NelsonPine®
Laminated Veneer Lumber LVL

SPECIFIC ENGINEERING DESIGN GUIDE

LIMIT STATE DESIGN CHARACTERISTIC PROPERTIES AND STRUCTURAL DESIGN INFORMATION

V4.0 SEPTEMBER 2025

Introduction to NelsonPine LVL

NelsonPine LVL (Laminated Veneer Lumber) is a sustainably grown plantation radiata pine engineered wood composite manufactured from rotary peeled veneers, laid up and bonded with parallel grain orientation.

NelsonPine LVL is available in large cross sections and long lengths and exhibits consistent strength and stiffness performance allowing efficient engineering design.

NelsonPine LVL is commonly used in:

- Residential housing
- Commercial offices and warehouses
- Public buildings
- Industrial buildings having environmental conditions similar to the above

Manufacture of NelsonPine LVL is in accordance with relevant AS/NZS and NZS standards for which NelsonPine holds third party certification from the Engineered Wood Products Association of Australasia (EWPAA) and Bureau Veritas. Additionally, Nelson Pine is accredited to ISO 9001, 14001 and 45001.

As well as manufacturing LVL up to 300 mm thickness, NelsonPine LVL components for large commercial projects are able to be machined on site with Nelson Pine's Hundegger K2i CNC joinery machine. The K2i has cutting, milling, routing and drilling capability, making Nelson Pine a one stop shop for commercial project LVL.

Product specification

VENEER

Thickness	2.8 – 3.7 mm
Species	Radiata Pine
Joints	Scarfed, plus small proportion of overlap & butt joins in core

MOISTURE CONTENT

10 – 15% ex mill

ADHESIVE

LVL 13, LVL 11, LVL 8 grades:
Phenolic adhesive in accordance with AS/NZS 2754.1, producing a Type A bond as per AS/NZS 2098.2.

P 11 grade:
Phenolic adhesive bonded feedstock as above plus Polyurethane (PUR) secondary bonding tested in accordance with AS/NZS 1328.1.

FORMALDEHYDE EMISSION CLASS

E_0 : AS/NZS 4357.0 Table 1, E_0 maximum emission = 0.5 mg/L

TABLE 1. NELSONPINE LVL STANDARD DIMENSIONS

THICKNESS (mm)	GRADE	WIDTH (mm)											
35	LVL 11	90	140		190	200	240		300		400		
45	LVL 8	90	140		190	200	240	290	300				
45	LVL 11	90	140	150	190	200	240	290	300	360	400	460	610
45	LVL 13	90	140	150		200	240		300	360	400	460	610
63	LVL 11	90	140		190	200	240		300	360	400		
63	LVL 13			150		200	240		300	360	400		
90	LVL 11, P 11	90	140	150	190	200	240	290	300	360	400	460	610
133	Enquire as to available Grades, Widths and minimum order quantities. Maximum length is 12 m.												
178													
222													
266													
300													

NON STANDARD DIMENSIONS

Up to 75 mm thickness, NelsonPine LVL can be manufactured up to 18 m long and 1,220 mm wide.
Thicknesses of 90 - 300 mm can be manufactured up to 12 m long and 1,220 mm wide.

NOMINAL DIMENSIONAL TOLERANCES

Depth:	-2, +2 mm
Width:	-2, +2 mm
Length:	-0 mm, +6 mm up to 9 m length, +20 mm above 9 m length

TREATMENT

Available treatment levels of NelsonPine LVL are:

- Untreated by arrangement for use within New Zealand in situations prescribed in NZS 3602.
- H1.2 full cross section treatment in accordance with NZS 3640 for the NZ market for situations prescribed in NZS 3602.
- H2S full cross section treatment in accordance with AS/NZS 1604 for use in the Australian market South of the Tropic of Capricorn.
- Customers may undertake at their own risk, H3 / H3.1 treatment at plants certified to treat LVL to that level.

Situations requiring specific consideration of appropriate treatment:

- NelsonPine LVL is not to be used in situations or exposure conditions within New Zealand not permitted by NZS 3602 unless approved by the Building Consent Authority as an Alternative Solution. Performance in weather exposure in Alternative Solutions is the responsibility of the designer and customer.
- Heating / Drying facilities are to be discussed with Nelson Pine to determine if treatment is appropriate.
- Treated NelsonPine LVL is not to be used in direct contact with foodstuffs.

