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TEST REPORT
BASIC WORKING LOADS AND CHARACTERISTIC
STRENGTH VALUES FOR TYPE A & B FASTENERS. SHEAR
AT JOINTS AND TENSION PERPENDICULAR TO GRAIN FOR
E10 & E13 AUSWOOD LVL IN ACCORDANCE WITH AS1649
AND AS/NZS4063.1

CLIENT:

AUSWOOD TIMBER
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1 OBJECTIVE

All the fasteners (Type A & B) capacities were determined using AUSWOOD E10 & E13 LVL with fasteners sourced from local hardware stores. The LVL grades were provided by AUSWOOD, UTF was involved in the grading process.

2 EXECUTIVE SUMMARY OF RESULTS

2.1 Withdrawal capacity:

The test data were statistically processed in accordance with AS 1649, to calculate the basic working loads and the characteristic loads.

- (a) Characteristic capacity in withdrawal of 50x2.8mm nails with LVL, see Table 1.

Table 1 Characteristic load capacity for limit state design, for a single nail in withdrawal axially loaded –LVL

<i>Species group tested</i>	<i>Characteristic capacity, N per mm penetration of nail</i>			
<i>Nail diameter, mm</i>	2.8			
LVL Grade	E10		E13	
LVL Size (mm)	90x35	240x45	90x45	240x45
LVL face	12.8	9.6	12.1	9.2
LVL edge	11.1	7.7	11.6	9.9

- (b) Characteristic capacity in withdrawal of 8Gx50mm taper countersunk zinc plated screws with LVL, see Table 2.

Table 2 Characteristic capacity for limit state design, for a single screw loaded in withdrawal axially loaded - LVL

<i>Species group tested</i>	<i>Characteristic capacity of screw, N per mm penetration of thread</i>			
<i>Screw diameter, mm</i>	2.8			
LVL Grade	E10		E13	
LVL Size (mm)	90x35	240x45	90x45	240x45
LVL face	72.3	60.1	55.2	57.1
LVL edge	66.6	55.8	54.9	57.9

2.2 Lateral resistance capacity:

The test data was statistically processed in accordance with AS 1649, to calculate the basic working loads and the characteristic loads.

- (a) Characteristic capacity for a 100x3.75mm bullet head bright steel nail laterally loaded with LVL, see Table 3. All specimens failed due to excessive deflection of the specimen, no fastener failure.

Table 3 Characteristic capacity for limit state design, for a single steel nail laterally loaded –LVL

<i>Species group tested</i>	<i>Characteristic capacity, N per nail (N)</i>			
<i>Nail diameter, mm</i>	3.75			
LVL Grade	E10		E13	
LVL Size (mm)	90x35	240x45	90x45	240x45
Capacity	2756	1920	1693	2222

(b) Characteristic capacity for Size 14 (Gauge)-10 (thread) x125mm bugle head screws for LVL E13 and 240x45 E10 LVL, and Size 6 (Gauge), 3.4mm diameter x100mm screws, see Table 4. All specimens failed due to excessive deflection of the specimen, no fastener failure.

Table 4 Characteristic capacity for limit state design, for a single screw laterally loaded –LVL

<i>Species group tested</i>	<i>Characteristic capacity, N per screw (N)</i>			
<i>Screw diameter, mm</i>	6G		14G	
LVL Grade	E10		E13	
LVL Size (mm)	90x35	240x45	90x45	240x45
Capacity	5315	5855	5456	8554

(c) Characteristic capacity for single M12x150mm grade 4.6 steel galvanised bolts parallel to grain of LVL, see Table 5. All specimens failed due to excessive deflection of the specimen, no fastener failure.

Table 5 Characteristic capacity for limit state design, for M12 galvanised bolts parallel to grain laterally loaded –LVL

<i>Species group tested</i>	<i>Characteristic capacity, N</i>			
<i>Bolt diameter</i>	M12			
LVL Grade	E10		E13	
LVL Size (mm)	90x35	240x45	90x45	240x45
Capacity	13479	11040	12580	16782

(d) Characteristic capacity for single M12x150mm grade 4.6 steel galvanised bolts perpendicular to grain for LVL. The summary is shown in Table 6. All specimens failed due to excessive deflection of the specimen, no fastener failure.

Table 6 Characteristic capacity for limit state design, for M12 galvanised bolts perpendicular to grain laterally loaded –LVL

<i>Species group tested</i>	<i>Characteristic capacity, N</i>			
<i>Bolt diameter</i>	M12			
LVL Grade	E10		E13	
LVL Size (mm)	90x35	240x45	90x45	240x45
Capacity	8450	7891	7028	11646

2.3 Shear strength at joint and Tension strength perpendicular to grain:

The test data was statistically processed in accordance with AS/NZS 4063.1, Appendices A2 and A4, to calculate the characteristic properties.

(a) Characteristic shear strength at joint, see Table 7.

Table 7 Characteristic shear strength at joint.

<i>Species group tested</i>	<i>Characteristic capacity, N per nail (N)</i>			
<i>Nail diameter, mm</i>	3.75			
<i>LVL Grade</i>	E10		E13	
<i>LVL Size (mm)</i>	90x35	240x45	90x45	240x45
<i>Shear strength</i>	1.4	1.3	1.8	1.4

(b) Characteristic Tension strength perpendicular to grain, see Table 8.

Table 8 Characteristic tension perpendicular to grain strength.

<i>Species group tested</i>	<i>Characteristic capacity, N per nail (N)</i>			
<i>Nail diameter, mm</i>	3.75			
<i>LVL Grade</i>	E10		E13	
<i>LVL Size (mm)</i>	90x35	240x45	90x45	240x45
<i>Shear strength</i>	1.4	1.8	1.8	1.4

3 TEST SPECIMENS

The following details were provided by Auswood, UTF is unable to verify this information:

- Sampling of the test specimens.
- LVL E grades (10 & 13).

Mean density for specimens.	744.7 kg/m ³
Mean equilibrium moisture content for both sizes.	11.6%
Fabricator	FUJIAN PROVINCE YOU XI CITY MANGROVE WOOD MACHINING CO., LTD
Address of fabricator	Fujian You Xi Economic Development Zone, CHENG XI PARK, SANMING, FUJIAN, CHINA

Product profile	Thickness	species	Veneer thickness	Actual Layers	Average Density	Average M.C.
E10	35mm	Masson pine	2.2	18	653.2	11.8
E10	45mm	Masson pine	2.2	21	608.0	12.5
E13	45mm	Masson pine	2.2	16	556.2	9.1
E13	45mm	Masson pine	2.2	25	731.5	14.2

Note that veneer layers in column 5 above are as provided by Auswood, column 6 shows the actual number of layers counted for the specimens tested.

All fasteners used in these tests were sourced from local hardware stores.

Density is measured in kg/m³, M.C. is the moisture content measured by dry oven method (%).

This report represents results for the specimens tested only and it shall not be interpreted to be representative or guarantees of any current or future production of the product.

