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Research Library

Advanced wood-based solutions for mid-rise and high-rise construction: Mid-rise wood exit shaft demonstration fire test report

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Author:	Ranger, Lindsay
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	Bénichou, Noureddine
Contributor:	Natural Resources Canada. Canadian Forest Service
Date:	April 2018
Material Type:	Research report
Physical Description:	48 p.
Sector:	Wood Products
Field:	Sustainable Construction
Research Area:	Advanced Wood Materials
Subject:	Wood
	Fire
	Building code
	Residential construction
Language:	English
Abstract:	FPInnovations conducted a research project to study the construction of mid-rise wood exit shafts in Ontario and Québec. The scope of the project included an investigation into the concerns that have been raised in regards to the use of wood exits in mid-rise buildings, an analysis of recent Canadian fire statistics in residential multi-family structures, and a fire demonstration of a mass timber wall and supported light-frame floor. This report describes the fire demonstration completed as part of this project; this report acts as a supplement to the full project report.

Documents

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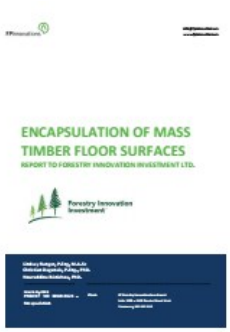
Encapsulation of mass timber floor surfaces, report to



Forestry Innovation Investment Ltd.

https://library.fpinnovations.ca/en/permalink/fpipub53043

Author:	Ranger, Lindsay
	Dagenais, Christian
	Bénichou, Noureddine
Contributor:	Natural Resources Canada. Canadian Forest Service
Date:	March 2020
Material Type:	Report
Physical Description:	55 p.
Sector:	Wood Products
Field:	Sustainable Construction
Research Area:	Building Systems
Subject:	Wood
	Fire
	Design
	Building code
	Floors
	Fire tests
	Residential construction
Language:	English
Abstract:	Currently, mass timber building designs commonly incorporate a concrete floor topping. This can improve building accoustics by increasing the mass of the assembly, reduce floor vibration and create a smooth flat surface to install finish flooring on. The installation of concrete requires formwork, pouring and finishing the concrete and time to cure which adds to project schedules. One way to address this is to use mass timber elements that are prefabricated with concrete toppings preinstalled. Replaceing the concrete floor toppings wiht dry alternatives, such as cement board, may also reduce construction timelines, while still ensuring adequate acoustic and vibration performance. Cement board needs only to be screwed in place and can be walked on immediately after installation; this reduction in construction time may reduce overall project costs and help make wood buildings more cost competitive than other types of construction.

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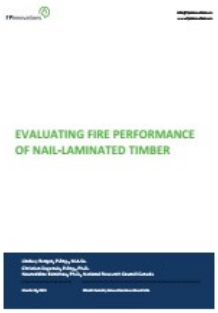

Evaluating fire performance of nail-laminated timber

https://library.fpinnovations.ca/en/permalink/fpipub52830

Author:	Ranger, Lindsay
	Dagenais, Christian
	Bénichou, Noureddine
Contributor:	Forertry Innovation Investment Ltd.
Date:	March 2019
Material Type:	Research report
Physical Description:	44 p.
Sector:	Wood Products
Field:	Sustainable Construction
Research Area:	Building Systems
Subject:	Building construction
	Fire
	Nailing
	Laminate product
	Cross Laminated Timber (CLT)
	Mechanical properties
Language:	English
Abstract:	The objective of this work is to generate fire resistance data for NLT assemblies to address significant gaps in technical knowledge. This research will support designers and builders in the use of mass timber assemblies in larger and taller buildings, as well as provide scientific justification for Authorities Having Jurisdiction (AHJ) to review and accept this construction method. The intent is to demonstrate that NLT construction can meet or exceed NBCC fire safety requirements for use in buildings of mass timber construction. The data could be used towards the inclusion of an NLT fire resistance calculation methodology into Annex B of CSA O86 – Engineering Design for Wood [4], which currently addresses only glue-laminated timber (GLT), structural composite lumber (SCL) and cross-laminated timber (CLT).

