's)		20 x K4 x Ry =	133	(P8 x K1) x (K2/0.55) =		168	Serviceability		
		111	BU/m	Limited by			Ultimate limit state		
Average Wind BR									
Wind (BU's)		20 * P =	155	(P8 x K1) x (K2/0.71) =		130	Serviceability		
		109	BU/m	Limited by			Serviceability limit state		

Figure 4: P21:2010 calculations for 1200mm x 2.40m bbi RedLine Poplar Core Plywood 9mm one side wall

Please feel free to contact me to discuss this information.

Doug Gaunt

P21 Test Report

—

bbi® Redline®

Premium Hardwood Core
Plywood 12mm 1200mm
Wall, Brackets

Results

To:	Martin Wallace	From:	Doug Gaunt
Organisation:	bbi Wood Products	Subject:	P21:2010 bbi RedLine Premium Hardwood Core Plywood 12mm1200mm Wall, Brackets
Location:	Hastings	Date:	30 May 2022
Fax No.:	021 745783	No. of	5
Tel No.:	06 8715539	Pages:	

Please find below the P21 bracing results for your three 1200mm x 2.4m bbi RedLine Premium Hardwood Core Plywood 12mm one side Walls with Brackets.

1. BU wind = 134 (112 BU/m) as limited by the serviceability load capacity. 157
2. BU Earthquake = (131 BU/m) as limited by the ultimate load capacity.

Figures 1, 2 & 3 show the load deflection plots, Figure 4 shows the P21:2010 calculations. Wall

Construction

bbi RedLine Premium Hardwood Core Plywood 12mm one side,
 90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs
 Plywood fixed with 50x2.8mm Galv clouts at 150 centres to end studs and plates, 300mm centres on
 internal stud
 GIB Handibracs brackets used
 M12 hold down bolts to bottom plate and brackets
 P21 Supplementary restraints used.

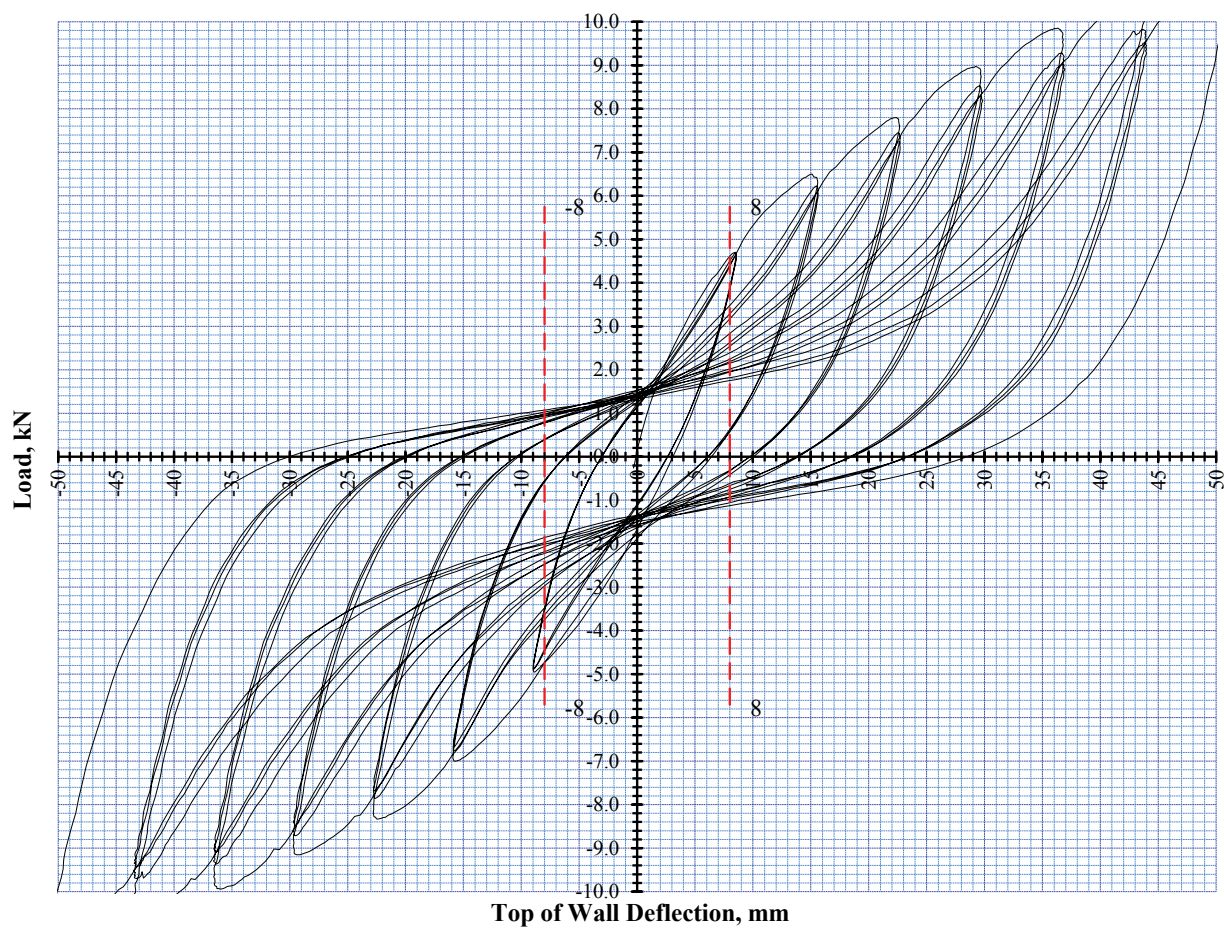
RISK AND LIMITATION OF LIABILITY: Scion's liability to the Client arising out of all claims for any loss or damage resulting from this work will not exceed in aggregate an amount equal to two times the Service Fees actually paid by the Client to Scion. Scion will not be liable in any event for loss of profits or any indirect, consequential or special loss or damage suffered or incurred by the Client as a result of any act or omission of Scion under this Agreement.