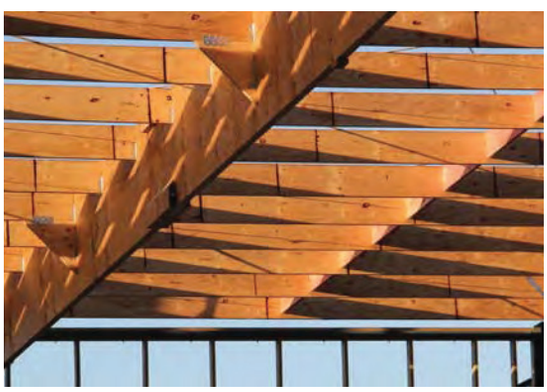
AVERAGE DENSITY AT 15% MOISTURE CONTENT

LVL 13	623 kg/m³
LVL 11, P 11	591 kg/m³
LVL 8	548 kg/m³

INSTALLATION

Installation of NelsonPine LVL in residential builds is to be in accordance with NZS 3604 Timber-framed Buildings within New Zealand, and AS 1684 Residential Timber Framed Construction within Australia.

For commercial and industrial projects the designer is to provide specific installation detail where it differs from or is not covered by the above standards.



NelsonPine LVL Limit State Design Characteristic Properties

STRUCTURAL RELIABILITY

The structural properties for NelsonPine LVL 13, LVL 11, P 11 and LVL 8 in Table 2 have been determined by testing in accordance with the requirements of AS/NZS 4357.0:2022 Structural Laminated Veneer Lumber. Characteristic stresses have been calculated in accordance with AS/NZS 4063.2:2010.

NelsonPine LVL characteristic stresses comply with the New Zealand building code through clause C2.3 in NZS 3603:1993. The modulus of elasticity is an average value which includes an allowance for shear deformation. Because of the low variability a lower bound MoE is not required.

TABLE 2. NELSONPINE LVL LIMIT STATE DESIGN CHARACTERISTIC VALUES

PROPERTY	LVL 13		LVL 11, P 11		LVL 8	
	EDGE (MPa)	FLAT (MPa)	LVL 11, P11 EDGE (MPa)	LVL 11 FLAT[4] (MPa)	EDGE (MPa)	FLAT (MPa)
Modulus of Elasticity (MoE)	13200	13200	11000	11000	8000	8000
Modulus of Rigidity (G)	660	660	550	550	400	400
Bending Strength[1] (f'b)	48.0	48.0	38.0	38.0	30.0	30.0
Tension Parallel to Grain[2] (f't)	33.0	33.0	26.0	26.0	20.0	20.0
Compression Parallel to Grain (f'c)	38.0	38.0	38.0	38.0	30.0	30.0
Shear in Beams[3] (f's)	5.3	3.0	5.0	3.0	5.0	3.0
Compression Perpendicular to Grain (f'p)	10.0	12.0	10.0	10.0	7.0	9.0

[1] for 95 mm in depth. Refer to Table 6 for adjustment factor above 95 mm depth

[2] for 150 mm in depth. Refer to Table 6 for adjustment factor above 150 mm depth

[3] using Rail Shear test method

[4] for NelsonPine LVL 11 only. NelsonPine P 11 is not certified for flat usage

NelsonPine LVL Structural Design Information

DESIGN STANDARDS

Design loads are to be determined in accordance with AS/NZS 1170:2002. Although design data for NelsonPine LVL is not specifically given in NZS 3603:1993, the general principles can be used, complying with the New Zealand Building Code through Clauses 2.3 and C2.3 of NZS 3603. NZS/AS 1720.1 is in draft form and yet to be cited by the NZBC. It may be used as an Alternative Solution.

For specific design in Australia this section is to be read in conjunction with AS 1720.1 and the relevant modifications made.

