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Institute for Research in Construction | Institut de recherche en construction

CCMC 13216-R

CCMC *EVALUATION REPORT*

DIVISION **06183**
Issued **2006-04-12**
Re-evaluation due **2009-04-12**

Nordic Lam ™

Nordic Engineered Wood
A Div. of Chantiers Chibougamau Ltd.
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Plant: 521 Merrill Road
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1. Purpose of Evaluation

The proponent sought confirmation from the Canadian Construction Materials Centre (CCMC) that "Nordic Lam™" glue-laminated timber (glulam) complies with the intent of the National Building Code of Canada (NBC) 1995 for use as beams and columns.

2. Opinion

Test results provided by the manufacturer show that "Nordic Lam™" glulam complies with CCMC's Technical Guide "Glulam Fabricated with Built-up Laminations of Short-Length End-Jointed Lumber," MasterFormat number 06183, dated 05-01-31. If used in accordance with the limitations and conditions stated in this report, the structural capacity of "Nordic Lam™" provides a level of structural performance equivalent to that required in:

- NBC 1995, Sections 4.1. and 4.3., and Article 9.23.4.2.

Materials used in the joists comply with:

- CSA O112.7-M1977, "Resorcinol and Phenol-Resorcinol Resin Adhesives for Wood (Room- and Intermediate-Temperature Curing);" and
- CCMC Technical Guide for Polymer Isocyanate Adhesive for Wood-Based Products, MasterFormat 06093 (see CCMC 12846-R and 12905-R).

The glulam plant manufacturing quality assurance complies with:

- CSA O177-M89, "Qualification Code for Manufacturers of Structural Glued-Laminated Timber."

Canada Mortgage and Housing Corporation permits the use of this product in construction financed or insured under the *National Housing Act*.

3. Description

"Nordic Lam™" is a glue-laminated timber construction made of black spruce in the tension and compression zones with either black spruce and/or spruce-pine-fir in the core. All laminating boards (lamina) are surfaced to a thickness of 50 mm or less prior to lamination. The lamina is made of short-length pieces, typically 900 mm with an occasional occurrence of no less than 685 mm, and are end-jointed by means of a structural finger joint. Laminations of various grades are arranged within the depth of the member according to the desired lay-up pattern having three zones. Table 2 outlines the minimum lay-up requirements.

The lamina may also be made with multiple pieces of 38 mm x 38 mm lumber graded in accordance with standard grading rules and face-bonded. The face bonding and end joints are bonded with either a phenol-resorcinol adhesive or a polyurethane adhesive.

APA-EWS conducts regular audits of the manufacturing plant and the quality assurance program to CSA O177-M.

The engineering properties of "Nordic Lam™" are listed in Table 1. The specified strengths for Limit States design were based on the format conversion used in CSA O86-01 for conventional Glulam. Additional engineering data is available from the manufacturer.

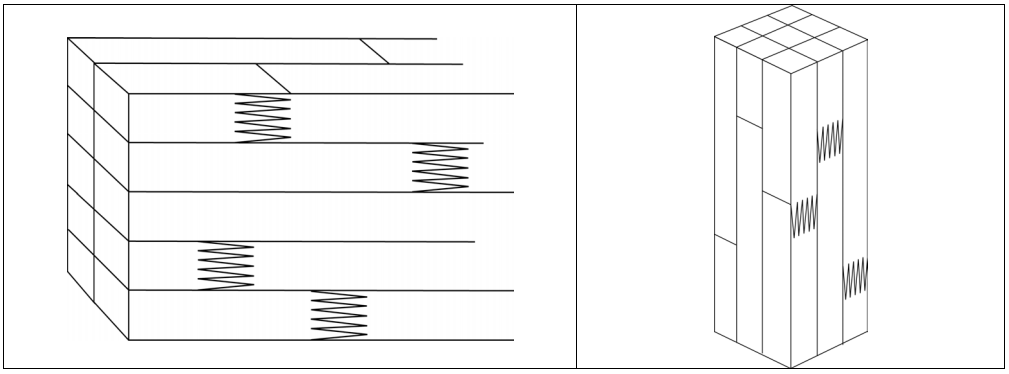

Figure 1. Examples of "Nordic Lam™" finger-jointed, short-length, face-bonded laminations in a beam and a column

Table 1. Specified Strengths (MPa) for "Nordic Lam™" Glued-Laminated Timbers(1)

