CCMC CANADIAN CODE COMPLIANCE EVALUATION

CCMC 12627-R

CCMC Canadian code compliance evaluation

CCMC number:	12627-R
Status:	Active
Issue date:	1994-09-28
Modified date:	2023-11-02
Evaluation holder:	**Weyerhaeuser** 32901 Weyerhaeuser Way South - Suite 102 Federal Way WA 98001 United States Website: www.weyerhaeuser.com Telephone: 888-453-8358
Product name:	TimberStrand® LSL
Compliance:	NBC 2015, OBC
Criteria:	CCMC-TG-061710-15B "CCMC Technical Guide for Structural Composite Lumber"

In most jurisdictions this document is sufficient evidence for approval by Canadian authorities.
Learn more about CCMC recognition Look for the trusted CCMC mark on products to verify compliance.

Compliance opinion

It is the opinion of the Canadian Construction Materials Centre that the evaluated product, when used as structural composite lumber in accordance with the conditions and limitations stated in this evaluation, complies with the following code:

National Building Code of Canada 2015

Code provision	Solution type
4.3.1.1.(1) Buildings and their structural members m ...	Acceptable
9.23.2.2.(1) Ends of wood joists, beams and other mem ...	Alternative
9.23.4.2.(3) Spans for built-up wood and glued-lamina ...	Alternative
9.23.10.1.(1) The size and spacing of studs shall conf ...	Alternative

Ontario Building Code

Ruling No. 05-19-143 (12627-R) authorizing the use of this product in Ontario, subject to the terms and conditions contained in the Ruling, was made by the Minister of Municipal Affairs and Housing on 2006-01-31 (revised 2010-02-17) pursuant to s.29 of the Building Code Act, 1992 (see Ruling for terms and conditions). This Ruling is subject to periodic revisions and updates.

The above opinion(s) is/are based on the evaluation by the CCMC of technical evidence provided by the evaluation holder, and is bound by the stated conditions and limitations. For the benefit of the user, a summary of the technical information that forms the basis of this evaluation has been included.

Product information

Product name

TimberStrand® LSL

Product description

The product is laminated strand lumber (LSL), which is a structural composite lumber manufactured from strands of wood species or species combinations blended with an isocyanate-based binder adhesive. The wood species, species combinations, and binder adhesive used are as specified in the Weyerhaeuser "TimberStrand® LSL Manufacturing Standards." The strands are oriented along the direction parallel to the length of the member. The mats are pressed to the required thickness using a steam injection press. The product is available in thicknesses up to 140 mm, depths up to 1 220 mm, and lengths up to 14.63 m.

The product is treated with zinc borate and may be used within the building envelope (i.e., in protected assemblies) as sill plates over masonry or concrete foundations, footings, or slabs.

Independent, third-party quality assurance monitoring and inspection is conducted by PFS Corporation, Los Angeles, CA, and/or by Intertek Testing Services NA Ltd., Coquitlam, BC.

The permitted design values are outlined in the Technical information section.

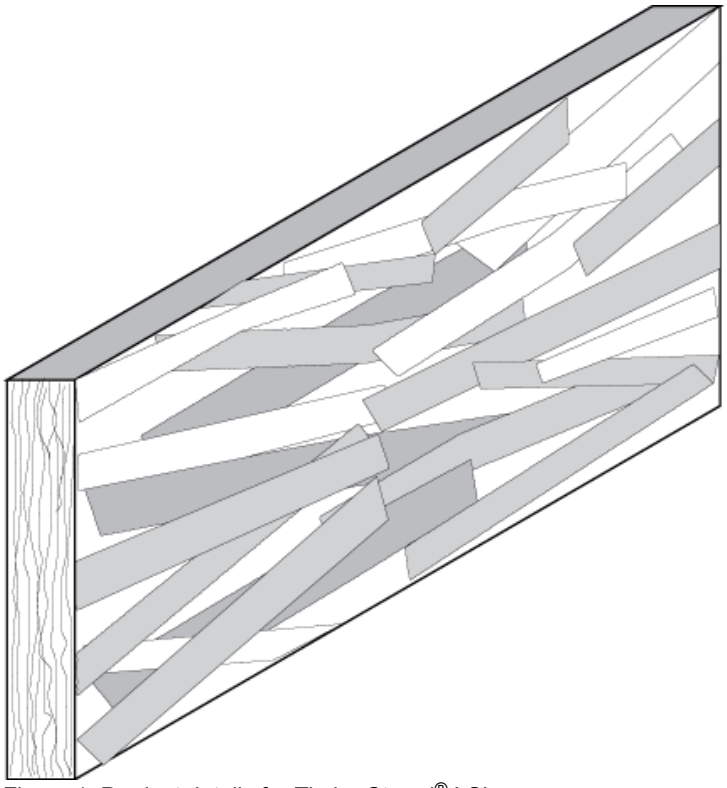

Figure 1. Product details for TimberStrand® LSL

Manufacturing plant

This evaluation is valid only for products produced at the following plant:

Product name	Manufacturing plant
	Kenora, ON, CA
TimberStrand® LSL	⊙

⊙ Indicates that the product from this manufacturing facility has been evaluated by the CCMC

Conditions and limitations

The CCMC's compliance opinion is bound by this product being used in accordance with the conditions and limitations set out below.

