

Nordic X-Lam
Nordic Structures

PR-L306

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Products: Nordic X-Lam
Nordic Structures
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1. Basis of the product report:
 - 2018 and 2015 International Building Code (IBC): Section 2303.1.4 Structural Glued Cross-Laminated Timber
 - 2012 IBC: Section 104.11 Alternative materials
 - 2018 and 2015 International Residential Code (IRC): Sections R502.1.6, R602.1.6, and R802.1.6 Cross-Laminated Timber
 - 2012 IRC: Section R104.11 Alternative materials
 - ANSI/APA PRG 320-2017 Performance Rated Cross-Laminated Timber
 - FPInnovations Reports 201002775, 201004981, 301010401, 301010956, and 301011903, HPVA Report T-14054R, and other qualification data
2. Product description:

Nordic X-Lam cross-laminated timber (CLT) is manufactured with spruce-pine-fir in accordance with the E1 or custom layups of ANSI/APA PRG 320 through product qualification and/or mathematical models using principles of engineering mechanics. Nordic X-Lam panels can be used in floor, roof, and wall applications, and is manufactured in a plank billet with nominal widths of 12 to 96 inches, thicknesses of 3 to 15 inches, and lengths up to 64 feet.
3. Design properties:

Nordic X-Lam CLT shall be designed with the design properties and capacities provided in Tables 1, 2, and 3, or with the allowable load table provided by the manufacturer (www.nordic.ca/en/documentation/technical-documents). The design adjustment factors shall be based on the 2015 National Design Specification for Wood Construction (NDS), the recommendations provided by the manufacturer, the U.S. CLT Handbook (www.rethinkwood.com/mass-timber-webform/cross-laminated-timber-clt-handbook), and approved by the engineer of record. The lateral resistance of Nordic X-Lam CLT, when used as shearwalls or diaphragms, depends on the panel-to-panel connection and anchorage designs, and shall be consulted with the CLT manufacturer and approved by the engineer of record.

Design values for the Load and Resistance Factor Design (LRFD) used in the U.S. for Nordic X-Lam CLT can be derived from the ASD values published in Tables 2 and 3 of this report in accordance with Tables 10.3.1, N1, N2, and N3 of the 2018 ANSI/AWC NDS.
4. Product installation:

Nordic X-Lam CLT shall be installed in accordance with the recommendations provided by the manufacturer (see link above) and the engineering drawing approved by the engineer of record. Permissible details shall be in accordance with the engineering drawing.

5. Fire-rated assemblies:
Fire-rated assemblies shall be constructed in accordance with the recommendations provided by the manufacturer (see link above). Procedures specified in Chapter 16 of the 2015 NDS shall be permitted for use in designing Nordic X-Lam CLT for a fire exposure up to 2 hours.
Nordic X-Lam CLT has been tested in accordance with ASTM E84, and meets the flame-spread index and smoke-developed index listed in AWC DCA 1 (www.awc.org).
6. Limitations:
 - a) Nordic X-Lam CLT shall be designed in accordance with principles of mechanics using the design properties specified in this report or provided by the manufacturer.
 - b) Nordic X-Lam products shall be limited to dry service conditions where the average equilibrium moisture content of solid-sawn lumber is less than 16 percent.
 - c) Design properties for Nordic X-Lam CLT, when used as beams or lintels with loads applied parallel to the face-bond gluelines, are beyond the scope of this report.
 - d) Nordic X-Lam CLT shall be manufactured in accordance with layup combinations specified in ANSI/APA PRG 320 or proprietary Nordic X-Lam CLT manufacturing specifications documented in the in-plant manufacturing standard approved by APA.
 - e) Nordic X-Lam CLT is produced at the Nordic Structures, Chibougamau, Quebec facilities under a quality assurance program audited by APA.
 - f) This report is subject to re-examination in one year.
7. Identification:
Nordic X-Lam CLT described in this report is identified by a label bearing the manufacturer's name (Nordic Structures) and/or trademark, the APA assigned plant number (1112), the product standard (ANSI/APA PRG 320), the APA logo, the CLT layup (E1), the report number PR-L306, and a means of identifying the date of manufacture.