3.2.1 Withdrawal test specimens for nails & screws

All test specimens were cut to a length of 200mm. The specimens comprised a nominal size of 100x35 and 240x45mm for E10 and 100x45 and 240x45 for E13 LVL. The fasteners used were 50x2.8mm bullet head nails, and 2.8x50mm screws, see Figure 1. Note that the 240x45 specimens were cut to suit the test rig.

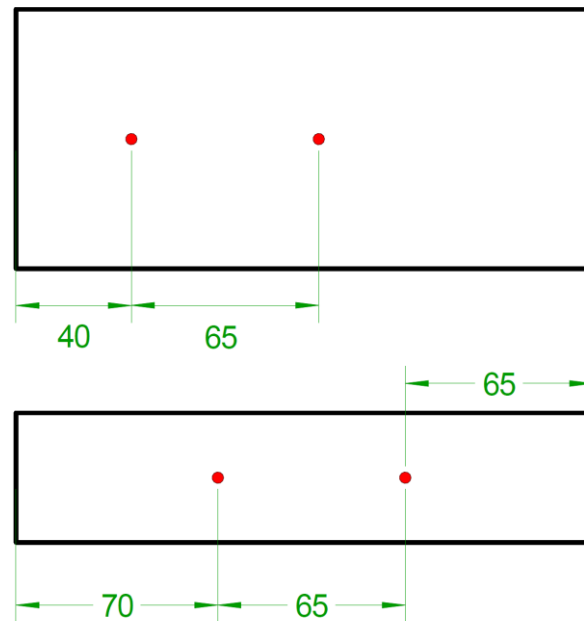


Figure 1 Nail/Screw withdrawal test specimen details

3.2.2 Lateral loading test specimens for nails & screws

The specimens comprised a nominal size of 100x35mm and 24x45mm for E10 and 100x45 and 240x45 for E13 LVL. The fasteners used were 100x3.75mm nails, and 100x3.4mm for 90x35mm E10 and 125x14G (5.1mm) hex screws for 240x45mm E10 and both sizes of E13, see Figure 2 for schematic sketch of specimens.

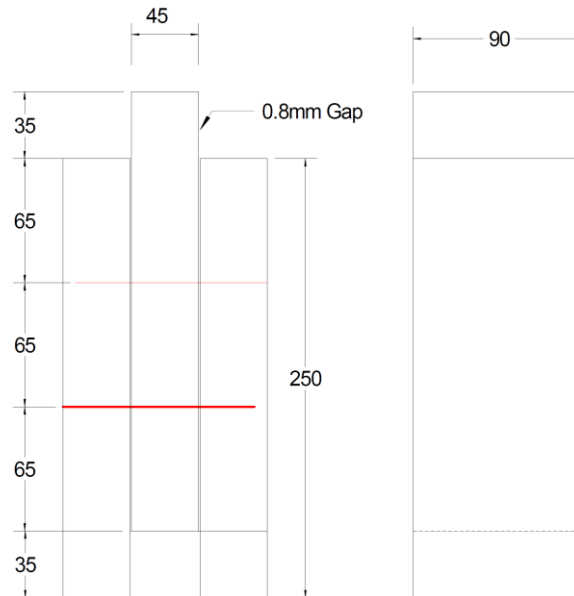


Figure 2 Lateral resistance of nails/screws specimen details

3.2.3 Lateral loading for M12 bolts parallel to grain

The schematic sketch for specimen details for lateral resistance of M12 grade 4.6 steel galvanised bolts parallel to grain is shown in Figure 3.

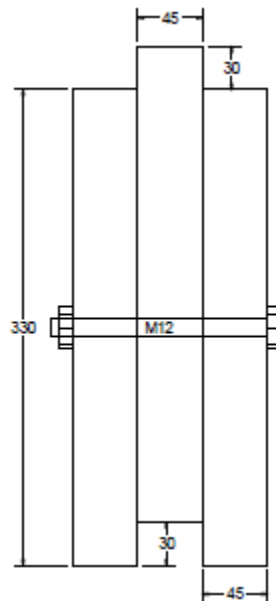


Figure 3 Lateral resistance of M12 bolts parallel to grain specimen details

3.2.4 Lateral loading for M12 bolts perpendicular to grain

The schematic sketch for specimen details for lateral resistance of M12 grade 4.6 steel galvanised bolts perpendicular to grain is shown in Figure 4.

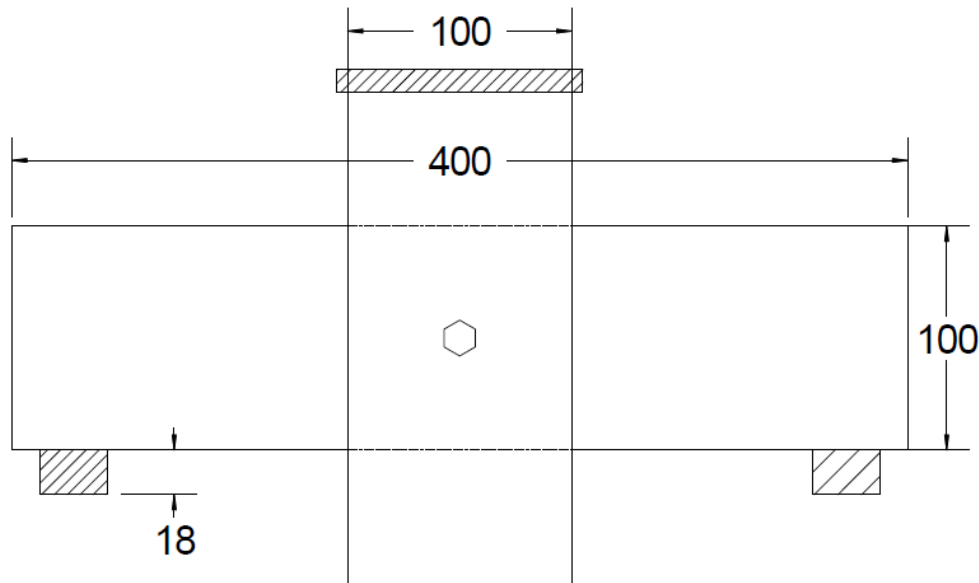


Figure 4 Lateral resistance of M12 bolts perpendicular to grain specimen details.

4. TEST METHOD

All test procedures undertaken were in accordance with AS 1649, Clause 2.2.6 for fasteners testing, and the shear at joint strength was undertaken in accordance with AS/NZS 4063.1, A4, and tension perpendicular to grain was undertaken in accordance with AS/NZS 4063.1, A2.

All testing equipment sensors are independently calibrated and certified to NATA specifications.

5. TEST RESULTS

5.1 Nail withdrawal test (Face & Edge) for E10 90x35mm LVL.

Table 9 Withdrawal Nail capacity on the face test results 90x35mm E10 LVL.

Specimen ID	Maximum load (x_i), N
1	728
2	580
3	512
4	660
5	429
6	493
7	695
8	636
9	798
10	557

$R_{bwl} = 3.34$ N = Basic working load in withdrawal.