- The product, as with all structural composite lumber, 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 presented for the product are to be used by professional engineers for design in accordance with CSA O86-14, "Engineering Design in Wood," for structural applications such as beams, headers, joists, rafters, studs, and columns, as intended by the product manufacturer. The specific application must be qualified through testing and validated by the manufacturer. Applications such as I-joist flanges and metal-plated truss chords are beyond the scope of this evaluation.
- The product is treated with zinc borate and may be used within the building envelope as sill plates over masonry or concrete foundations, footings, or slabs (AWPA Use Category UC2) as long as the product is not in contact with the ground but may be subjected to dampness.
- The product is considered equivalent to sawn lumber floor joists with respect to its fire-resistance rating for equivalent member size and spacing within a rated floor assembly, including the wood floor assemblies in Table 9.10.3.1.-B, Fire and Sound Resistance of Floors, Ceilings and Roofs, of Division B of the NBC 2015. The product may also be considered equivalent to sawn lumber for use as a firestop material.
- See Appendix B for the conditions and limitations for the use of the product as studs in shear walls.
- The pre-engineered tables in the literature below have been provided to the CCMC by Weyerhaeuser to demonstrate compliance with Part 9, Housing and Small Buildings, of the NBC 2015 for acceptance by the local authority having jurisdiction (AHJ):
    i. **Weyerhaeuser's pre-engineered tables** (2)
    When the product is used to support uniform loads only, the installation must be in accordance with the tables and installation details published in the documents by Weyerhaeuser entitled:

        1. "Beams, Headers, and Columns (TJ-9505) (Limit States Design for Western Canada)," July 2016;
        2. "Beams, Headers, and Columns (TJ-9500) (Limit States Design for Eastern Canada)," October 2017; and
        3. "Select Beam Design Tables (TB-354)," February 2019.

    When TimberStrand® LSL (32 mm thickness) is used as a rim board supporting uniform loads only, the installation must be in accordance with the information and details contained in:

        1. "Technical Bulletin for 1-1/4" Rim Board, TimberStrand LSL (2542)." (3)

    Except where a floor is required to support a concentrated load or a specified unfactored live load in excess of 1.9 kN/m^2, and in lieu of engineering design, the spans for the product when used as floor joists, rafters, and beams may conform to the spans for Select Structural Grade for the Douglas Fir – Larch (D Fir–L) group in Span Tables 9.23.4.2-A to 9.23.4.2-I of the NBC 2015. Maximum deflections must conform to Subsection 9.4.3., Deflections, of Division B of the NBC 2015. Floor joists must be designed to meet the deflection and vibration criteria set in the NBC 2015 for lumber.

    The product must be installed in accordance with Weyerhaeuser's installation guidelines noted in the above-mentioned documents for those applications falling within the scope of the documents.

Applications outside the scope of these installation guidelines require engineering on a case-by-case basis.

ii. **Weyerhaeuser's installation details**

Weyerhaeuser’s pre-engineered details within the documents identified as (1), (2), and (3) and outlined in Section i. above are limited in scope to building designs where the anticipated loads on the following structural details are not exceeded:

- floor and/or snow (plf) tables (pages 6–7 of (2), page 5 of (1));
- beam installation details (page 12 of (2), page 10 of (1));
- nails installed on the narrow face (page 13 of (2), page 11 of (1));
- allowable holes in beams (page 14 of (2), page 12 of (1));
- tapered end cuts (page 15 of (2), page 13 of (1));
- multiple-member connections for side-loaded beams (pages 16–17 of (2), pages 14–15 of (1));
- multiple-member connections for top-loaded beams (page 18 of (2), page 16 of (1));
- rim board installation details (page 2 of (4)); and
- vertical load resistance (page 3 of (4)).

iii. **Engineering required**

When required by the AHJ or for structural applications beyond the scope/limitations of the above-referenced Weyerhaeuser publications, the drawings or related documents must bear the authorized seal of a professional engineer (or other certified authority approved by the AHJ) who is skilled in wood design and licensed to practise under the appropriate provincial or territorial legislation.

