



Evaluation Report CCMC 13006-R Pacific Woodtech LVL

MasterFormat:	06 17 10
Evaluation issued:	2001-04-11
Re-evaluated:	2018-01-26
Re-evaluation due:	2019-04-11

1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that “Pacific Woodtech LVL” when used as structural composite lumber (SCL) in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code (NBC) of Canada 2015:

- Clause 1.2.1.1.(1)(a), Division A, using the following acceptable solutions from Division B:
 - Sentence 4.3.1.1.(1), Design Basis for Wood (CSA O86-14 for SCL qualification)
- Clause 1.2.1.1.(1)(b), Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
 - Sentence 9.23.4.2.(3), Spans for beams

This opinion is based on CCMC's evaluation of the technical evidence in Section 4 provided by the Report Holder.

2. Description

“Pacific Woodtech LVL” (see Figure 1) is manufactured by laminating Douglas fir veneer sheets coated with a phenolic adhesive in specific lay-up patterns in a continuous press with all grain oriented parallel to the length of the member. The ends of the veneer sheets are either butt- or scarf-cut according to the requirements of the lay-up pattern, then lapped. The lay-up patterns and adhesives used are as specified in Pacific Woodtech Corporation’s “Quality Control Manual for Laminated Veneer Lumber”.

The product is available in thicknesses ranging from 19 mm to 178 mm, depths from 44 mm to 1219 mm, and lengths up to 20.3 m. Products with a thickness greater than 89 mm are fabricated by means of a secondary face-bonding process.

The phenol-formaldehyde (PF) adhesive used in the manufacture of this LVL complies with CSA O112.6-M1977, “Phenol and Phenol-Resorcinol Resin Adhesives for Wood (High-Temperature Curing).” A phenol resorcinol formaldehyde (PRF) adhesive (Momentive 4001/5830 hardener), used in the secondary face-bonding process at a certified laminating plant, conforms to CSA O112.9-10, “Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).” LT75/FM260 PRF adhesive, used in the secondary face-bonding process when face-bonded at another certified laminating plant, conforms to CSA O112.7-1960, “Resorcinol and Phenol-Resorcinol Resin Adhesives for Wood (Room- and Intermediate-Temperature Curing).”

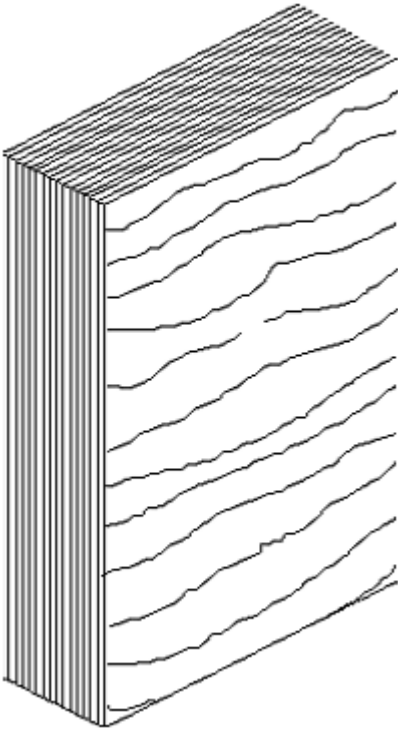


Figure 1. Pacific Woodtech LVL

3. Conditions and Limitations

CCMC's compliance opinion in Section 1 is bound by the use of the product, "Pacific Woodtech LVL", in accordance with the conditions and limitations set out below.

The product, as with all SCL, is intended for dry service applications only.¹

The product is intended for use in construction as an alternative material to lumber. Proprietary design values are presented for "Pacific Woodtech LVL" to be designed by professional engineers in accordance with CSA O86-14 (Update No. 1), "Engineering Design in Wood", for structural applications such as beams, headers, joists, rafters and columns as intended by the product manufacturer. The specific application must be qualified through specific testing and validated by the manufacturer. Applications such as I-joist flanges, studs and metal-plated truss chords are beyond the scope of this evaluation.