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New Zealand Forest Research Institute Limited – A Crown Research Institute of New Zealand



Top of Wall Deflection, mm

Figure 1: Wall 289124

Observations

No obvious signs of failure to framing or plywood
Plywood pulling on bottom plate nails.

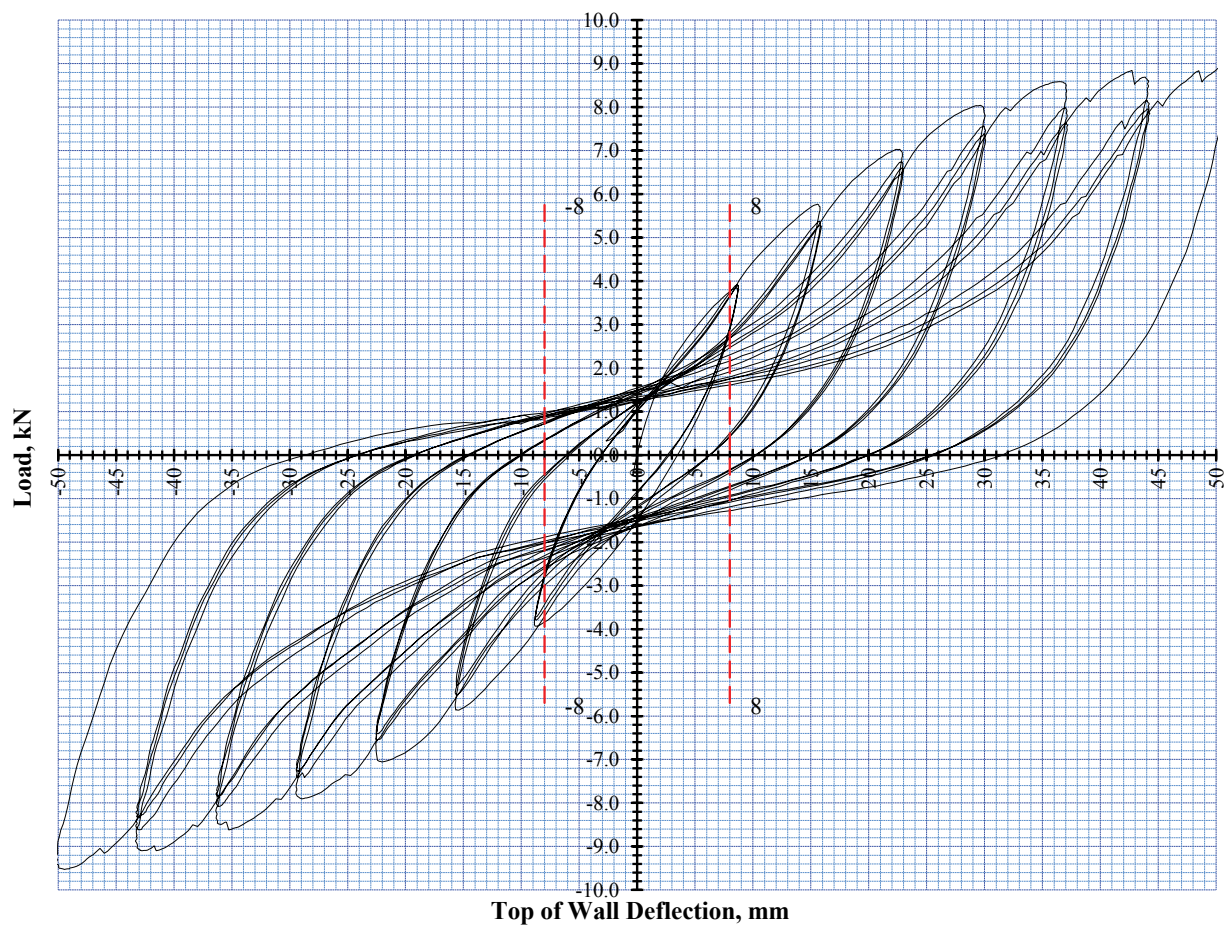


Figure 2: Wall 289125

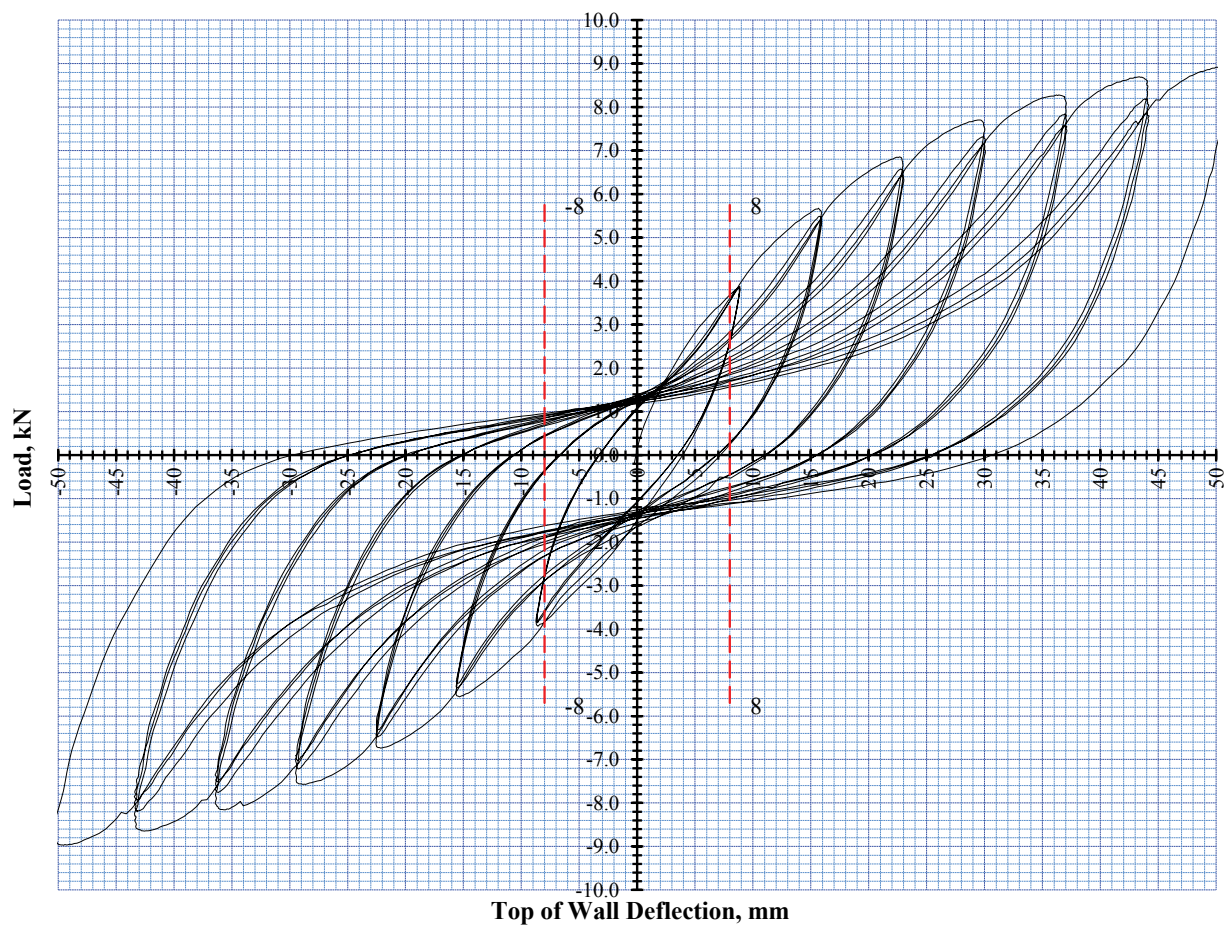


Figure 3: Wall 289126

P21:2010 BRACING RACKING TEST RESULT EVALUATION									
Wall Construction									
1200mm, bbi RedLine Premium Hardwood Core Plywood 12mm one side									
90x45 H1.2 SG8 framing, studs at 600mm centres, no nogs									
Plywood fixed 50mmx2.8mm Galv Steel Nails at 150mm centres							Summary		
to plates and external studs, 300mm to internal studs,							Earthquake	131 (U)	BU/m
7mm min edge distances all around. GIB Handibracs used each end							Wind	112 (S)	BU/m
M12 hold down bolts to bottom plate & brackets									
P21 Supplementary restraints used									
Date of test:-		24-May-22	Ship No.		3251	Tested by		John Lee	
Date of calc's:-		24-May-22	Job No.		TE21-068	Analysed by		Doug Gaunt	
Calculated to BRANZ P21:2010, AS/NZS1170.2&5, NZS3604:2011 Scion, Private Bag 3020 Rotorua.									