Installations beyond the scope/limitations of Sections i. and ii. imply, but are not limited to, the following:

- higher loads/longer spans than the manufacturer's pre-engineered details;
- concentrated loads;
- areas of high wind or high seismicity;
- design of supporting members/columns when the total beam/header load exceeds the NBC 2015 pre-engineered beam/lintel tables; and
- design of supporting foundation footings when the total load exceeds the NBC 2015 pre-engineered floor/roof joist tables.

The engineer must design in accordance with CSA O86-14 and may consult the "Engineering Guide for Wood Frame Construction," published by the Canadian Wood Council.

The specified strengths for the product must not exceed the values set forth in the Technical information section of this evaluation. See Figure 2 for strand orientation with respect to loading.

The factored resistances of the rim board product are shown in Table 4.

The ends of all product members used as joists, rafters, and beams must be restrained to prevent rollover. This is normally achieved by attaching a diaphragm sheathing to the top or to the compression edge and to an end wall or shear transfer panel capable of transferring a minimum unfactored uniform load of 730 N/m or the required shear forces due to wind or seismic conditions. Blocking or cross-bracing with the equivalent strength may also be used.

The compression edges of all product members used as joists, rafters, and beams must be laterally supported at least every 610 mm, except where designed in accordance with CSA O86-14.

Nailing of the product perpendicular to the wide face of strand (WFS) must conform to Table 9.23.3.4., Nailing for Framing, of Division B of the NBC 2015. Edge nailing of the product parallel to the WFS must conform to Table 2.

iv. **Engineering support provided by the manufacturer**
Weyerhaeuser may provide engineering services in conjunction with Weyerhaeuser product specification and offers the following support contact number for its Canadian offices: 888-453-8358.

- This product must be identified with the phrase "CCMC 12627-R" along its side. This CCMC number is only valid when it appears in conjunction with the WH-ETL certification mark of Intertek Testing Services and/or the mark of PFS Corporation. In addition, because the product is treated with zinc borate, it must be further identified with the designations "StrandGuard®" and "AWPA UC2."

Notes

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 in which the 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 list the pre-engineered factored resistance values of the beam. The AHJ may require further engineering to determine the factored load in accordance with Part 4, Structural Design, of Division B of the NBC 2015.

3 In accordance with Section 9.4., Structural Requirements, of Division B of the NBC 2015, the adequacy of the rim board to transfer loads from shear walls and the diaphragm must be verified, particularly in areas of high wind and high seismicity.

Technical information

This evaluation is based on demonstrated conformance with the following criteria:

Criteria number	Criteria name
CCMC-TG-061710-15B	CCMC Technical Guide for Structural Composite Lumber

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

Design requirements

Table 1. TimberStrand® LSL specified strengths (MPa) (1) (2) (3)

Grade	Modulus of Elasticity E	Axial – tension parallel to grain F_t (4)	Axial – compression parallel to grain F_c	Joist or beam (1) – flexure F_b (5) (6)	Joist or beam (1) – shear F_v	Joist or beam (1) – compression perpendicular to grain $F_c$perp	Plank (1) – flexure F_b (7)	Plank (1) – shear F_v	Plank (1) – compression perpendicular to grain $F_c$perp
1.30E	8 965	13.70	20.21	21.65	5.39	8.92	24.20	1.95	7.92 (8)
1.35E	9 310	15.05	20.94	23.41	5.66	9.39	26.19	1.95	8.27
1.40E	9 655	16.40	21.68	25.18	5.93	9.87	28.18	1.95	8.62
1.45E	9 995	17.75	22.41	26.94	6.19	10.34	30.16	1.95	8.98
1.50E	10 345	19.10	23.14	28.70	6.46	10.81	32.15	1.95	9.33
1.55E	10 685	20.40	23.88	29.60	6.73	11.28	33.30	1.95	9.69
1.60E	11 030	21.65	24.61	30.90	7.00	11.75	34.40	1.95	10.04 (9)
1.65E	11 375	22.45	25.35	32.03	7.27	12.23	35.68	1.95	10.39
1.70E	11 720	23.25 (10)	26.08	33.15	7.54	12.70	36.95	1.95	10.75
1.75E	12 065	24.29	26.82	34.66	7.81	13.17	38.70	1.95	11.10
1.80E	12 410	25.33	27.55 (11)	36.18	8.07 (12)	13.64 (13)	40.45	1.95	11.45
1.85E	12 755	26.36	27.55 (11)	37.69	8.07 (12)	13.64 (13)	42.20	1.95	11.81
1.90E	13 100	27.40	27.55 (11)	39.20	8.07 (12)	13.64 (13)	43.95	1.95	12.16
1.95E	13 445	28.51	27.55 (11)	40.55	8.07 (12)	13.64 (13)	45.46	1.95	12.52
2.00E	13 790	29.63	27.55 (11)	41.90	8.07 (12)	13.64 (13)	46.98	1.95	12.87
2.05E	14 135	30.74	27.55 (11)	43.25	8.07 (12)	13.64 (13)	48.49	1.95	13.22
2.10E	14 480	31.85	27.55 (11)	44.60	8.07 (12)	13.64 (13)	50.00	1.95	13.58

Notes

1 See Figure 2 for strand orientation.

2 Specified strengths are based on covered, dry service conditions of use. "Dry service conditions of use" are those in which a 19% MC will not be exceeded.