The characteristic load capacity $R_k = 1.70R_{bwl} = 5.7$ N.

Table 10 Withdrawal Nail capacity on the edge test results for 90x35mm E10 LVL.

Specimen ID	Maximum load (x_i), N
1	678
2	681
3	490
4	555
5	464
6	617
7	437
8	412
9	408
10	601

$R_{bwl} = 3.2$ N =Basic working load in withdrawal.

The characteristic load capacity $R_k = 1.70R_{bwl}=5.4$ N.

5.2 Nail withdrawal test (Face & Edge) for E10 240x45mm LVL.

Table 11 Withdrawal Nail capacity on the face test results for 240x45mm E10 LVL.

Specimen ID	Maximum load (x_i), N
1	436
2	417
3	518
4	327
5	405
6	718
7	456
8	447
9	431
10	488

$R_{bwl} = 5.6$ N =Basic working load in withdrawal.

The characteristic load capacity $R_k = 1.70R_{bwl}=9.6$ N.

Table 12 Withdrawal Nail capacity on the edge test results for 240x45 E10 LVL.

Specimen ID	Maximum load (x_i), N
1	404
2	316
3	328
4	359
5	433
6	446
7	342
8	349
9	246
10	481

$R_{bwl} = 4.5$ N =Basic working load in withdrawal.

The characteristic load capacity $R_k = 1.70R_{bwl}=7.7$ N.

5.2 Nail withdrawal test (Face & Edge) for E13 90x45mm and 240x45mm LVL.

Table 13 Withdrawal Nail capacity on the face test results for 90x45mm E13.

Specimen ID	Maximum load (x_i), N
1	478
2	645
3	713
4	552
5	732
6	475
7	839
8	489
9	796
10	482

$R_{bwl} = 3.34$ N =Basic working load in withdrawal.

The characteristic load capacity $R_k = 1.70R_{bwl}=5.7$ N.

Table 14 Withdrawal Nail capacity on the edge test results for 90x45mm E13 LVL.

Specimen ID	Maximum load (x_i), N
1	491
2	419
3	446
4	510
5	455
6	455
7	666
8	493
9	565
10	446

$R_{bwl} = 3.2$ N =Basic working load in withdrawal.

The characteristic load capacity $R_k = 1.70R_{bwl}=5.4$ N.

Table 15 Withdrawal Nail capacity on the face test results for 240x45mm E13 LVL.

Specimen ID	Maximum load (x_i), N
1	363
2	580
3	429
4	462
5	325
6	383
7	401
8	400
9	358
10	389

$R_{bwl} = 3.34$ N =Basic working load in withdrawal.

The characteristic load capacity $R_k = 1.70R_{bwl}=5.7$ N.

Table 16 Withdrawal Nail capacity on the edge test results for 240x45 E13 LVL.

Specimen ID	Maximum load (x_i), N
1	416
2	327
3	370
4	434
5	407
6	431
7	515
8	456
9	546
10	536

$R_{bwl} = 3.2$ N =Basic working load in withdrawal.

The characteristic load capacity $R_k = 1.70R_{bwl}=5.4$ N.

5.3 Screw withdrawal test (Face & Edge) for E13 90x45mm and 240x45mm LVL.

Table 17 Withdrawal Screw capacity on the face test results for 90x45mm E13 LVL.

Specimen ID	Maximum load (x_i), N
1	2284
2	2072
3	2065
4	2115
5	2007
6	1946
7	1988
8	1858
9	1910
10	2318

$R_{bwl} = 31.2$ N =Basic working load in withdrawal.

The characteristic load capacity $R_k = 1.70R_{bwl}=53.0$ N.

Table 18 Withdrawal Screw capacity on the edge test results for 90x45mm E13 LVL.

Specimen ID	Maximum load (x_i), N
1	1970
2	1978
3	2520
4	1807
5	2106
6	2377
7	2242
8	2156
9	2106
10	2316

$R_{bwl} = 28.3$ N =Basic working load in withdrawal.

The characteristic load capacity $R_k = 1.70R_{bwl}=48.2$ N.

Table 19 Withdrawal Screw capacity on the face test results for 240x45mm E13 LVL.

Specimen ID	Maximum load (x_i), N
1	2246
2	1942
3	2322
4	2045
5	1957
6	2499
7	2203
8	2266
9	2424
10	2039

$R_{bwl} = 31.2$ N =Basic working load in withdrawal.

The characteristic load capacity $R_k = 1.70R_{bwl}=53.0$ N.

Table 20 Withdrawal Screw capacity on the edge test results for 240x45mm E13 LVL.

Specimen ID	Maximum load (x_i), N
1	2530
2	2451
3	2061
4	2116
5	2420
6	2319
7	1917
8	2890
9	2543
10	2458

$R_{bwl} = 28.3$ N =Basic working load in withdrawal.
The characteristic load capacity $R_k = 1.70R_{bwl}=48.2$ N.

5.4 Lateral resistance for nails for 90x35 & 240x45mm E10 LVL.

Table 21 Lateral resistance capacity of nails test results for 90x35mm E10 LVL.

Specimen ID	Maximum load (x_i), N	Load at 2.5mm displacement
1	7872	6364
2	9162	7776
3	9196	7702
4	9136	7988
5	10244	8912
6	9206	7420
7	9864	7882
8	9002	7974
9	9098	7660
10	10982	8932

Table 22 Statistical analysis for nail's lateral resistance of 90x35mm E10 LVL.

R_{bwl}	1869
R_k (2 nails)	5513
R_k (per nail)	2756

Where:

$R_{bwl} = \text{lowest}(ULL_1, ULL_2, ULL_3)$ = Basic working lateral load.

$R_k = 2.95R_{bwl}$. = The characteristic load capacity

Table 23 Lateral resistance capacity of nails test results for 240x45mm E10 LVL.

Specimen ID	Maximum load (x_i), N	Load at 2.5mm displacement
1	7200	6738
2	6282	5808
3	6674	6182
4	6388	5736
5	6414	5950
6	6532	5738
7	6140	5282
8	5304	4488
9	7512	6246
10	6898	5964

Table 24 Statistical analysis for nail's lateral resistance of 240x45mm E10 LVL.

R_{bwl}	1302
R_k (2 nails)	3840
R_k (per nail)	1920

Where:

$R_{bwl} = \text{lowest}(ULL_1, ULL_2, ULL_3)$ = Basic working lateral load.

$R_k = 2.95R_{bwl}$ = The characteristic load capacity

5.5 Lateral resistance for nails for 90x45 & 240x45mm E13 LVL.

Table 25 Lateral resistance capacity of nails test results for 90x45mm E13 LVL.

Specimen ID	Maximum load (x_i), N	Load at 2.5mm displacement
1	5876	4914
2	6140	5276
3	6014	4714
4	5802	4606
5	5880	5134
6	6168	5424
7	5266	4432
8	5808	5004
9	5028	4604
10	5514	4738

Table 26 Statistical analysis for nail's lateral resistance of 90x45mm E13 LVL.