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Preliminary CLT fire resistance testing report

https://library.fpinnovations.ca/en/permalink/fpipub39445

Author:	Osborne, Lindsay
	Dagenais, Christian
	Bénichou, Noureddine
Date:	July 2012
Material Type:	Research report
Physical Description:	107 p.
Sector:	Wood Products
Field:	Sustainable Construction
Research Area:	Building Systems
Subject:	Timber
	Resistance
	Laminate product
Series Number:	Project No. 301006155
	E-4794
Location:	Québec, Québec
Language:	English

Abstract: FPInnovations is involved in a large research project regarding CLT construction. One objective of this research is the creation of a design methodology for calculating the fire-resistance of CLT assemblies/construction. This methodology will foster the design of fire-safe buildings of wood or hybrid construction. In order to establish such calculation methods, a series of experimental tests has been undertaken. A total of eight full-scale CLT fire resistance tests have been conducted at the NRC fire laboratory where the panels were subject to the standard ULC S101 [1] fire exposure. The series consisted of three wall and five floor tests. Each test was unique using panels with a different number of plies and varying thicknesses. Some of the assemblies were protected using CGC Sheetrock® FireCode® Core Type X gypsum board while others were left unprotected.

The panels were instrumented with thermocouples and deflections gauges. Thermocouples were placed in accordance with the standard layout. In addition, thermocouples were placed in between the CLT plies and at mid-depth of each ply at five locations. In tests where the panels were protected, thermocouples were also placed between the layers of gypsum board as well as between the gypsum board and the panels.

Test 1 was a 3-ply floor assembly protected with two layers of ½" Type X gypsum board. A load of 2.7 kPa was applied. The test was terminated at 77 minutes due to equipment concerns from the laboratory staff; therefore structural failure was not reached. The maximum deflection of the floor was 32.1 mm.

Test 2 was a 3-ply wall assembly protected with two layers of ½" Type X

gypsum board, which failed structurally due to buckling after 106 minutes when subjected to a load of 333 kN/m. From one data point a charring rate of 0.4 mm/min was calculated. The maximum average deflection of the wall was 47.5 mm. The two layers of gypsum delayed the onset of charring in both the floor and wall tests by approximately 60 minutes.

Test 3 was an unprotected 5-ply floor with an applied load of 11.75 kPa. The floor failed after 96 minutes when flames were observed at one of the joints. The maximum deflection was 129.4 mm.

Test 4 was an unprotected 5-ply wall with an applied load of 333 kN/m. The wall failed after 113 minutes due to structural failure. The assembly popped out of the furnace possibly to a loading eccentricity that developed as the panels charred during the test. The maximum deflection was 47.7 mm.

Test 5 was a 3-ply floor protected with one layer of 5/8” Type X gypsum board. A load of 2.4 kPa was applied. The floor failed after 86 minutes due to flames observed at one of the joints. The maximum deflection was 321.4 mm.

Test 6 was a 5-ply floor protected with one layer of 5/8” Type X gypsum board. A load of 8.1 kPa was applied. The floor failed after 124 minutes due to flames observed at one of the joints. The maximum deflection was 153 mm.

Test 7 was an unprotected 7-ply floor. A load of 14.58 kPa was applied. The floor failed after 178 minutes due to structural failure. The maximum deflection was 170 mm.

Test 8 was a 5-ply wall with 21 mm plies. A load of 72 kN/m was applied. The wall failed after 57 minutes due to structural failure. The maximum deflection was 77 mm.

Cross-laminated timber

Fire resistance tests

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Solutions for upper mid-rise and high-rise mass timber construction: fire resistance of mass timber laminated elements

https://library.fpinnovations.ca/en/permalink/fpipub52833

Author:	Ranger, Lindsay
	Dagenais, Christian
	Bénichou, Noureddine
Contributor:	Natural Resources of Canada (NRCan)
Date:	March 2019
Material Type:	Research report
Physical Description:	62 p.
Sector:	Wood Products
Field:	Sustainable Construction
Research Area:	Building Systems
Subject:	Building construction
	Fire
	Cross Laminated Timber (CLT)
	Mid-rise
	Hig-rise
	Charring
	Floors
	Walls
	Wood building systems
Language:	English
Abstract:	This project assesses the fire resistance of laminated timber structural systems as wall and floor assemblies. Full-scale tests were conducted to assess structural fire resistance and charring behaviour. This research could be used to expand current fire design provisions and support inclusion of these types of assemblies into Annex B of CSA O86.

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