3 Simple span uniform load deflection is calculated as follows:

$$\Delta = \frac{156WL^4 \times 10^6}{Ebd^3} + \frac{2400WL^2}{E > bd}$$

where:

Δ = deflection, mm

E = modulus of elasticity (shear-free), MPa

W = specified uniform load, N/m

L = span, m

b = beam width, mm

d = beam depth, mm

4 F_t values reflect the volume effects of length, depth, and thickness for a range of common application conditions. The F_t values for the product may be higher when approved by Weyerhaeuser for use as a component of engineered products that are manufactured under a recognized quality control program.

5 For product depths other than 305 mm, regardless of thickness, multiply table values by $(305/d)^{0.092}$. Adjustments for common depths are shown below. For product depths less than 89 mm, use the factor for the 89-mm depth.

Depth (mm)	89	140	184	241	305	406	457	610
Multiplier	1.12	1.07	1.05	1.02	1.00	0.97	0.96	0.94

6 When structural members qualify as repetitive members in accordance with CSA O86-14, a 4% increase is permitted for F_b in addition to the increases permitted in Table Note 4.

7 Values shown are for thicknesses up to 89 mm.

8 Specified strength is for the product labeled rim board. For all other 1.3E products, use 8.39 MPa.

9 For thicknesses less than 64 mm, use 11.22 MPa.

10 When TimberStrand® LSL 1.7E grade is used as truss chords and as webs of engineered wood trusses, the specified axial tension strength is 26.15 MPa, which includes an adjustment for length effect. TimberStrand® LSL materials must be marked as "Truss Chord Grade," and the engineered wood trusses must be manufactured under a recognized quality control program. The plate tooth holding values for TimberStrand® LSL web and chord members are as listed in other evaluations.

11 Specified strength conservatively capped at 27.55 MPa.

12 Specified strength conservatively capped at 8.07 MPa.

13 Specified strength conservatively capped at 13.64 MPa.

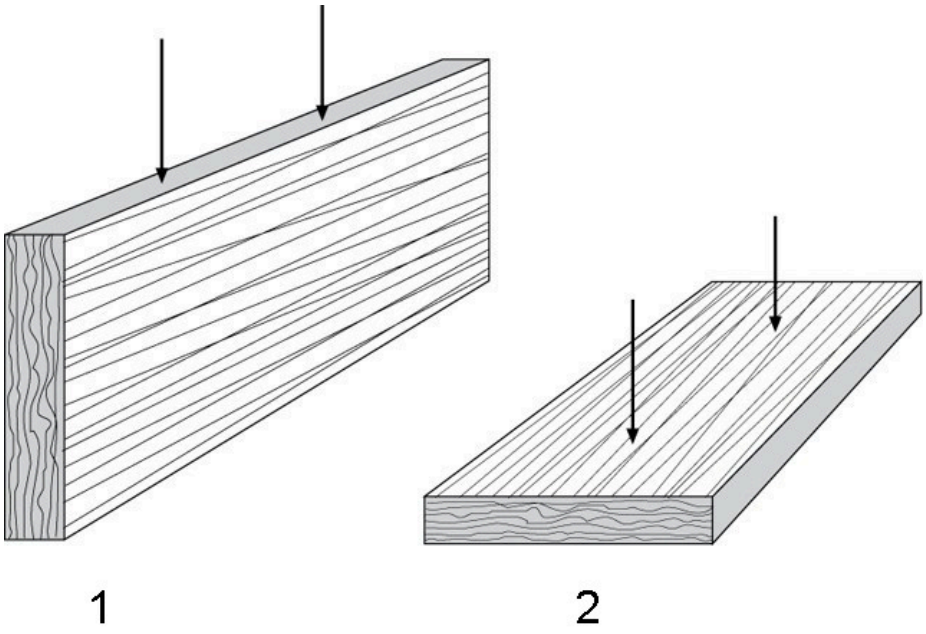

Figure 2. Load direction with respect to strand orientation

1. Edge (joist) loading
2. Face (plank) loading

Notes

- Edge/joist loading is parallel to the wide face of strand
- Face/plank loading is perpendicular to the wide face of strand