R_{bwl}	1148
R_k (2 nails)	3386
R_k (per nail)	1693

Where:

$R_{bwl} = \text{lowest}(ULL_1, ULL_2, ULL_3)$ = Basic working lateral load.

$R_k = 2.95R_{bwl}$ = The characteristic load capacity

Table 27 Lateral resistance capacity of nails test results fo 240x45mm E13 LVL.

Specimen ID	Maximum load (x_i), N	Load at 2.5mm displacement
1	7066	6814
2	8528	6776
3	7556	6432
4	7128	6882
5	7054	5890
6	9306	7382
7	8046	6474
8	6594	5800
9	7634	6498
10	6812	5208

Table 28 Statistical analysis for nail's lateral resistance for 240x45mm E13 LVL.

R_{bwl}	1506
R_k (2 nails)	4444
R_k (per nail)	2222

Where:

$R_{bwl} = \text{lowest}(ULL_1, ULL_2, ULL_3) =$ Basic working lateral load.

$R_k = 2.95R_{bwl} =$ The characteristic load capacity

5.6 Lateral resistance for screws for 90x35 & 240x45mm E10 LVL.

Table 29 Lateral resistance capacity of screws test results for 90x35mm E10 LVL.

Specimen ID	Maximum load (x_i), N	Load at 2.5mm displacement
1	17656	11824
2	18672	11768
3	20964	14214
4	18054	10686
5	18932	12848
6	15862	11552
7	18292	12668
8	17060	11932
9	17216	11828
10	17888	11656

Table 30 Statistical analysis for screw's lateral resistance 90x35mm E10 LVL.

R_{bwl}	3603
R_k (2 screws)	10629
R_k (per screw)	5315

Table 31 Lateral resistance capacity of screws test results for 240x45mm E10 LVL.

Specimen ID	Maximum load (x_i), N	Load at 2.5mm displacement
1	23712	18260
2	20900	15146
3	19726	16604
4	21736	15724
5	20816	17410
6	17846	14806
7	19124	14080
8	16678	12672
9	18262	13352
10	20624	16324

Table 32 Statistical analysis for screw's lateral resistance 240x45mm E10 LVL.

R_{bwl}	3969
R_k (2 screws)	11710
R_k (per screw)	5855

5.7 Lateral resistance for screws for 90x45 & 240x45mm E13 LVL.

Table 33 Lateral resistance capacity of screws test results for 90x45mm E13 LVL.

Specimen ID	Maximum load (x_i), N	Load at 2.5mm displacement
1	18560	16464
2	18384	14586
3	18604	15392
4	18214	15414
5	18292	14754
6	21278	17712
7	18054	14612
8	15728	13704
9	19214	15714
10	19066	15352

Table 34 Statistical analysis for screw's lateral resistance 90x45mm E13 LVL.

R_{bwl}	3699
R_k (2 screws)	10192
R_k (per screw)	5456

Table 35 Lateral resistance capacity of screws test results for 240x45mm E13 LVL.

Specimen ID	Maximum load (x_i), N	Load at 2.5mm displacement
1	27214	20986
2	26360	22896
3	30290	25064
4	30550	22508
5	30538	25258
6	26764	21282
7	31676	25582
8	31330	23466
9	27640	24544
10	28222	21358

Table 36 Statistical analysis for screw's lateral resistance 240x45mm E13 LVL.

R_{bwl}	6341
R_k (2 screws)	17107
R_k (per screw)	8554

5.8 Lateral resistance for M12 bolts for 90x35 & 240x45mm E10 LVL.

Table 37 Bolts lateral resistance capacity parallel to grain for 90x35mm E10 LVL.

Specimen ID	Maximum load (x_i), N
1	26720
2	32776
3	26988
4	29778
5	27096
6	30442
7	31632
8	31426
9	33382
10	26286

$R_{bwl} = \text{lowest}(ULL_1, ULL_2) = 3693 \text{ N}$ =Basic working lateral load.
 The characteristic load capacity $R_k = 3.65R_{bwl} = 13479\text{N}$.

Table 38 Bolts lateral resistance capacity perpendicular to grain for 90x35mm E10 LVL.

Specimen ID	Maximum load (x_i), N
1	19346
2	20454
3	18112
4	29540
5	17256
6	17872
7	17246
8	17644
9	17480
10	17866

$R_{bwl} = \text{lowest}(ULL_1, ULL_2) = 2315 \text{ N}$ =Basic working lateral load.

The characteristic load capacity $R_k = 3.65R_{bwl} = 8450 \text{ N}$

Table 39 Bolts lateral resistance capacity parallel to grain for 240x45mm E10 LVL.

Specimen ID	Maximum load (x_i), N
1	28200
2	25068
3	26056
4	23818
5	24586
6	25872
7	23532
8	21556
9	23260
10	20898

$R_{bwl} = \text{lowest}(ULL_1, ULL_2) = 2988 \text{ N}$ =Basic working lateral load.

The characteristic load capacity $R_k = 3.65R_{bwl} = 10905 \text{ N}$.

Table 40 Bolts lateral resistance capacity perpendicular to grain for 240x45mm E10 LVL.

Specimen ID	Maximum load (x_i), N
1	19068
2	16454
3	16832
4	19034
5	20280
6	16164
7	15994
8	16426
9	16262
10	17022

$R_{bwl} = \text{lowest}(ULL_1, ULL_2) = 2162 \text{ N}$ =Basic working lateral load.

The characteristic load capacity $R_k = 3.65R_{bwl} = 7891 \text{ N}$

5.9 Lateral resistance for M12 bolts for 90x45 & 240x45mm E13 LVL.

Table 41 Bolts lateral resistance capacity parallel to grain for 90x45mm E13 LVL.

Specimen ID	Maximum load (x_i), N
1	27586
2	27428
3	26540
4	30356
5	30354
6	25130
7	26574
8	27456
9	26596
10	28150

$R_{bwl} = \text{lowest}(ULL_1, ULL_2) = 3447 \text{ N}$ =Basic working lateral load.

The characteristic load capacity $R_k = 3.65R_{bwl} = 12580 \text{ N}$.

Table 42 Bolts lateral resistance capacity perpendicular to grain for 90x45mm E42 LVL.

Specimen ID	Maximum load (x_i), N
1	15770
2	15448
3	15118
4	15200
5	14818
6	14484
7	15768
8	16624
9	14638
10	16310

$R_{bwl} = \text{lowest}(ULL_1, ULL_2) = 1925 \text{ N}$ =Basic working lateral load.

The characteristic load capacity $R_k = 3.65R_{bwl} = 7028 \text{ N}$

Table 43 Bolts lateral resistance capacity parallel to grain for 240x45mm E13 LVL.

Specimen ID	Maximum load (x_i), N
1	37576
2	37880
3	39168
4	34470
5	39760
6	37488
7	36272
8	35698
9	36536
10	33450

$R_{bwl} = \text{lowest}(ULL_1, ULL_2) = 4598 \text{ N}$ =Basic working lateral load.