STRENGTH MODIFICATION FACTORS

Because of the low variability in properties of NelsonPine LVL, a number of the k factors do not apply or are different from those in NZS 3603. The strength modification factors for NelsonPine LVL are:

1. Strength Reduction Factor
The strength reduction factor for calculating the design of structural members should be taken from Table 3.

TABLE 3. STRENGTH REDUCTION FACTORS

Table extracted from Table 2.1 AS 1720.1-2010

	CATEGORY 1	CATEGORY 2	CATEGORY 3
Structural Timber Material	Structural members for houses for which failure would be unlikely to affect an area* greater than 25m²: OR secondary members in structures other than houses	Primary structural members in structures other than houses: OR elements in houses for which failure would be likely to affect an area* greater than 25m²	Primary structural members in structures intended to fulfill an essential service or post disaster function
Stuctural Laminated Veneer Lumber - AS/NZS 4357.0	0.95	0.90	0.80

* In this context, area should be taken as the plan area.

2. Duration of Load Factors
Duration of load factors k_1 for strength and k_2 for stiffness should be the same as for solid timber in Tables 2.4 and 2.5 of NZS 3603. NelsonPine LVL is a solid veneer product and has similar load duration properties to timber. It is manufactured in the dry condition so will behave like kiln dried solid sawn timber, except that moisture change will be slower because the glue lines provide a barrier to moisture movement.

3. Bearing Area Factor
The bearing area k_3 as per NZS 3603 clause 2.8.

4. Load sharing factor
Because NelsonPine LVL is much less variable than sawn lumber, the load sharing and lamination relationships in NZS 3603 do not apply.
Hence, $k_4 = k_5 = k_6 = 1.0$.

5. Moisture Content Factor
For use of NelsonPine LVL in dry conditions, no modification is required. Where NelsonPine LVL is subject to humid conditions such that the average moisture content would exceed 16% over a 12 month period, the moisture content factor k_{14} in Table 4 should be used for strength calculations. A moisture content exceeding 20% may be subject to a decay hazard, requiring chemical treatment of the NelsonPine LVL or detailing to avoid the high moisture content.

NelsonPine LVL responds to moisture a similar way as solid wood, albeit slower as the gluelines inhibit moisture uptake.

TABLE 4. MOISTURE CONTENT FACTOR K_{14}

PROPERTY	MOISTURE CONTENT (MC)		
	<16%	16 TO 25%	>25%
Bending and Compression	1.0	1.53 - 0.033 MC	0.7
Tension and Shear	1.0	1.35 - 0.022 MC	0.8
Modulus of Elasticity	1.0	1.35 - 0.022 MC	0.8

6. Stability Factor
The stability factor k_8 as per NZS 3603 clause 2.10.

7. Face Grain Orientation (Curved or Tapered edges)
LVL is very strong parallel to the grain, but stresses perpendicular to the grain should be avoided, just as in solid timber. Wide sections must be handled carefully.

When a design includes principal stresses parallel to edges which have been cut sloped or curved to the longitudinal grain direction (Figure 1), the grain orientation factor k_{16} for strength given in Table 5 should be used to evaluate strength reduction at the extreme fibre edges. Examples where this might be considered are at the point of highest bending moment in a sloping rafter or column edge, such as at a knee or apex joint in a portal frame. Steep grain slopes should be avoided if possible in tension zones because the strength reduction is severe.

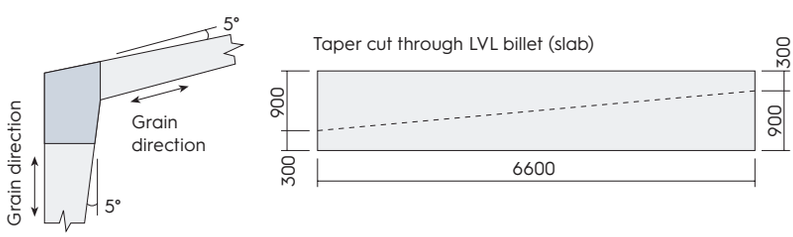
To determine bending deflections k_{16}, the stiffness of sloping sections can be evaluated by integrating a number of small lengths of changing section depth.