Table 2. TimberStrand® LSL fastener detail: all grades

Fastener property	Nail orientation	Load direction	Specific gravity (SG) of equivalent species for design purposes
Nail withdrawal	Edge	Withdrawal	Spruce-Pine-Fir, SG = 0.42
Nail withdrawal	Face	Withdrawal	Douglas Fir-Larch, SG = 0.50
Lateral nail capacity	Edge	Parallel to grain	Douglas Fir-Larch, SG = 0.50
Lateral nail capacity	Edge	Perpendicular to grain	Douglas Fir-Larch, SG = 0.50
Lateral nail capacity	Face	Parallel to grain	Douglas Fir-Larch, SG = 0.50
Lateral nail capacity	Face	Perpendicular to grain	Douglas Fir-Larch, SG = 0.50
Bolt bearing capacity	—	Parallel to grain	Douglas Fir-Larch, SG = 0.50
Bolt bearing capacity	—	Perpendicular to grain	Douglas Fir-Larch, SG = 0.50

Fastener property	Nail orientation	Load direction	Specific gravity (SG) of equivalent species for design purposes
	Bolt size	Load direction	Specified strength (N)
Lag screw capacity	12.7 mm	Parallel to grain	2 820 (1)
Lag screw capacity	12.7 mm	Perpendicular to grain	2 820 (1)

Note

1 Value shown is the factored resistance permitted for a 12.7-mm-diam lag screw in 38-mm-thick main and side members with full penetration into the main member. All other loading conditions are to be evaluated in accordance with CSA O86-14 using a mean relative density of 0.50 (D Fir–L). Capacities in withdrawal have not been evaluated.

Table 3. Nail spacing requirements for TimberStrand® LSL

Closest on centre nail spacing parallel to the wide face of strand (WFS) orientation (mm) (1) (2)								
	Nominal member thickness (mm)							
	32		38		44.5–89			89
Common nail size	1 row	2 rows	1 row	2 rows	1 row	2 rows	3 rows	3 rows
63.5 mm × 3.33 mm	102	102	76	76	76	76	76	76
76 mm × 3.75 mm	102	102	76	76	76	76	76	76
89 mm × 4.11 mm	152 (3)	152 (3)	152 (3)	152 (3)	152 (4)	152 (4)	152 (4)	152 (4)

Notes

1 The closest on centre (o.c.) spacing for nails perpendicular to the WFS is the same as permitted by the NBC 2015 for sawn lumber.

2 Member edge distance and spacing between the rows must be 2.5 times the diameter or 9.5 mm, whichever is greater. Where multiple rows are used, fasteners in adjacent rows must be staggered, and the rows must be equally spaced from the centreline of the narrow face axis.

3 When nailing through the wall sill plate and floor sheathing, such that the maximum nailing penetration into the member is 32 mm, the minimum allowable o.c. spacing may be decreased to 102 mm.

4 When nailing through the wall sill plate and floor sheathing, such that the maximum nailing penetration into the member is 32 mm, the minimum allowable o.c. spacing may be decreased to 89 mm.

Table 4. TimberStrand® LSL 1.3E rim board: factored vertical load resistance values (1)

Nominal thickness (mm)	Limit states design – factored vertical load resistance (2) (kN/m)	Depth range (mm)
32 (3)	98.20	≤ 406

Nominal thickness (mm)	Limit states design – factored vertical load resistance (2) (kN/m)	Depth range (mm)
32 (3)	79.75	> 406, ≤ 508
38	95.65	≤ 610

Notes

1 The specified shear strengths (kN/m) for horizontal diaphragms with 38-mm-thick D Fir–L framing in Table 9.5.2 of CSA O86-09 are applicable to TimberStrand® LSL rim board.

2 Compression resistances perpendicular to the grain of the sill plate and floor sheathing must be checked.

3 Decrease 12.7 mm lag screw-factored resistance to 2 290 N for 32 mm thickness.

Table 5. TimberStrand® LSL stud and shearwall applications (1) (2)

TimberStrand® LSL grade	Nailing (3) (4)	Equivalent species for framing material
Grade (5) < 1.5E	Panel edge nailing of 150 mm	Spruce-Pine-Fir
1.5E ≤ Grade < 1.6E	Panel edge nailing of 75 mm (6) to 150 mm	Spruce-Pine-Fir
1.6E ≤ Grade ≤ 1.7E	Panel edge nailing of 75 mm to 150 mm	Douglas Fir-Larch

Notes

1 The product may be used as wall stud material in accordance with the prescriptive requirements of Part 9 of the NBC 2015. The specified shear strength for nailed structural panel shear walls using the product framing is equivalent to lumber-framed, structural wood-based panel shear walls using nailed connections and must be determined in accordance with Clause 11.5.1, Shear resistance of shearwalls, of CSA O86-14 for the specified nail size, spacing, and equivalent species for framing material.