The characteristic load capacity $R_k = 3.65R_{bwl} = 16782 \text{ N}$.

Table 44 Bolts lateral resistance capacity perpendicular to grain for 240x45mm E13 LVL.

Specimen ID	Maximum load (x_i), N
1	27650
2	23970
3	22306
4	21724
5	26438
6	23790
7	29692
8	27750
9	25752
10	27402

$R_{bwl} = \text{lowest}(ULL_1, ULL_2) = 3191 \text{ N} = \text{Basic working lateral load.}$

The characteristic load capacity $R_k = 3.65R_{bwl} = 11646 \text{ N}$

6.0 Density and M.C. for LVL.

Table 45 Density & M.C for 90x35mm E10 LVL.

Specimen ID	Density (kg/m ³)	M.C. (%)	Specimen ID	Density (kg/m ³)	M.C. (%)
1	682.0	12.3	16	671.0	12.7
2	645.3	9.6	17	663.8	12.7
3	679.4	12.5	18	659.9	9.5
4	644.2	13.1	19	661.9	10.0
5	646.4	13.1	20	649.1	12.7
6	653.7	9.3	21	617.5	9.9
7	635.5	12.3	22	661.7	12.9
8	642.3	10.2	23	659.3	13.2
9	618.4	13.0	24	645.9	13.1
10	670.5	9.5	25	645.8	13.6
11	652.3	13.0	26	638.2	14.2
12	642.1	13.5	27	654.8	13.0
13	680.6	12.5	28	624.7	9.5
14	644.8	11.8	29	635.6	8.8
15	657.1	12.2	30	711.6	10.2

Table 46 Density & M.C for 240x45mm E10 LVL.

Specimen ID	Density (kg/m ³)	M.C. (%)	Specimen ID	Density (kg/m ³)	M.C. (%)
1	614.5	11.0	16	627.5	13.6
2	598.6	12.4	17	599.6	12.8
3	611.7	11.8	18	592.2	13.2
4	610.2	11.6	19	594.0	13.2
5	604.5	11.5	20	619.5	12.7
6	594.3	13.5	21	586.3	11.8
7	595.6	12.6	22	575.4	12.1
8	607.7	12.6	23	629.3	11.6
9	635.6	12.4	24	620.8	12.6
10	588.0	15.6	25	626.4	12.5
11	588.0	12.4	26	633.0	12.4
12	616.7	13.6	27	641.1	12.1
13	583.4	12.7	28	608.0	12.2
14	604.5	13.2	29	632.3	11.8
15	598.4	12.4	30	602.8	12.0

Table 47 Density & M.C for 90x45mm E13 LVL.

Specimen ID	Density (kg/m ³)	M.C. (%)	Specimen ID	Density (kg/m ³)	M.C. (%)
1	576.8	8.5	16	529.7	8.8
2	531.5	8.8	17	537.7	8.8
3	528.0	9.2	18	552.3	8.5
4	519.7	10.1	19	548.4	8.3
5	567.5	8.7	20	541.6	8.9
6	554.9	9.6	21	544.6	8.3
7	568.4	8.9	22	537.0	8.8
8	579.4	8.9	23	578.0	8.7
9	526.9	9.1	24	561.8	9.0
10	571.7	8.8	25	567.5	8.9
11	561.0	10.8	26	571.5	9.3
12	552.1	9.7	27	585.7	8.2
13	582.5	8.9	28	552.4	8.7
14	539.3	10.0	29	565.2	9.7
15	579.9	9.2	30	573.0	10.3

Table 48 Density & M.C for 240x45mm E13 LVL.

Specimen ID	Density (kg/m ³)	M.C. (%)	Specimen ID	Density (kg/m ³)	M.C. (%)
1	744.3	14.9	16	709.1	14.4
2	701.4	15.1	17	691.5	13.3
3	684.2	14.1	18	721.9	14.5
4	693.8	14.4	19	700.2	13.7
5	741.2	14.4	20	742.3	13.9
6	748.0	14.0	21	725.3	14.2
7	763.9	13.1	22	779.7	14.1
8	736.1	15.1	23	758.2	12.9
9	742.2	15.3	24	751.3	14.6
10	675.2	14.5	25	709.4	14.7
11	753.4	14.4	26	690.8	13.6
12	736.9	14.7	27	727.1	13.8
13	764.7	14.6	28	729.7	14.6
14	764.6	13.8	29	765.8	14.8
15	742.9	13.5	30	750.0	13.6

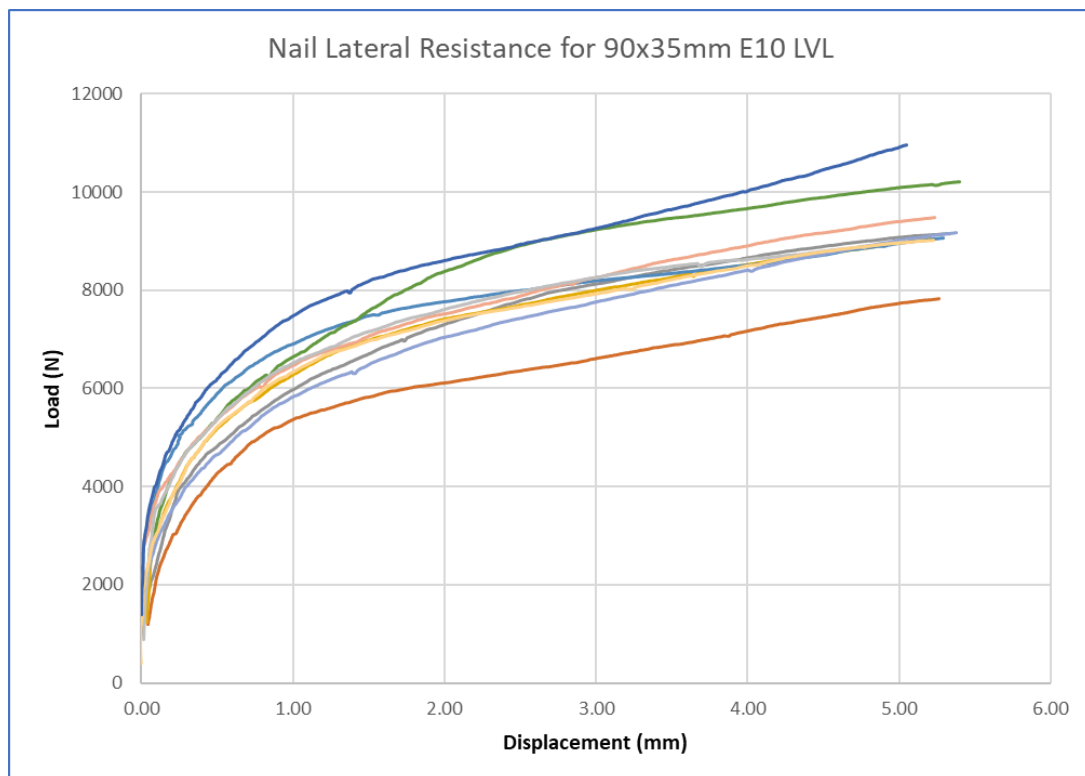


Figure 5 Lateral resistance load versus displacement for nails for 90x35mm E10 LVL.