		Serviceability Cycles		Ultimate Cycles					
Lab Number	Direction	Cycle to H/300 or DLQ or DLW		Cycle to Displacement				Wall dimensions	
		8.0	X mm	y=(mm)				L(mm)	H(mm)
		Loads	Residual	Maximum				1200	2410
		(P ₈)	Defln, C	Load	def @ P			d at P/2	4th, R
		kN	mm	P(kN)	y (mm)	P/2 (kN)	d mm	kN	
289124	+	4.45	3.10	9.80	36.0	4.90	7.4	8.50	
	-	4.97	2.50	9.96	36.0			9.00	
289125	+	3.75	2.50	8.60	36.0	4.30	9.5	7.18	
	-	3.86	3.10	8.48	36.0			7.80	
289126	+	3.68	3.40	8.25	36.0	4.13	7.4	7.20	
	-	3.80	3.30	8.15	36.0			7.48	
		(P ₈)	(C)	(P)	(y)	P/2 (kN)	(d)	(Ry)	
Averages		4.09	2.98	8.87	36.00	4.44	8.10	7.86	
Coefficient of Variation %		11.50	11.99	8.21	0.00	7.47	12.22	8.62	
y = average failure deflection or peak deflection of the three tests.									
d= average first cycle displacement at half peak, (the very first cycle wall reaches the load)									
R = Residual load, P = Peak Load, S = Serviceability load									
Displacement Recovery Factor (K1), (0.8 <= K1 <= 1.0)					Systems factor K2 = 1.2				
Average Structural Displacement Ductility factor					u = y/d 4.44				
Ductility Modification factor					K4 = 1.00				
DLW = Selected deflection limit for wind forces				DLQ = Selected deflection limit for earthquake forces					
P21:2010 BR Calc's									