2 See Conditions and limitations for stud and shear wall applications.

3 See Conditions and limitations for stud and shear wall applications, Note 12.

4 For unblocked walls, the nails must not exceed D = 3.3 mm (0.13 in.) (8d) and 64 mm (2.5 in.), nor should they be placed closer than 150 mm (6 in.) o.c. For blocked walls, the nails must not exceed D = 3.7 mm (0.15 in.) (10d) and 76 mm (3 in.), nor should they be placed closer than 76 mm (3 in.) o.c.

5 TimberStrand® LSL 1.3E grade must have a minimum average density of 39 lb/ft.^{3}.

6 The minimum panel edge nail spacing of 75 mm is currently limited by the scope of the CCMC technical guide development tests.

Manufacturing quality assurance program

The manufacturing quality assurance program has been updated to include requirements specified in ASTM D5456-13a, "Standard Specification for Evaluation of Structural Composite Lumber Products," and has been verified by

independent, third-party monitoring and inspection conducted by PFS Corporation and Intertek Testing Services NA Ltd. as part of the product certification.

Design values obtained from testing to ASTM D5456-13a

The design values obtained from testing to ASTM D5456-13a, as specified in CSA O86-14, are summarized below.

Table 6. Additional test information for TimberStrand® LSL

Property	Test information
Bending	Specimens were tested in edgewise and flatwise bending directions to establish the characteristic value. Data from quality control (QC) tests were 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 in shear to establish the characteristic value. Data from QC tests were 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 parallel to grain	Specimens were tested in compression parallel to grain to establish the characteristic value. Data from QC tests were 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	Specimens were tested in compression perpendicular to grain to establish the characteristic value. The two methods, namely min. density and 0.04 in. deformation stress, were used with a voluntary adjustment of 0.71 by the proponent. The characteristic value was multiplied by 1.09 to establish the specified strength in accordance with CSA O86-14 and ASTM D5456-13a.
Tension parallel to grain	Specimens were tested in tension to establish the characteristic value. Data from QC tests were 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 D1761-12, "Standard Test Methods for Mechanical Fasteners in Wood," for an 8d common nail having a 31.75 mm penetration. Specimens were tested, and equivalent species capacity was determined in accordance with ASTM D5456-13a, A2.4.
Nail bearing	Dowel bearing strength was determined in accordance with ASTM D5764-97a, "Standard Test Method for Evaluating Dowel-Bearing Strength of Wood and Wood-Based Products," using 10d common nails with a nominal diameter of 3.76 mm and a lead hole diameter of 2.77 mm. Specimens were tested, and the mean bearing capacity was used to establish the equivalent species capacity in accordance with ASTM D5456-13a, A2.5.
Bolt bearing	Bolt bearing capacity was determined in accordance with ASTM D5764-97a using 12.5 mm and 19.0 mm bolts. Specimens were tested, and the mean bolt bearing capacity was used to establish the equivalent species capacity in accordance with ASTM D5456-13a, A2.5.
Creep and recovery	A total of 240 specimens were tested to a short-term and long-term creep assessment program. The creep performance of the product was found to be equal to or better than Aspen lumber. Long-term (90-day) creep testing was also conducted. It demonstrated equivalency to the duration of load behaviour of sawn lumber.
Fire resistance	Two full-scale floor assemblies were tested, one containing sawn lumber joists and the other containing TimberStrand® LSL joists. Charring rate tests were also conducted for comparison. The testing and performance were considered adequate to demonstrate equivalency to the fire resistance of sawn lumber joists within a fire-rated floor assembly.

Property	Test information
Adhesive	See CSA O325-07, "Construction Sheathing" (OSB binder requirements). For adhesive and species mix qualification, additional creep testing was conducted in accordance with CCMC's creep and recovery test. After conditioning of the specimens, the creep and recovery performance was considered favourable.
Zinc borate treatment	As the product is treated with zinc borate in accordance with AWPA N2-03, "Composite Wood Products, Preservative Treatment by Nonpressure Processes," it was found to be effective in controlling decay from environmental conditions expected in sill plate applications.
Stud (general)	Notching: Strength and stiffness reduction for a 22 mm × 75 mm notch in 1.3E TimberStrand® LSL was compared with "standard and better" Douglas fir sawn lumber (not NBC-specified minimum stud lumber). The Douglas fir lumber showed 70% reduction, while the 1.3E LSL showed 43% reduction. End nail connection: Lateral nail capacity of 10 stud/plate connections was tested with 4 mm to 82 mm (16d) nails, and a minimum 5 kN was attained, which exceeds the 3.77 kN criterion. Nail slip, e_n, performance (optional): The sheathing-to-framing connection was tested for nail slip, and in combination with the full-scale shearwall test results, 1.3E grade showed a similar load–slip relationship to "dry assemblies/dry use" SG = 0.50 material.
Studs in shearwalls	Full-scale shearwall tests of various combinations and permutations of LSL grades, sheathing thickness, nail size, and spacing were undertaken to verify equivalency to lumber shearwalls in Table 9.5.1.A in CSA O86-09. Testing was performed following the CUREE protocol in Method C, ASTM E2126, "Standard Test Methods for Cyclic (Reversed) Load Test for Shear Resistance of Vertical Elements of the Lateral Force Resisting Systems for Buildings." Three parameters needed to be met based on the equivalent energy elastic-plastic (EEEP) curve. The three parameters included: (i) ductility (μ) ≥ 11; (ii) drift capacity (D_u) ≥ 0.028H; and (iii) 2.3 ≤ overstrength (Ω) ≤ 5.0. These criteria were met for the LSL grades, panel edge spacing, and species adjustment outlined in Table 5.