Table 1. ASD Reference Design Values^(a) for Lumber Laminations Used in Nordic X-Lam (For Use in the U.S.)

| CLT Layup | Laminations Used in Major Strength Direction | | | | | | Laminations Used in Minor Strength Direction | | | | | |
|-----------|--|----------------------------|-------------------------|-------------------------|-------------------------|-------------------------|--|----------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| | F _b (psi) | E (10 ⁶ psi) | F _t (psi) | F _c (psi) | F _v (psi) | F _s (psi) | F _b (psi) | E (10 ⁶ psi) | F _t (psi) | F _c (psi) | F _v (psi) | F _s (psi) |
| E1 | 1,950 | 1.7 | 1,375 | 1,800 | 135 | 45 | 500 | 1.2 | 250 | 650 | 135 | 45 |

For SI: 1 psi = 0.006895 MPa

^(a) Tabulated values are allowable design values and not permitted to be increased for the lumber size adjustment factor in accordance with the NDS. The design values shall be used in conjunction with the section properties provided by the CLT manufacturer based on the actual layup used in manufacturing the CLT panel (see Table 2).

Table 2. ASD Reference Design Values^(a) for Nordic X-Lam Listed in Table 1 (For Use in the U.S.)

| CLT Layup ^(b) | Layup ID ^(c) | Thick-ness, t _p (in.) | Lamination Thickness (in.) in CLT Layup | | | | | | Major Strength Direction | | | | | Minor Strength Direction | | | | | |
|--------------------------|-------------------------|-------------------------------------|---|----------|--------|--------|----------|--------|--------------------------|---|---|--|--------------------------|---|--|--|---|---------------------------|--|
| | | | = | ⊥ | = | ⊥ | = | ⊥ | = | (F _b S) _{eff,t,0} (lb-ft/ft) | (EI) _{eff,t,0} (10 ⁶ lb-ft-in. ² /ft) | (GA) _{eff,t,0} (10 ⁶ lb/ft) | V _{s,0} (lb/ft) | G _{e,0} t _p ^(d) (10 ⁶ lb/ft) | (F _b S) _{eff,t,90} (lb-ft/ft) | (EI) _{eff,t,90} (10 ⁶ lb-ft-in. ² /ft) | (GA) _{eff,t,90} (10 ⁶ lb/ft) | V _{s,90} (lb/ft) | G _{e,90} t _p ^(d) (10 ⁶ lb/ft) |
| E1 | 78-3s | 3 1/8 | 1 1/64 | 1 1/16 | 1 1/64 | | | | | 2,525 | 48 | 0.34 | 1,110 | 1.36 | 95 | 1.4 | 0.47 | 380 | 1.36 |
| | 89-3s | 3 1/2 | 1 3/8 | 3/4 | 1 3/8 | | | | | 3,350 | 72 | 0.48 | 1,260 | 1.52 | 45 | 0.51 | 0.39 | 270 | 1.52 |
| | 105-3s | 4 1/8 | 1 3/8 | 1 3/8 | 1 3/8 | | | | | 4,525 | 115 | 0.46 | 1,490 | 1.79 | 160 | 3.1 | 0.61 | 495 | 1.79 |
| | 131-5s | 5 1/8 | 1 1/64 | 1 1/16 | 1 1/64 | 1 1/16 | 1 1/64 | | | 5,800 | 184 | 0.69 | 1,860 | 2.23 | 790 | 36 | 0.94 | 1,130 | 2.23 |
| | 140-4s | 5 1/2 | 1 3/8 | 1 3/8 x2 | 1 3/8 | | | | | 7,325 | 248 | 0.54 | 1,980 | 2.39 | 630 | 25 | 1.2 | 990 | 2.39 |
| | 143-5s | 5 5/8 | 1 3/8 | 3/4 | 1 3/8 | 3/4 | 1 3/8 | | | 7,725 | 267 | 0.96 | 2,030 | 2.44 | 615 | 26 | 0.78 | 1,040 | 2.44 |
| | 175-5s | 6 7/8 | 1 3/8 | 1 3/8 | 1 3/8 | 1 3/8 | 1 3/8 | | | 10,400 | 440 | 0.92 | 2,480 | 2.99 | 1,370 | 81 | 1.2 | 1,490 | 2.99 |
| | 197-7s | 7 3/4 | 1 3/8 | 3/4 | 1 3/8 | 3/4 | 1 3/8 | 3/4 | 1 3/8 | 13,725 | 654 | 1.4 | 2,800 | 3.37 | 1,410 | 101 | 1.2 | 1,800 | 3.37 |
| | 213-7l | 8 3/8 | 1 3/8 x2 | 3/4 | 1 3/8 | 3/4 | 1 3/8 x2 | | | 18,700 | 963 | 1.6 | 3,025 | 3.64 | 615 | 26 | 0.93 | 1,040 | 3.64 |
| | 220-7s | 8 5/8 | 1 3/8 | 1 1/16 | 1 3/8 | 1 1/16 | 1 3/8 | 1 1/16 | 1 3/8 | 15,975 | 853 | 1.4 | 3,125 | 3.75 | 2,190 | 187 | 1.5 | 2,130 | 3.75 |
| | 244-7s | 9 5/8 | 1 3/8 | 1 3/8 | 1 3/8 | 1 3/8 | 1 3/8 | 1 3/8 | 1 3/8 | 18,375 | 1,089 | 1.4 | 3,475 | 4.18 | 3,150 | 313 | 1.8 | 2,480 | 4.18 |
| | 244-7l | 9 5/8 | 1 3/8 x2 | 1 3/8 | 1 3/8 | 1 3/8 | 1 3/8 x2 | | | 23,700 | 1,404 | 1.4 | 3,475 | 4.18 | 1,370 | 81 | 1.3 | 1,490 | 4.18 |
| | 267-9l | 10 1/2 | 1 3/8 x2 | 3/4 | 1 3/8 | 3/4 | 1 3/8 | 3/4 | 1 3/8 x2 | 28,325 | 1,831 | 2.0 | 3,775 | 4.56 | 1,410 | 101 | 1.3 | 1,800 | 4.56 |
| | 314-9l | 12 3/8 | 1 3/8 x2 | 1 3/8 | 1 3/8 | 1 3/8 | 1 3/8 | 1 3/8 | 1 3/8 x2 | 36,700 | 2,794 | 1.8 | 4,450 | 5.38 | 3,150 | 313 | 1.9 | 2,480 | 5.38 |