The pre-engineered tables in the literature outlined below have been provided to CCMC by Pacific Woodtech Corporation to demonstrate compliance to Part 9 buildings for acceptance by the local authority having jurisdiction (AHJ).

3.1 Pacific Woodtech Corporation Pre-engineered Tables²

When "Pacific Woodtech LVL" is used as floor beams or headers in simple spans supporting uniform loads only, or as columns, the installation shall be in accordance with the Pacific Woodtech Corporation's publication entitled "PWLVL Headers & Beams - Limit States Design User's Guide", dated 19 June 2017.

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1. All lumber, wood-based panels and proprietary engineered wood products are intended for "dry service conditions". "Dry service" is defined as the in-service environment under which the average equilibrium moisture content (MC) of lumber is 15% or less over a year and does not exceed 19% at any time. Wood contained within the interior of dry, heated or unheated buildings has generally been found to have an MC of between 6% and 14% depending on season and location. During construction, all wood-based products should be protected from the weather to ensure that the 19% MC is not exceeded in accordance with Article 9.3.2.5., Moisture Content, of Division B of the NBC 2015.
 2. The pre-engineered tables present the pre-engineered factored resistance of the beams and columns, as well as the maximum unfactored uniform load in accordance with Part 4 of Division B of the NBC 2015.
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The product shall be installed in accordance with Pacific Woodtech Corporation’s installation guidelines as noted in these documents for those applications falling within the scope of the documents. Applications outside the scope of these installation guidelines shall require engineering on a case-by-case basis.

3.2 Pacific Woodtech Corporation’s Installation Details

In the attachment of “Pacific Woodtech LVL”, nails and bolts shall be used and installed in accordance with the manufacturer’s size and spacing specifications.

The ends of all “Pacific Woodtech LVL” beams shall be restrained to prevent rollover.

The compression edges of all “Pacific Woodtech LVL” beams shall be continuously laterally supported to prevent lateral displacement and rotation.

3.3 Engineering Required

For structural applications beyond the scope/limitations of the above-referenced Pacific Woodtech Corporation publication or when required by the AHJ, the drawings or related documents shall bear the authorized seal of a professional engineer skilled in wood design and licensed to practice under the appropriate provincial or territorial legislation.

“Pacific Woodtech LVL” shall be designed in accordance with the requirements of CSA O86-14 (Update No.1) and Part 4 of Division B of the NBC 2015. The specified strengths and fastener limits for “Pacific Woodtech LVL” shall not exceed the values set forth in Tables 4.1.1 and 4.1.2. The designer shall use the properties specified in Tables 4.1.1 and 4.1.2 in accordance with CSA O86-14 (Update No.1).

The engineer shall design in accordance with CSA O86-14 (Update No.1), and may use the “Engineering Guide for Wood Frame Construction,” published by the Canadian Wood Council, as a guide.

3.4 Engineering Support Provided by Manufacturer

Pacific Woodtech Corporation provides engineering support and may be consulted using the contact information in the Report Holder section of this Report.

4. Technical Evidence

The Report Holder has submitted technical documentation for CCMC’s evaluation. Testing was conducted at laboratories recognized by CCMC. The corresponding technical evidence for this product is summarized below.

4.1 Design Requirements

NBC 2015 compliance data for “Pacific Woodtech LVL” on which CCMC based its opinion in Section 1:

Table 4.1.1 Specified Strengths (Limit States Design) for “Pacific Woodtech LVL” (MPa)¹

Mechanical Properties		Grade		
		2 250F _b -1.5E	2 750F _b -1.8E	3 100F _b -2.0E
Bending	f _b ² - joist	28.7	35.0	39.5
	f _b ³ - plank	28.7	35.0	39.5
Tension parallel to grain, f _t ⁴		16.3	20.1	22.8
Compression parallel to grain, f _c		21.5	27.0	30.3
Compression perpendicular to grain, f _c	parallel to the glue line (joist)	9.4	10.7	10.7
	perpendicular to the glue line (plank)	8.1	8.1	8.1