Conditions and limitations for stud and shearwall applications

For use in Part 9 applications:

1. For general stud applications, notwithstanding that Article 9.23.5.3., Wall Studs, of the NBC 2015 permits notching of stud grade lumber up to 1/3 of the depth, TimberStrand® LSL studs must not be notched more than 1/4 of stud depth.
2. Braced wall panels utilizing LSL studs are subject to the limitations in Article 9.23.1.1., Limitations, of the NBC 2015, as applicable.
3. Fasteners for sheathing must conform to Tables 9.23.3.5.-A., 9.23.3.5.-B., and 9.23.3.5.-C. of the NBC 2015.
4. Appropriate LSL grade must be specified for stud size, and spacing must conform to Table 9.23.10.1. of the NBC 2015.
5. LSL stud-braced walls must be detailed in accordance with Subsection 9.23.13., Bracing to Resist Lateral Loads Due to Wind and Earthquake, of the NBC 2015.

For use in Part 4 applications:

1. Blocked shear walls with LSL studs can be used as lateral load resisting systems in wood construction in Canada with no height limitation. Unblocked shear walls are limited to a height of 4.88 m (16 ft.) in accordance with Section 11.4.4 of CSA O86-14.
2. When a vertical load is present on any wall, it should be included in the design of the wall studs, especially in the case of high walls, to avoid potential stud buckling.

3. Framing members must be at least 38 mm thick in shear walls and diaphragms. For diaphragms with multiple rows of fasteners, framing members must be at least 64 mm thick and 64 mm wide at boundaries or adjoining panel edges in accordance with Clause 11.5.3.2 of CSA O86-14.
4. Blocked shear walls must be used in high seismic zones (i.e., Part 4, where $I_E F_a S_a(0.2) \geq 0.35$, and Part 9, where $S_a(0.2) \geq 0.7$, of the NBC 2015).
5. For double-sided walls, LSL studs must be a minimum nominal 2 in. × 6 in. Nails must be attached in accordance with Clause 11.5.5.2 and Table 11.5.4 of CSA O86-14.
6. In cases where double studs are used in walls with LVL/LSL studs, the connection between plies must be designed with mechanical fasteners to resist the shear force at the stud interface and prevent separation of the studs. Relatively large forces are generated between the studs during the shear wall response, especially in the end studs and in studs on the perimeters of the panels.
7. The nail diameter for sheathing-to-framing connections in any wall must not exceed 3.7 mm.
8. The nail spacing in any case must be equal to or greater than the minimum nail spacing of 76 mm.
9. The size of the nail heads should be equal to or larger than those of the nails used in the testing program.
10. A maximum sheathing thickness of 15.8 mm (5/8 in.) can be used in combination with the same length of nails and nail spacing as used in the testing. A sheathing thickness greater than 15.8 mm (5/8 in.) is not permitted.
11. See Table 5, Note 5.
12. The stud spacing must not exceed 610 mm (2 ft.) o.c.

Administrative information

Use of Canadian Construction Materials Centre (CCMC) assessments

This assessment must be read in the context of the entire CCMC Registry of Product Assessments, any applicable building code or by-law requirements, and/or any other regulatory requirements (for example, the Canada Consumer Product Safety Act, the Canadian Environmental Protection Act, etc.).

It is the responsibility of the user to confirm that the assessment they are using is current and has not been withdrawn or superseded by a later version on the CCMC Registry of Product Assessments.

Disclaimer

The National Research Council of Canada (NRC) has evaluated only the characteristics of the specific product described herein. The information and opinions in this evaluation are directed to those who have the appropriate degree of experience to use and apply its contents (such as authorities having jurisdiction, design professionals and specifiers). This evaluation is valid when the product is used as part of permitted construction, respecting all conditions and limitations stated in the evaluation, and in accordance with applicable building codes and by-laws.