	Beams		Columns	
Stress Grade	20F-1.6E	24F-1.9E		
EWS combination layup symbol	20F-E8M1	24F-E / ES1M1	ES11	ES12
Bending about X-X axis (Loaded Perpendicular to Wide Faces of Laminations)				
Bending at Extreme Fibre due to Positive Bending Moment (F_{bx})	25.6 (2)	30.7 (2)	17.2	24.9
Bending at Extreme Fibre due to Negative Bending Moment (F_{bx})	25.6 (2)	30.7 (2)	17.2	24.9
Longitudinal Shear (F_{vx})	2.2 (3)	2.2 (3)	2.2	2.2
Compression Perpendicular to Grain (F_{cp})				
Compression Face	5.8	7.0	5.8	7.0
Tension Face	5.8	7.0	5.8	7.0
True Modulus of Elasticity (E)	10 900	13 100	10 900	13 100
Apparent Modulus of Elasticity (E)	10 300	12 400	10 300	12 400
Bending about Y-Y axis (Loaded Parallel to Wide Faces of Laminations)				
Bending at Extreme Fibre due to Positive Bending Moment (F_{by})	13.4	14.1	17.9 (2 lams) 20.4 (3 lams) 22.4 (4+ lams)	29.4 (2 lams) 30.7 (3 lams) 30.7 (4+ lams)
Bending at Extreme Fibre due to Negative Bending Moment (F_{by})	13.4	14.1	17.9 (2 lams) 20.4 (3 lams) 22.4 (4+ lams)	29.4 (2 lams) 30.7 (3 lams) 30.7 (4+ lams)
Longitudinal Shear (F_{vy})	2.2	2.2	1.9 (2 lams) 2.1 (3 lams) 2.2 (4+ lams)	1.9 (2 lams) 2.1 (3 lams) 2.2 (4+ lams)
Compression Perpendicular to Grain (F_{cp})				
Compression Face	3.9	3.8	5.8	7.0
Tension Face	3.9	3.8	5.8	7.0
True Modulus of Elasticity (E)	10 300	10 900	10 900	13 100
Apparent Modulus of Elasticity (E)	9 700	10 300	10 300	12 400
Axially Loaded				
Compression Parallel to Grain (F_c)	14.4	16.5	19.4 (2 or 3 lams) 22.3 (4+ lams)	24.4 (2 or 3 lams) 33.0 (4+ lams)
Tension Parallel to Grain (F_t)	10.2	13.4	12.5	20.4
Modulus of Elasticity (E)	9 700	10 900	10 300	12 400

Notes to Table 1:

(1) Design of glulam members shall be in accordance with CSA O86-01, Engineering Design in Wood (Limit States Design).

(2) Maximum specified strength in bending, confirmed by test, for beams up to 600 mm in depth. *(For deeper beams based on an analytical approach consult the manufacturer and APA).* In addition, the specified strength in bending have been adjusted for volume (adjusted to CAN / CSA O86 standard beam of 130 x 610 x 9100 mm) and adjusted to a standard 12% moisture content.

(3) Specified strength in shear has been adjusted to a 2.0 m^3 of beam volume.

Table 2. Lay-up Combinations and Minimum Percent Grade Laminations

	Min. Grade of Laminations-Beam		Min. Grade of Laminations-Columns	
	20F-1.6E	24F-1.9E		
Zone	20F-E8M1	24F-E / ES1M1	ES11	ES12
Outer Compression	4 lams to 13 ½ in. 10% MSR 2250f > 13 ½ to 19 ½ in. 20% MSR 2250f > 19 ½ to 24 in. 15% MSR 2400f	≤ 24 in. 25% MSR 2250f	MSR 1650f	MSR 2250f
Inner	MSR 1650f	MSR 1650f		
Outer Tension	4 lams to 13 ½ in. 10% MSR 2250f > 13 ½ to 19 ½ in. 20% MSR 2250f > 19 ½ to 24 in. 15% MSR 2400f	≤ 24 in. 25% MSR 2250f		

Grade designations are as follows:
- MSR 2400f has a minimum long-span E of 1.8×10^6 psi
- MSR 2250f has a minimum long-span E of 1.71×10^6 psi and a mean long-span E of 1.9×10^6 psi
- MSR 1650f has a minimum long-span E of 1.4×10^6 psi

4. Usage and Limitations

"Nordic Lam™" is a glulam intended for use where conventional glulam is permitted by the 1995 NBC for structural use, i.e. typically for beams and columns.

"Nordic Lam™" is intended for 'dry service' use(1) applications only.

Conventional glulam is intended for combustible construction and its fire-resistance ratings may be determined in accordance with Appendix Note D-2.11. of the 1995 NBC. Fire-resistance ratings of "Nordic Lam™," have not been established, consult the manufacturer and Annex A of the 2005 version of CSA O177.

"Nordic Lam™" beams covered within the scope of this evaluation shall not exceed 2.0 m^3 in volume nor 600 mm in depth based on empirical data provided.

The published documents and pre-engineering outlined in 4(i) below, for the grades covered within this CCMC report, are intended to demonstrate compliance to Part 9 of the NBC for acceptance by the local authority having jurisdiction (AHJ). The pre-engineering was provided to CCMC by Nordic Engineered Wood. The pre-engineering was carried out in accordance with Part 4 of the NBC and sealed by a professional engineer for anticipated loads in small buildings falling within the scope of Part 9 of the NBC. Articles 4(iii) and 4(iv) outline when further engineering is required and whether the manufacturer provides engineering support for installation of the glue-laminated timber framing system.

i) Nordic Engineered Wood Pre-engineered Tables

When "Nordic Lam™" is used as beams, headers or columns, the installation must be in accordance with the spans and details found in the following documents, in limit states design for Canada:

- Nordic Lam ™, Beams and Headers, dated March 2006,

- Nordic Lam ™, Columns and Wall Studs, dated March 2006, and
- Nordic Lam ™, Residential Design / Construction Guide, dated January 2006.