Table 4.1.1 Specified Strengths (Limit States Design) for “Pacific Woodtech LVL” (MPa)¹ (continued)

Mechanical Properties		Grade		
		2 250F _b -1.5E	2 750F _b -1.8E	3 100F _b -2.0E
Horizontal shear, <i>f</i> _v	perpendicular to the glue line (joist)	2.9	3.7	3.7
	parallel to the glue line (plank)	1.8	1.8	1.8
Modulus of elasticity (MOE)	MOE - joist	10 343	12 411	13 790
	MOE - plank	10 343	12 411	13 790

Notes to Table 4.1.1:

1. All specified strengths are based on CSA O86-14 (Update No.1). Standard term $K_D = 1.0$. Dry service use $K_S = 1.0$.
2. For depths greater than or equal to 44 mm, multiply by $(305/d)^{1/5}$; for depths less than 44 mm, multiply by 1.47, where *d* = depth in joist orientation (mm).
3. For depths greater than or equal to 44 mm, multiply by $(44/d)^{1/3}$; for depths less than 44 mm, multiply by 1.00, where *d* = depth in plank orientation (mm).
4. Tension values are adjusted to a reference length of 6 096 mm. For lengths greater than or equal to 1 219 mm, multiply by $(6 096/L)^{1/10}$; for lengths less than 1 219 mm, multiply by 1.17, where *L* = length in mm.

Table 4.1.2 “Pacific Woodtech LVL” Fastener Capacities

Fastener Property	Nail Orientation or Bolt Size	Load Direction	Specific Gravity (SG) of Equivalent Species For Design Purposes
Nail withdrawal	Edge	Withdrawal	Western hemlock, SG = 0.47
	Face	Withdrawal	Douglas fir, SG = 0.50
Nail lateral capacity	Edge	Parallel to grain	Douglas fir, SG = 0.50
		Perpendicular to grain	
	Face	Parallel to grain	
		Perpendicular to grain	
Bolt bearing capacity	12.5 mm	Parallel to grain	Douglas fir, SG = 0.50
		Perpendicular to grain	
	19.0 mm	Parallel to grain	
		Perpendicular to grain	

This Evaluation Report is applicable only to “Pacific Woodtech LVL” labeled with the APA certification mark and the phrase “CCMC 13006-R” on each beam or header member.

The manufacturing quality assurance program has been adapted to include requirements specified in ASTM D 5456, “Standard Specification for Evaluation of Structural Composite Lumber Products,” and is verified by APA – The Engineered Wood Association as part of the product certification. The APA conducts monthly audits of the manufacturing plants and the quality assurance program.

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Date modified:
2018-02-12

APPENDIX

The design values obtained from testing to ASTM D5456-14b as specified in CSA O86-14 (Update No.1), “Engineering Design in Wood”, are summarized below. The manufacturer’s published pre-engineered beam and header spans were then designed in accordance with CSA O86-14 (Update No.1).

Table A1. Additional Test Information for “Pacific Woodtech LVL”