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Language

Une version française de ce document est disponible.
In the case of any discrepancy between the English and French version of this document, the English version shall prevail.

Copyright

CCMC recognition

The Canadian Construction Materials Centre (CCMC) assesses compliance with Canadian building, energy and safety codes. We are the only construction code compliance service supported and operated by the Government of Canada. Trusted by over 6,000 regulators across Canada.

> Most Canadian authorities having jurisdiction (AHJs) consider CCMC product assessments acceptable as evidence for product approval.

CCMC assessments are recognized by construction authorities across Canada:

Alliance of Canadian Building Official Associations (ACBOA)	(Alliance of Canadian Building Official Associations (ACBOA))
First Nations National Building Officers Association (FNNBOA)	(First Nations National Building Officers Association (FNNBOA))
Canadian Home Builders' Association (CHBA)	(Canadian Home Builders' Association (CHBA))
Alberta Building Officials Association (ABOA)	(Alberta Building Officials Associations (ABOA))
Saskatchewan Building Officials Association (SBOA)	(Saskatchewan Building Officials Association (SBOA))
Manitoba Building Officials Association (MBOA)	(Manitoba Building Officials Association (MBOA))
Ontario Building Officials Association (OBOA)	(Ontario Building Officials Association (OBOA))
New Brunswick Building Officials Association (NBBOA)	(New Brunswick Building Officials Association (NBBOA))
Nova Scotia Building Officials Association (NSBOA)	(Nova Scotia Building Officials Association (NSBOA))

> The CCMC provides code compliance assessments to Canadian code requirements, consulting nationwide with construction regulators to elicit regional variations in code requirements as well as provincial and local interpretations. Users are advised to review the technical information presented in CCMC assessments when making approval decisions. Learn more about how the CCMC provides a unique service for Canada.

For more information, contact the CCMC by phone at (613) 993-6189 or by email at ccmc@nrc-cnrc.gc.ca

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- this PDF is intended for record-keeping purposes only,
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Code compliance as an acceptable solution

Code Compliance via Acceptable Solutions

> If a building design (e.g. material, component, assembly or system) can be shown to meet all provisions of the applicable **acceptable solutions** in Division B (e.g. it complies with the applicable provisions of a referenced standard), it is deemed to have satisfied the objectives and functional statements linked to those provisions and thus to have complied with that part of the Code.
>
> — **National Building Code of Canada, Sentence A-1.2.1.1.(1)(a)**

The CCMC has determined that compliance with this provision of the Code has been demonstrated as an **Acceptable Solution**. The evaluation report provides a summary of the basis of CCMC's compliance opinion.

CCMC's code compliance opinions

All CCMC evaluation reports are opinions of code compliance established in accordance with the National Building Code of Canada, Subsection 1.2.1. "Compliance with this Code," which requires compliance to be achieved by:

- complying with the applicable acceptable solutions in Division B, or
- using an alternative solution that will achieve at least the minimum level of performance required by Division B in the areas defined by the objective and functional statements attributed to the applicable acceptable solutions.

The CCMC assesses compliance with Canadian building, energy and safety codes, and is trusted by over 6,000 regulators across Canada.

Code compliance as an alternative solution

Code Compliance via Alternative Solutions

> Where a design differs from the acceptable solutions in Division B, then it should be treated as an "**alternative solution**." A proponent of an alternative solution must demonstrate that the alternative solution addresses the same issues as the applicable acceptable solutions in Division B and their attributed objectives and functional statements. However, because the objectives and functional statements are entirely qualitative, demonstrating compliance with them in isolation is not possible. Therefore, Clause 1.2.1.1.(1)(b) identifies the principle that Division B establishes the quantitative performance targets that alternative solutions must meet. In many cases, these targets are not defined very precisely by the acceptable solutions [...] Nevertheless, Clause 1.2.1.1.(1)(b) makes it clear that an effort must be made to demonstrate that an alternative solution will perform as well as a design that would satisfy the applicable acceptable solutions in Division B—not “well enough” but “as well as.”
>
> — **National Building Code of Canada, Sentence A-1.2.1.1.(1)(b)**

The CCMC has determined that compliance with this provision of the Code has been demonstrated as an **Alternative Solution**. The evaluation report provides a summary of the basis of CCMC's compliance opinion.

CCMC's code compliance opinions

All CCMC evaluation reports are opinions of code compliance established in accordance with the National Building Code of Canada, Subsection 1.2.1. "Compliance with this Code," which requires compliance to be achieved by:

- complying with the applicable acceptable solutions in Division B, or
- using an alternative solution that will achieve at least the minimum level of performance required by Division B in the areas defined by the objective and functional statements attributed to the applicable acceptable solutions.

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