Lab Number		K1	EQ ultimate	EQ service	Wind Ultimate	Wind Service			
		(= 1.4 - C/X)	BU's	BU's	BU's	BU's			
289124	(BU)	1.00	175.0	205.5	197.6	159.2			
	(BU/m)		146	171	165	133			
289125	(BU)	1.00	149.8	166.0	170.8	128.6			
	(BU/m)		125	138	142	107			
289126	(BU)	0.98	146.8	160.4	164.0	124.3			
	(BU/m)		122	134	137	104			
		289124	15% Ok result	192.5	15% Ok result	149.1			
<20% Result Check		289125	-7% Ok result	-10% Ok result	-6% Ok result	-10% Ok result			
		289126	-11% Ok result	-16% Ok result	-12% Ok result	-16% Ok result			
Note: Where the value of BR Wind or BR EQ for any specimen is more than 20% greater than either of the other two specimens, assign it a value of 1.2 times the lower value before averaging.									
Average Earthquake BR			Ultimate				Serviceability		
EQ (BU's)		20 x K4 x Ry =	157	(P8 x K1) x (K2/0.55) =		173			
		131	BU/m	Limited by		Ultimate limit state			
Average Wind BR			Ultimate				Serviceability		
Wind (BU's)		20 * P =	177	(P8 x K1) x (K2/0.71) =		134			
		112	BU/m	Limited by		Serviceability limit state			

Figure 4: P21:2010 calculations for 1200mm x 2.40m bbi RedLine Premium Hardwood Core Plywood 12mm one side wall

Please feel free to contact me to discuss this information.

Doug Gaunt

Endless possibilities.