Property	Test Information
Bending	Specimens were tested in edgewise and flatwise bending for qualification and for establishing volume effects. A non-parametric, 5% tolerance limit with 75% confidence level approach was used to determine the characteristic value. Qualification test data have been used to establish the applicable coefficient of variation, CV_w , and the reliability normalization factor from CSA O86-14 was used to determine the specified strength.
Shear	Specimens were tested edgewise and flatwise orientation. A non-parametric, 5% tolerance limit with 75% confidence level approach was used to determine the characteristic value. Qualification test data have been used to establish the applicable coefficient of variation, CV_w , and the reliability normalization factor from CSA O86-14 was used to determine the specified strength.
Compression perpendicular to grain (edgewise)	Specimens were tested edgewise and the average stress at a 1.0-mm deformation was determined. This value was multiplied by 1.09 to establish the specified strength.
Compression perpendicular to grain (flatwise)	Specimens were tested flatwise and the lower of the average stress at 1.0-mm deformation or the average stress at the proportional limit was determined in accordance with ASTM D5456-14b. This value was multiplied by 1.81 to establish the specified strength in accordance with CSA O86-14 Update No.1.
Compression parallel to grain	Specimens were tested and a non-parametric, 5% tolerance limit with 75% confidence level approach was used to determine the characteristic value. Qualification test data have been used to establish the applicable coefficient of variation, CV_w , and the reliability normalization factor from CSA O86-14 was used to determine the specified strength.
Tension parallel to grain	Specimens were tested in tension for qualification and to establish volume effects. A non-parametric, 5% tolerance limit with 75% confidence level approach was used to determine the characteristic value. Qualification test data have been used to establish the applicable coefficient of variation, CV_w , and the reliability normalization factor from CSA O86-14 was used to determine the specified strength.
Nail withdrawal	Nail withdrawal values were established following ASTM D1761-06, “Standard Test Methods for Mechanical Fasteners in Wood”, for an 8d common nail having a 31.75-mm penetration. Twenty specimens were tested and the equivalent specific gravity along with the equivalent species combination was determined in accordance with ASTM D5456-01, A2.
Nail bearing	Dowel bearing strength was determined as per ASTM D5764-95, “Standard Test Method for Evaluating Dowel-Bearing Strength of Wood and Wood-Based Products”, with 10d common nails with a nominal diameter of 3.76 mm and a lead hole diameter of 2.77 mm. Forty specimens (10 specimens for four combinations of load direction) of each LVL were tested and the mean bearing capacity was used to establish the equivalent specific gravity and equivalent species combination as per ASTM D5456-01, A2.
Bolt bearing	Bolt bearing capacity as per ASTM D5764-95 with 12.5-mm and 19.0-mm bolts was determined. Twenty specimens (10 specimens for two combinations) of each LVL were tested and the mean bolt bearing capacity was used to establish the equivalent specific gravity and equivalent species combination as per ASTM D5456-01, A2.
Creep and recovery	Thirty specimens of “Pacific Woodtech LVL” were tested within a three-month creep and recovery test program, resulting in acceptable performance demonstrating equivalency to duration of load behavior of lumber.

Adhesive	The phenol-formaldehyde adhesive used in the manufacture of this LVL complies with O112.6-M1977, "Phenol and Phenol-Resorcinol Resin Adhesives for Wood (High-Temperature Curing)." See CCMC 13019-L. A phenol resorcinol formaldehyde adhesive (Momentive 4001 / 5830 hardener), used in the secondary face-bonding process when face-bonded at a certified laminating plant, conforms to CSA O112.9-10, "Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure)." See CCMC 13522-L. LT75/FM260 phenolic resorcinol formaldehyde adhesive, used in the secondary face-bonding process when face-bonded at another certified laminating plant, conforms to CSA O112.7-1960, "Resorcinol and Phenol-Resorcinol Resin Adhesives for Wood (Room- and Intermediate-Temperature Curing)."
Bond quality	The bond quality was evaluated in accordance with Section 6.7.2 of ASTM D5456-10a based on longitudinal shear (block shear) tests per Section 14 of ASTM D143. The test results confirmed the longitudinal (flatwise) shear design value of 2350F _b -1.9E and evaluated the percentage of wood failure. The average percentage of wood failure tested was deemed to be acceptable (no less than 85%).
Product durability	The product durability was evaluated in accordance with Section 6.8.1 of ASTM D5456-10a based on the single vacuum-pressure-soak cycle edgewise bending tests. The test results indicated that the 3100F _b -2.0E LVL met the ASTM D5456 edgewise bending durability requirement which requires the average strength retention to be at least 75%.