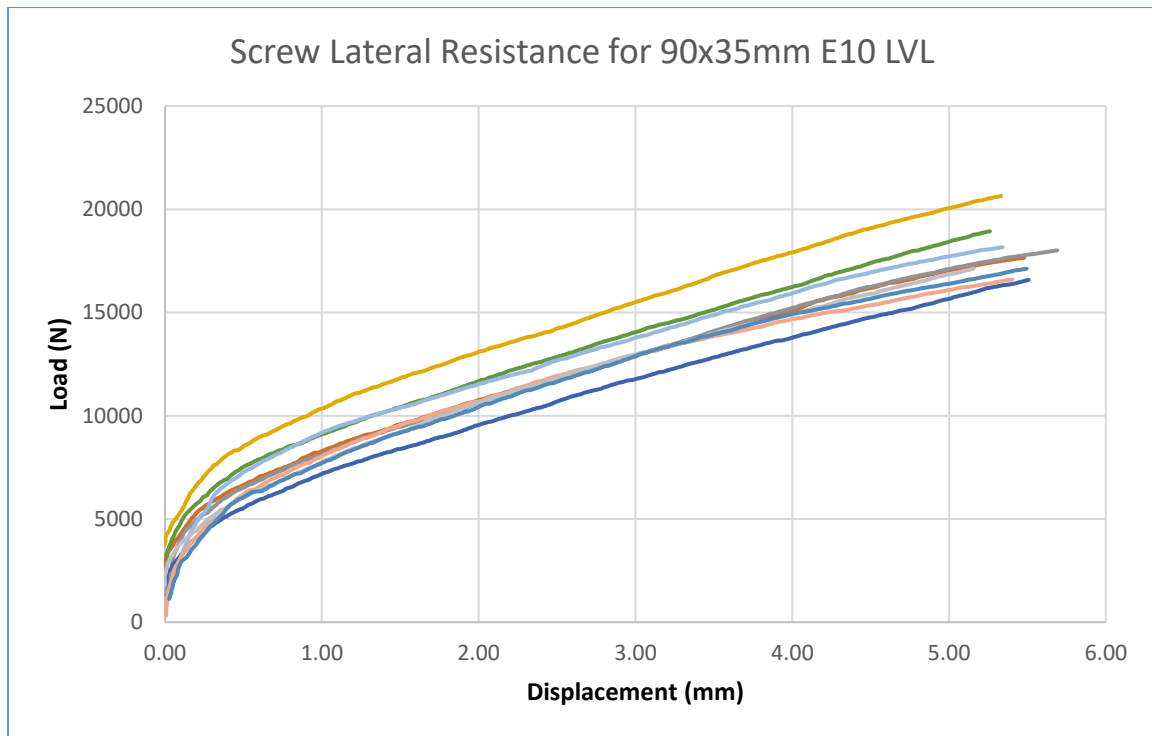


Figure 6 Lateral resistance load versus displacement for screws for 90x35mm E10 LVL

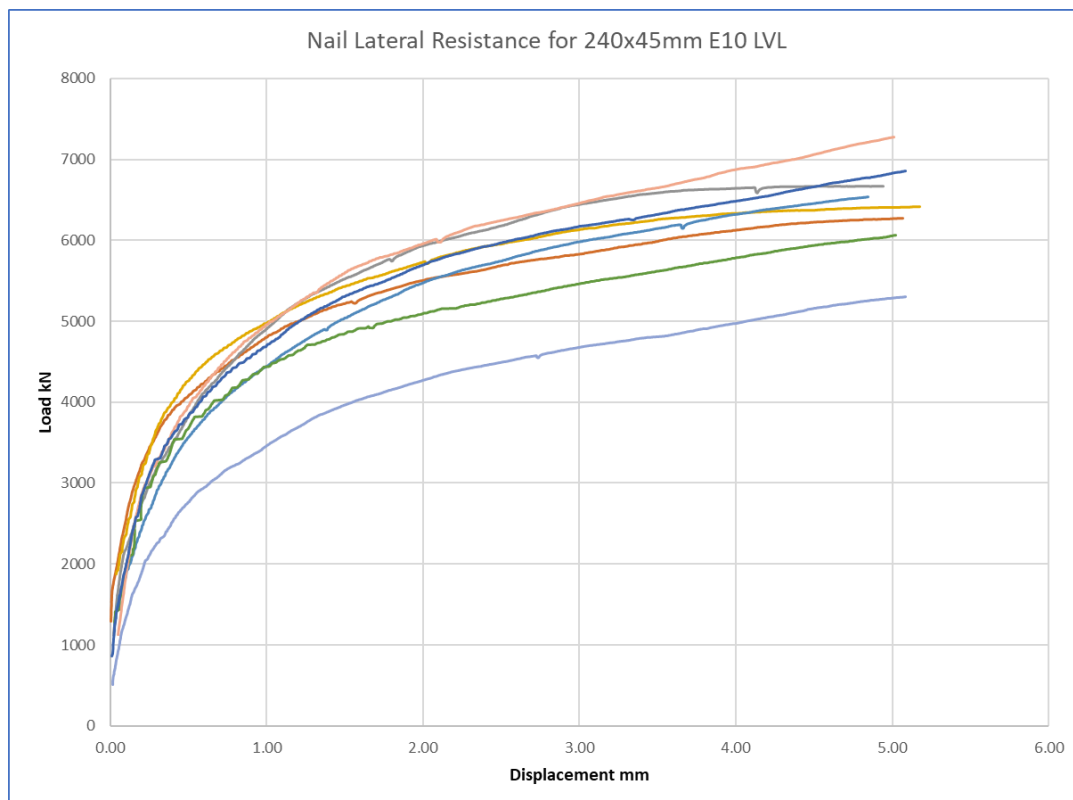


Figure 7 Lateral resistance load versus displacement for nails for 240x45mm E10 LVL