Applications outside the scope of these installation guidelines and this CCMC evaluation report shall require engineering on a case-by-case basis.

ii) Nordic Engineered Wood Pre-engineered Installation Details

"Nordic Lam™" beams, headers and columns are to be installed in accordance with the installation details outlined in 4(i); their use is limited to building designs where the anticipated loads, outlined in the literature, on the following structural details are not exceeded:

- Floor Loads
- Roof Loads
- Garage Door Headers
- Bearing Length Requirements
- Connections for Multiple–Piece Members
- Columns
- Floor Framing Details
- Garage Door Header Framing Details
- Holes in Beams & Headers
- Tapered Cut

iii) Engineering Required

For structural applications beyond the scope / limitations of the above-referenced Nordic Engineered Wood publications 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.

Installations beyond the scope / limitations of 4(i) and 4(ii) imply, but are not limited to, the following:

- higher loads / longer spans than the manufacturer's pre-engineered details
- concentrated loads
- high wind and seismic areas
- non-bearing-type fastener designs
- design of supporting foundation footings when the total load exceeds the NBC 1995 pre-engineered floor / roof joist spans and beam spans
- fire-resistance ratings

The engineer shall design in accordance with CSA O86 and may use, as a guide, the *Engineering Guide for Wood Frame Construction* published by the Canadian Wood Council.

iv) Engineering Support Provided by Manufacturer

Nordic Engineered Wood does provide engineering support. Nordic Engineered Wood offers the following customer support contact number:

Nordic Engineered Wood: 1-514-633-9661

This product must be identified with the phrase "CCMC # 13216-R" along the side or top of the glulam member. This CCMC number is only valid when it appears in conjunction with the APA-EWS certification mark.

Damaged or defective product shall not be used, unless repaired in accordance with written instructions from the manufacturer.

[(1)]General Note: 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 equilibrium moisture content (M.C.) 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 a M.C. 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% M.C. is not exceeded in accordance with the NBC 1995, Article 9.3.2.5.

5. Performance

Structural testing of the "Nordic Lam™" was carried out at accredited labs recognized by CCMC and witnessed and certified by APA.. The tests were in accordance with CCMC's Technical Guide "Glulam Fabricated with Built-up Laminations of Short-Length End-Jointed Lumber," MasterFormat number 06183, dated 05-01-31. Results of the tests are summarized below.

"Nordic Lam™" with a built-up lamina that is made of short-length end-jointed and edge-bonded lumber laminations (i.e. less that 1830 mm (6') long) is not covered in commodity-type glulam by CAN/CSA-O122, "Structural Glued-Laminated Timber." In this case, the proprietary laminations are 'manufactured' differently than described in CAN/CSA-O122, but are produced to match the same 24f and 20f conventional glulam stress grades to allow for direct substitution of the conventional laminations.

The equivalency being sought is with respect to producing conventional 24f and 20f stress grades. This is to be accomplished by establishing bending strength and stiffness that are equivalent to or better than conventional glulam lamination grades. The quality of manufacturing of new built-up short-length lamina in proprietary lay-up designs will be equivalent to glulam manufactured in accordance with CAN/CSA-O122. In addition, beams covered within the scope of this report are limited to a maximum 2.0 m^3 in volume and 600 mm depth of beams.

Short-length Elements

The short-length lumber elements are typically 900 mm with an occasional occurrence of no less than 685 mm. The laminating effect of joining 38 mm x 38 mm short lengths and face-bonding was demonstrated by testing a statistical sample of short-length end-joints, jointed short-length elements, and 38 mm x 140 mm lamina made of short-length elements. In production, the jointed elements are proof-loaded at the full-length.

Tension

Tension testing of 102 samples of various lamina grades was conducted to confirm the design tension values.

Modulus of Elasticity

Long span E was confirmed on statistical samples of all grades of lamina.

Moment Capacity

The moment capacity predictions were confirmed through testing of sixty (60) beams of 20f and 24f grades at 300-mm and 400-mm depths. Fifteen (15) beams of 600-mm depth were also tested.

Shear Capacity

Thirty (30) short beams of 450-mm depth were tested to confirm the characteristic value.

Compression Parallel to Grain

Thirty (30) short column tests were conducted for 89 mm x 89 mm and 140 mm x 140 mm columns to confirm the characteristic value.

Fasteners

Fastener tests were not conducted to establish an 'equivalent' species for fastener design. SPF species is recommended for fastener design as a conservative approach.

Manufacturing Quality Assurance

The manufacturing quality assurance program follows the principles of CSA O177 and ANSI 190.1 is verified by APA-EWS part of the plant qualification.

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