

Performance of Adhesives in Finger-joined Lumber in Fire-resistance-rated Wall Assemblies

The Canadian Wood Council (CWC) and its member companies have a long history of conducting research to ensure that wood products achieve the level of safety required by the building code. In cooperation with FPInnovations, Canada’s forest products laboratory and the US Forest Products Laboratory, the CWC and American Forest & Paper Association (AF&PA) initiated a research program to better understand the performance of adhesives used in finger-joined lumber in fire-resistance-rated assemblies.

As part of the research, the wood products industry conducted ASTM E119 (equivalent to CAN/ULC-S101 in Canada) fire-resistance tests on finger-joined lumber wall assemblies in March 2006, August 2006, and December 2006, at NGC Testing in Buffalo, New York. In light of this research, it appeared that adhesives used in finger-joined lumber should be evaluated for use in fire-resistance-rated assemblies. Across the industry, many different adhesives have been used in making finger-joined lumber and identification of the particular adhesive used is usually not available with the product.

Table 1 summarizes the full-scale fire-resistance test results. All fire tests were conducted on the wall assembly design specified in U.S. 2006 International Building Code Table 720.1(2), Item Number 15-1.15. The wall assembly design tested is similar to the wall assembly described in the *2010 National Building Code of Canada (NBCC)*,¹ Table A-9.10.3.1.A., Wall Number W1a, with mineral wool insulation in the stud cavity.

In Division B of the NBCC, the requirements of Sentence 9.23.10.4.(1) *Continuity of Studs* states: “Wall studs shall be continuous for the full storey height except at openings and shall not be spliced except by finger-joining with a structural adhesive. (See Appendix A.)”

The Appendix note of NBCC Section A-9.23.10.4.(1) Fingerjoined Lumber states, in part: “The NLGA *Standard Grading Rules for Canadian Lumber (Interpretation Included)* referenced in Article 9.3.2.1.

refers to two special product standards, SPS-1, *Fingerjoined Structural Lumber* and SPS-3, *Fingerjoined ‘Vertical Stud Use Only’ Lumber* as produced by the NLGA. Material identified as conforming to these standards is considered to meet the requirements in this Article for joining with a structural adhesive.”

| Type of Lumber | Assembly Loading* | Fire Resistance Rating |
|--|-------------------|------------------------|
| Finger-joined lumber studs made with a Phenol-Resorcinol Formaldehyde adhesive | 100% design | 1 hour |
| Finger-joined lumber studs made with a Poly-Urethane adhesive | 100% design | 51 min |
| Finger-joined lumber studs made with a Poly-Vinyl Acetate adhesive | 100% design | 49 min |
| * Based on US National Design Specification (NDS) for Wood Construction, 2005 Edition. | | |

Table 1. Full-scale fire-resistance test results – finger-joined lumber with differing adhesives.

Even though no problems had been brought to our attention with the fire-performance of finger-joined lumber in the field, the CWC and National Lumber Grades Authority (NLGA) worked in conjunction with the Canadian Lumber Standards Accreditation Board (CLSAB), AF&PA and the American Lumber Standards Committee (ALSC) to develop appropriate qualification criteria for finger-joined lumber adhesives, along with requirements for proper labelling for identification by building officials.

On February 23, 2007, the ALSC approved an amendment to its Glued Lumber Policy (GLP) to provide for labelling of finger-joined lumber for designating use

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of either a Heat Resistant Adhesive (HRA) or Non-Heat Resistant Adhesive (Non-HRA) by glued lumber manufacturers, for the US market.

The ALSC Glued Lumber Policy may be found at: http://www.alsc.org/untreated_gluedlbr_mod.htm.

On March 2, 2007, the AF&PA's Subcommittee on Fire Performance approved an Adhesive Qualification Procedure for conducting large scale fire tests using FJL in a wall assembly.

Subsequently, this methodology was standardized by ASTM forming two new ASTM standards, D7374-08 Practice for Evaluating Elevated Temperature Performance of Adhesives Used in End-Jointed Lumber and D7470-08 Practice for Evaluating Elevated Temperature Performance of End-Jointed Lumber Studs.

On April 4, 2007, CLSAB approved revisions to two of the NLGA special product standards, SPS-1 and SPS-3, for finger-joined lumber in the Canadian market. The revisions reference the new NLGA SPS Annex B – *Elevated-Temperature Adhesive Qualification Procedure*, which references the ASTM standards above.

Therefore, effective April 4, 2007, finger-joined lumber manufactured in Canada and grade stamped under the

accreditation system of the CLSAB is required to be stamped with marks that include either the designation “HRA” or “Non-HRA”, to signify whether a “Heat Resistant Adhesive” has been utilized in the finger-joined lumber.

In September 2007, CWC submitted a code-change proposal to the Canadian Commission on Building and Fire Codes (CCBFC) to change the NBCC by adding a footnote to the table of ‘generic’ fire-resistance ratings for wall assemblies, Table A-9.10.3.1.A *Fire and Sound Resistance of Walls*, that would make reference to the adhesive testing and qualification criteria requirements for finger-joined lumber for use in generic-fire-resistance-rated wood-stud wall assemblies.

This proposed code change would not affect ‘proprietary’ fire-resistance-rating listings of wood-frame wall assemblies constructed using finger-joined lumber.

Having been approved through the code process, the code change was included in the 2010 edition of the NBCC.

[This information relates only to finger-joined lumber used in fire-resistance-rated wall assemblies.]

¹ National Building Code of Canada, National Research Council, Ottawa, ON, 2010.