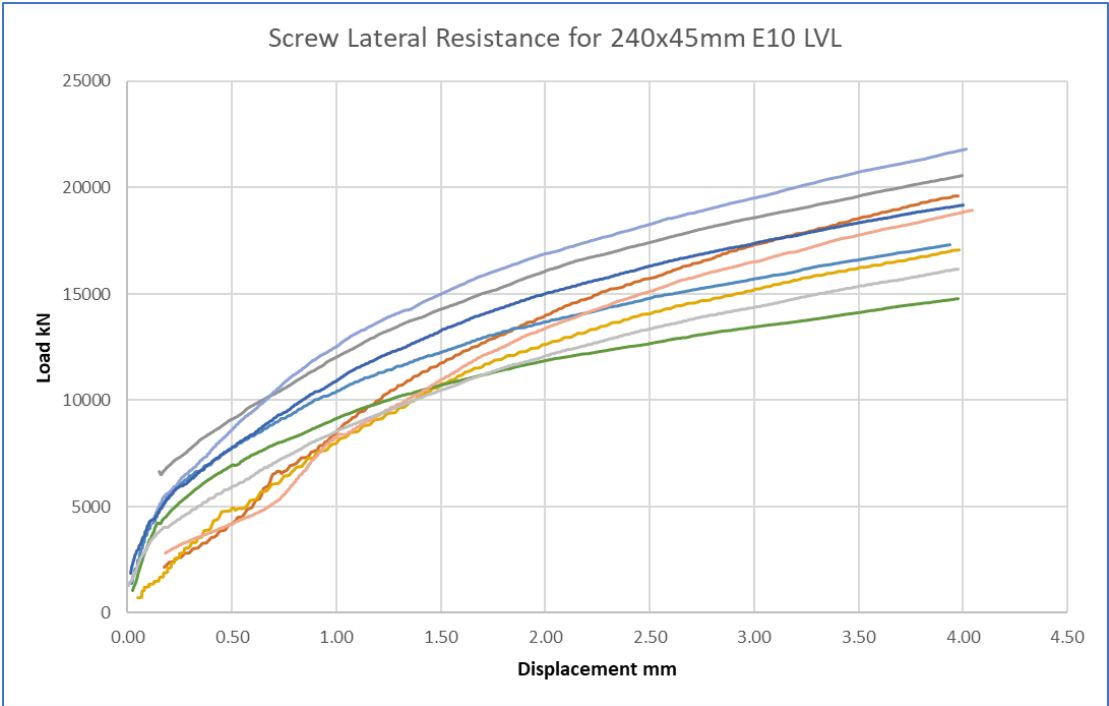


Figure 8 Lateral resistance load versus displacement for nails for 240x45mm E10 LVL

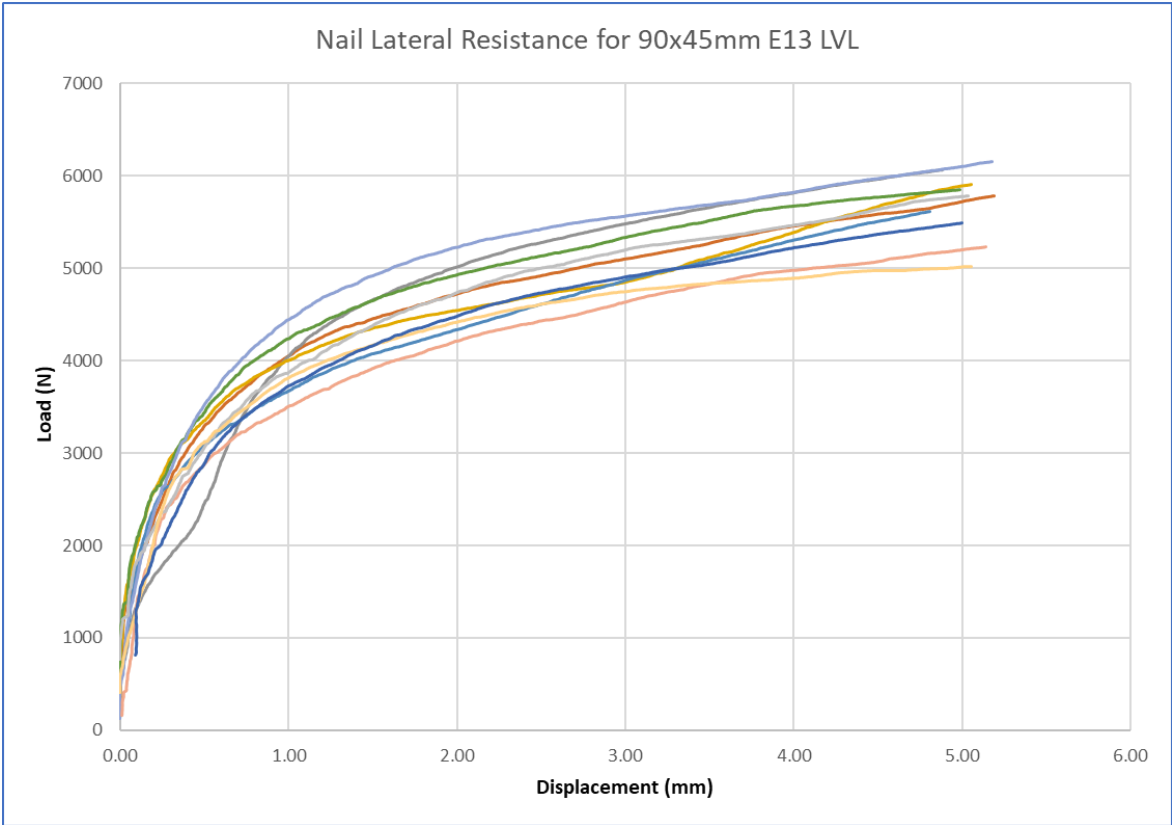


Figure 9 Lateral resistance load versus displacement for nails for 90x45mm E13 LVL

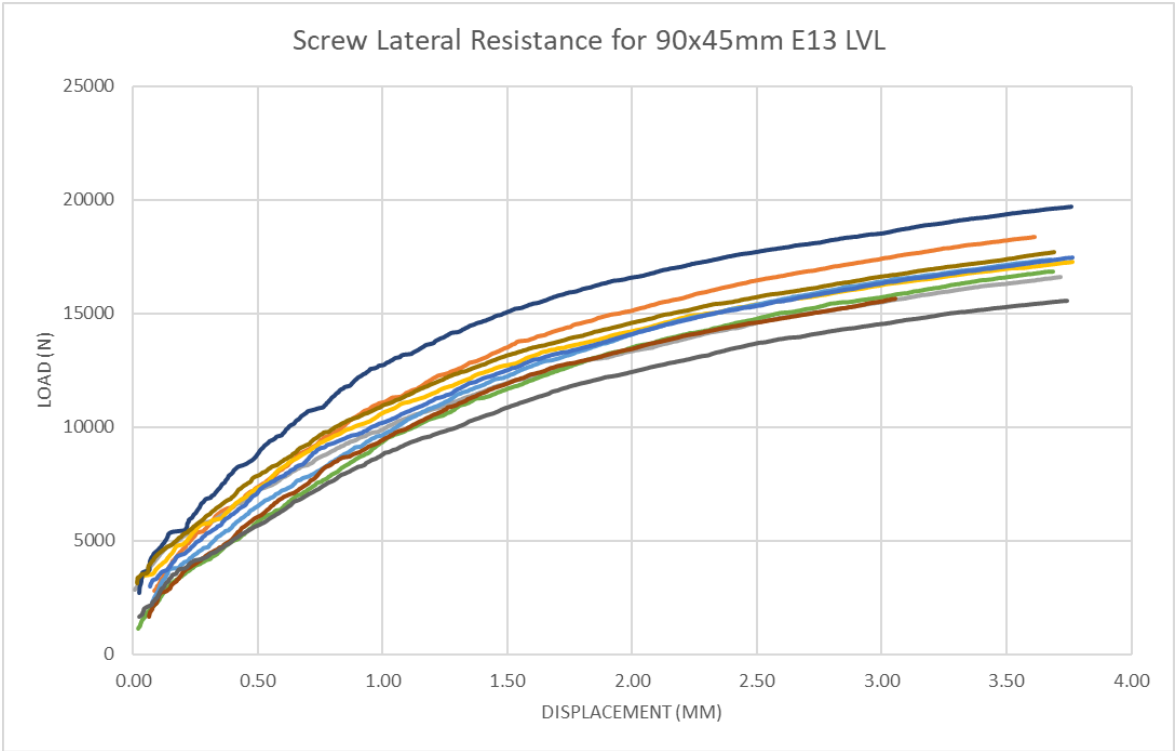


Figure 10 Lateral resistance load versus displacement for screws for 90x45mm E13 LVL