TABLE 5. GRAIN ORIENTATION FACTOR K_{15} AND K_{16} FOR CUT EDGES

ANGLE OF CUT EDGE (°)	0	3	5	10	15	20	30	45
Edge in Tension	1.00	0.92	0.80	0.50	0.31	0.21	0.11	0.06
Edge in Compression	1.00	0.97	0.93	0.79	0.65	0.55	0.42	0.32

FIGURE 1. AN EXAMPLE OF DESIGN FOR SLOPING GRAIN IN NELSONPINE LVL

The taper cut rafter has taper cut through LVL billet (slab) high tensile stress at 5° cut, so use k_{15} = 0.8.
The column cut from the same slab has cut edge in compression, so use k_{15} = 0.93.



8. Size Effect Factor
A size factor shall be applied to the characteristic strength of NelsonPine LVL in bending and tension parallel to grain as per Table 6. For beams in bending less than 95 mm in depth there is no adjustment. For beams deeper than 95 mm in bending multiply the characteristic bending strength by $(95/d)^{0.167}$. For beams in tension less than 150 mm in depth there is no adjustment. For beams deeper than 150 mm multiply the characteristic tension strength by $(150/d)^{0.167}$.

TABLE 6. SIZE FACTOR K_{24} FOR BENDING AND TENSION STRENGTH (PARALLEL TO GRAIN) IN NELSONPINE LVL

	DEPTH OF LVL MEMBER (mm)												
	95	140	150	190	200	240	290	300	360	400	460	610	1220
Bending K_{24}	1.00	0.94	0.93	0.89	0.88	0.86	0.83	0.83	0.80	0.79	0.77	0.73	0.65
Tension K_{24}	1.00	1.00	1.00	0.96	0.95	0.92	0.90	0.89	0.86	0.85	0.83	0.79	0.70
Bending LVL 13	48.0	45.0	44.5	42.8	42.4	41.1	39.8	39.6	38.4	37.8	36.9	35.2	31.3
Strength LVL 11, P 11	38.0	35.6	35.2	33.8	33.6	32.6	31.5	31.4	30.4	29.9	29.2	27.9	24.8
incl K_{24} LVL 8	30.0	28.1	27.8	26.7	26.5	25.7	24.9	24.8	24.0	23.6	23.1	22.0	19.6
Tension LVL 13	33.0	33.0	33.0	31.7	31.5	30.5	29.6	29.4	28.5	28.0	27.4	26.1	23.3
Strength LVL 11, P 11	26.0	26.0	26.0	25.0	24.8	24.0	23.3	23.2	22.5	22.1	21.6	20.6	18.3
incl K_{24} LVL 8	20.0	20.0	20.0	19.2	19.1	18.5	17.9	17.8	17.3	17.0	16.6	15.8	14.1

For shear and compression the size factor = 1.0
For tension perpendicular to grain, refer to AS 1720.1

9. Joint Group

The Joint Strength Group for NelsonPine LVL depends on the orientation and type of fasteners as per Table 7. For structures that require specific design of joints, this table is to be read in conjunction with NZS 3603 Section 4, Joints.

TABLE 7. CLASSIFICATION OF NELSONPINE LVL FOR JOINT DESIGN

GRADE	NAILS AND SCREWS IN LATERAL LOAD		NAILS AND SCREWS IN WITHDRAWAL		SELF DRILLING SCREWS IN LATERAL LOAD (E.G. TYPE 17)		SELF DRILLING SCREWS IN WITHDRAWAL (E.G. TYPE 17)		BOLTS AND COACH SCREWS IN LATERAL LOAD DRILLED INTO THE FACE	
	EDGE	FACE	EDGE	FACE	EDGE	FACE	EDGE	FACE	PARALLEL	PERP
LVL 13	J5	J4	J5	J4	J4		J4/5		J3	J2
LVL 11, P 11	J5	J4	J5	J4	J4		J4/5		J3	J2
LVL 8	J5	J5	J5	J5	J5		J5		J4	J2

Fasteners in the Face = fasteners that penetrate the face perpendicular to the grain
Fasteners in the Edge = fasteners that penetrate the edge parallel to the glue lines
For test methods, refer to AS 1649

10. Fire Resistance NelsonPine LVL 13, LVL 11 and LVL 8

Large NelsonPine LVL members have excellent fire resistance on account of the slow and predictable charring rate when exposed to severe fires. The phenol formaldehyde adhesive used in the manufacture of NelsonPine LVL remains inert during fire exposure. NelsonPine LVL can be designed for fire resistance in the same way as glulam. From studies completed at the University of Canterbury, the design charring rate of NelsonPine LVL in the standard fire test has been shown to be 0.72 mm/min.