For SI: 1 in. = 25.4 mm; 1 ft = 304.8 mm; 1 lbf = 4.448N

^(a) Tabulated values are allowable design values and not permitted to be increased for the lumber size adjustment factor in accordance with the NDS.

^(b) The CLT layups are developed based on ANSI/APA PRG 320, as permitted by the standard.

^(c) The layup designation refers to the panel thickness (expressed in mm), the number of layers, and the layup combination ("s" for standard perpendicular layers, and "l" for doubled outermost parallel layers).

^(d) G_{e,0} and G_{e,90} = 36,200 psi based on product performance testing.

Table 3. Allowable In-Plane Shear Stress for Nordic X-Lam^(a) (For Use in the U.S.)

| CLT Layup | Layup ID | Thickness, t_p (in.) | Allowable In-Plane Shear Stress | |
|-----------|----------|------------------------|---------------------------------|--------------------|
| | | | $F_{v,e,0}$ (psi) | $F_{v,e,90}$ (psi) |
| E1 | 78-3s | 3 1/8 | 155 ^(b) | 190 ^(b) |
| | 89-3s | 3 1/2 | 155 | 190 ^(b) |
| | 105-3s | 4 1/8 | 155 | 190 |
| | 131-5s | 5 1/8 | 185 ^(c) | 215 ^(c) |
| | 140-4s | 5 1/2 | 145 | 190 ^(b) |
| | 143-5s | 5 5/8 | 185 ^(c) | 215 ^(c) |
| | 175-5s | 6 7/8 | 185 | 215 |
| | 197-7s | 7 3/4 | 155 ^(b) | 215 ^(c) |
| | 213-7I | 8 3/8 | 185 ^(c) | 215 ^(c) |
| | 220-7s | 8 5/8 | 185 ^(c) | 215 ^(c) |
| | 244-7s | 9 5/8 | 185 ^(c) | 215 ^(c) |
| | 244-7I | 9 5/8 | 185 ^(c) | 215 ^(c) |
| | 267-9I | 10 1/2 | 155 ^(b) | 215 ^(c) |
| | 314-9I | 12 3/8 | 185 ^(c) | 215 ^(c) |

For SI: 1 psi = 0.006895 MPa

- (a) The tabulated values are for Allowable Stress Design (ASD) for use in the U.S. based on the full CLT thickness in the major strength direction ($F_{v,e,0}$) and minor strength direction ($F_{v,e,90}$). The values shall be used in conjunction with the CLT thickness, t_p , to determine the in-plane shear capacities. If the net CLT thickness is less than the full CLT thickness, the in-plane shear capacities shall be calculated based on the net CLT thickness.
- (b) Based on test results from 105-3s.
- (c) Based on test results from 175-5s.

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