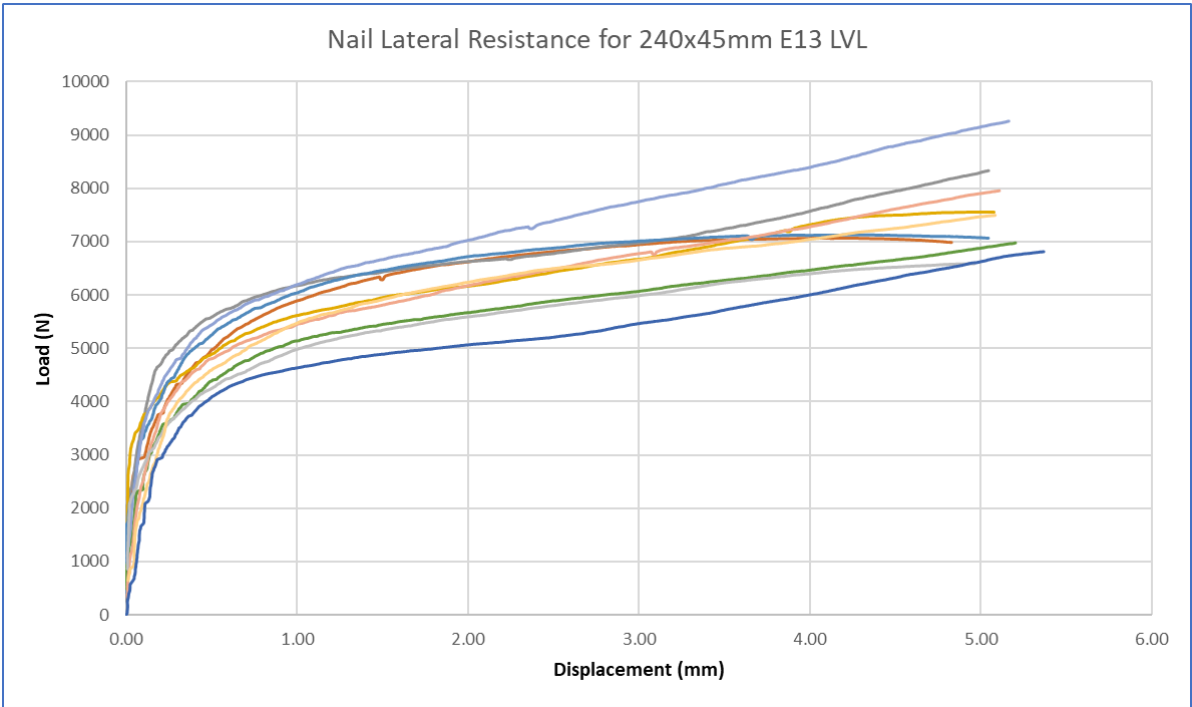


Figure 11 Lateral resistance load versus displacement for nails for 240x45mm E13 LVL

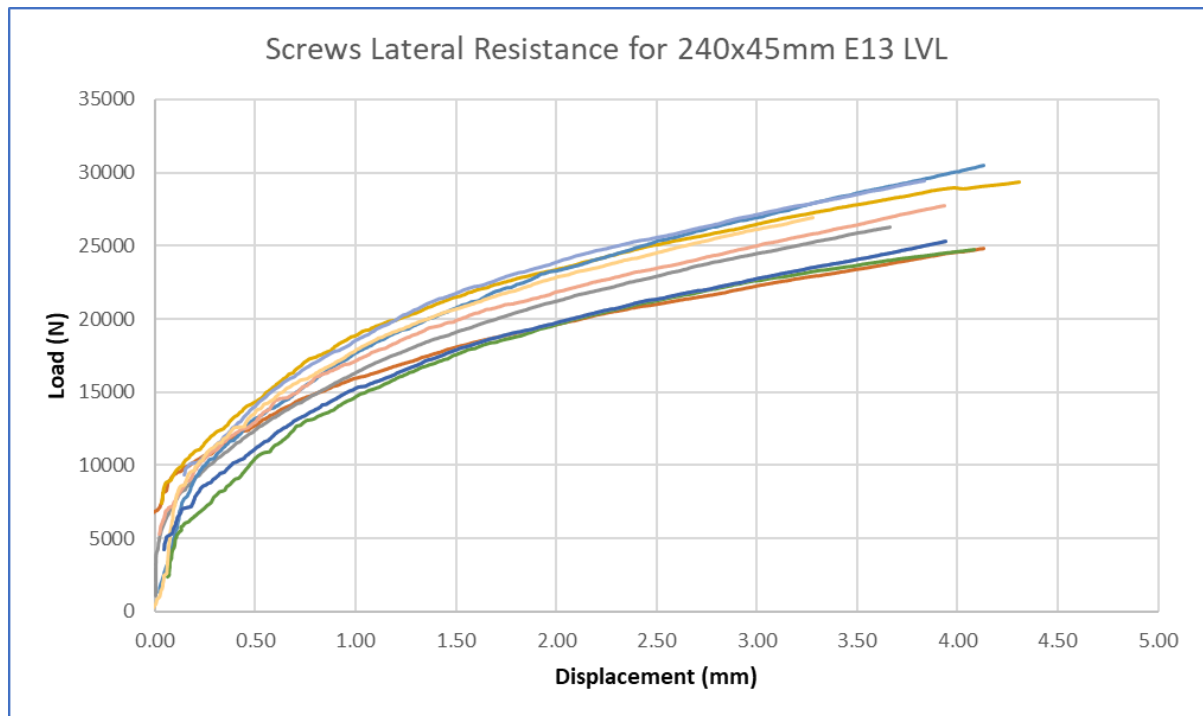


Figure 12 Lateral resistance load versus displacement for screws for 240x45mm E13 LVL

APPENDIX



Figure A1 Typical lateral load test setup for screws/nails.



Figure A2 Typical lateral load parallel to grain test setup for bolts.



Figure A3 Typical lateral load perpendicular to grain test setup for bolts.



Figure A4 Typical face screw withdrawal test.



Figure A5 Typical edge screw withdrawal test.