11. Fire Resistance NelsonPine P 11

NelsonPine P 11 is manufactured by re-laminating 45 mm structural LVL feedstock into thicker sections. The LVL feedstock uses phenol formaldehyde (PF) adhesive, whilst the secondary bond is polyurethane (PUR) adhesive. PUR is used extensively in glulam manufacture and has a proven track record in the NZ construction industry, however as PUR is thermoplastic and yields in fire, its use is more restricted than phenolic adhesives.

NelsonPine P 11 may be used in:

- Detached residential housing designed using NZS 3604.
- Multi unit residential dwellings where NelsonPine P 11 is surrounded by plasterboard or equivalent fire system providing the required fire rating between fire cells.

12. Durability of NelsonPine LVL

Durability is covered in the New Zealand Building Code (NZBC) in Section B2 – Durability and Section E2 – External Moisture.

The durability clause requires that materials, components and construction methods allow the building to function for its specified intended life of not less than 50 years for structural and inaccessible elements. An acceptable solution to the building code is referenced in B2/AS1 where the New Zealand standards NZS 3604 and NZS 3602 specify the level of treatment and the application respectively. Alternative solutions may be accepted by Territorial Authorities if the solution meets the durability requirements of the Building Code.

Internal Use of NelsonPine LVL

In internal dry conditions where the equilibrium moisture content of wood will be below 20%, NelsonPine LVL may be used untreated to meet the NZBC requirements of 50 years of durability.

13. Corrosion Resistance

Radiata Pine is relatively inert chemically and under normal conditions, unlike many other structural materials it is not subject to chemical change or deterioration. NelsonPine LVL is resistant to most acids, rust and other corrosive situations including hide curing complexes, fertiliser storage and swimming pools.

REFERENCES

New Zealand Building Code

AS/NZS 4357.0:2022 Structural laminated veneer lumber - Specifications

AS/NZS 4357.1:2005 Structural laminated veneer lumber - Method of test for measurement of dimensions and shape

AS/NZS 4357.2:2006 Structural laminated veneer lumber - Determination of structural properties - Test methods

AS/NZS 4357.3:2006 Structural laminated veneer lumber - Determination of structural properties - Evaluation methods

AS/NZS 4357.4:2005 Structural laminated veneer lumber - Determination of formaldehyde emissions

AS/NZS 2754.1:2016 Adhesives for timber and timber products - Part 1: Adhesives for manufacture of plywood and laminated veneer lumber (LVL)

AS/NZS 2098.2:2012 Methods of test for veneer and plywood - Method 2: Bond quality of plywood (chisel test)

AS/NZS 1328.1:1998 Glued laminated structural timber - Performance requirements and minimum production requirements

AS/NZS 4063.2:2010 Characterization of structural timber - Determination of characteristic values

NZS 3640:2003 Chemical preservation of round and sawn timber

AS/NZS 1604.1:2021 Preservative-treated wood-based products - Part 1: Products and treatment

AS/NZS 1604.2:2021 Preservative-treated wood-based products - Part 2: Verification requirements

NZS 3602:2003 Timber and wood-based products for use in building

NZS 3603:1993 Timber Structures Standard

NZS 3604:2011 Timber-framed buildings

AS 1684 2-4 Residential Timber Framed Construction

AS/NZS 1170:2002 Structural Design Actions

NZS AS 1720.1:2022 Timber Structures – Design Methods

ISO 9001:2015 Quality Management Systems

ISO 14001:2015 Environmental Management Systems

ISO 45001:2018 Occupational health and safety management systems

NELSON PINE INDUSTRIES LTD

PO Box 3049, Richmond,
Nelson, New Zealand 7050

Phone: 03 543 8800 or 0800 800 438

Website: www.nelsonpine.co.nz