Composite CLT-Glulam Double-T Panels

https://research.thinkwood.com/en/permalink/catalogue2645

Organization:	Fast + Epp
	University of Northern British Columbia
Country of Publication:	Canada
Material:	CLT (Cross-Laminated Timber)
	Glulam (Glue-Laminated Timber)
Application:	Floors
	Roofs
Topic:	Mechanical Properties
	Connections
Keywords:	Vibration
	Stiffness Properties
	Strength
	Screw
	Vibration Test
	Monotonic Loading Tests
	GCWood
Research Status:	In Progress

Summary:

To support the associated Sir Matthew Begbie Elementary School and Bayview Elementary School projects in pushing the boundaries forward for long-span floor and roof construction, this testing project aims to compare different connection approaches for composite connections between glulam and cross-laminated timber (CLT) – for vibration, stiffness, and strength. Working with the University of Northern British Columbia (UNBC), Fast + Epp aimed to complete a series of vibration and monotonic load tests on 30’ long full-scale double-T ribbed panels. The tests consisted of screws in withdrawal, screws in shear, and nominal screws clamping with glue. Both the strength and stiffness are of interest, including slip stiffness of each connection type. This physical testing was completed in January and February 2020, where the full composite strength of each system was reached. Initial data analysis has provided information for comparison with existing models for shear connection stiffness. Publications will follow in 2021.

Resource Link

https://www.fastepp.com/portfolio/composite-clt-glulam-double-t-panels/

Design Options for Three- and Four-Storey Wood School Buildings in British Columbia

https://research.thinkwood.com/en/permalink/catalogue2373

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Organization:	Fast + Epp
	Wood Works! BC
	Thinkspace
Year of Publication:	2019
Country of Publication:	Canada
Format:	Report
Material:	CLT (Cross-Laminated Timber)
	NLT (Nail-Laminated Timber)
	DLT (Dowel Laminated Timber)
	Glulam (Glue-Laminated Timber)
	Other Materials
Application:	Wood Building Systems
Topic:	Design and Systems
Keywords:	Construction
	Education
	School Buildings
	Mass Timber
	Multi-Storey
	Building Code
	Fire Protection
Language:	English
Research Status:	Complete

Summary:

This study illustrates the range of possible wood construction approaches for school buildings that are up to four storeys in height. As land values continue to rise, particularly in higher-density urban environments, schools with smaller footprints will become increasingly more necessary to satisfy enrollment demands. There are currently a number of planned new school projects throughout British Columbia that anticipate requiring either three-or four-storey buildings, and it is forecasted that the demand for school buildings of this size will continue to rise.

This study is closely related to the report Risk Analysis and Alternative Solution for Three- and Four-Storey Schools of Mass Timber and/or Wood-Frame Construction prepared by GHL Consultants, which explores the building code related considerations of wood construction for school buildings that are up to four storeys in height. Though wood construction offers a viable structural material option for these buildings, the British Columbia Building Code (BCBC 2018) currently limits schools comprised of wood construction to a maximum of two storeys, while also imposing limits on the overall floor area. As such, the reader is referred to the GHL report for further information regarding building code compliance (with a particular emphasis on fire protection) for wood school buildings.

Online Access: Free

Resource Link

http://wood-works.ca/wp-content/uploads/2019/12/Design-Options-for-Three-and-Four-Storey-Wood-School-Buildings-in-BC-Final.pdf

MEGANT Concealed Beam Hanger Interstorey Drift Testing

https://research.thinkwood.com/en/permalink/catalogue2742

Organization:	Fast + Epp
	Queen's University
Country of Publication:	Canada
Material:	Glulam (Glue-Laminated Timber)
Application:	Beams
Topic:	Seismic
	Connections
Keywords:	Rotation Capacity
	Beam Hanger
	GCWood
Research Status:	In Progress

Multi-Storey Continuous CLT Shear Wall Testing

https://research.thinkwood.com/en/permalink/catalogue2646

Organization:	Fast + Epp
Country of Publication:	Canada
Material:	CLT (Cross-Laminated Timber)
Application:	Wood Building Systems
	Shear Walls
Topic:	Seismic
	Mechanical Properties
Keywords:	Monotonic Test
	Reverse Cyclic Test
Research Status:	In Progress

Summary:

To support the associated elementary school projects in pushing the boundaries forward for wood construction in seismic zones, this testing project aims to establish the seismic behaviour of two-storey continuous cross-laminated (CLT) timber shear walls in comparison to typical single-storey CLT shear walls and ensure they are able to provide necessary ductility in a seismic event. Working with the University of Northern British Columbia (UNBC), Fast + Epp aimed to complete a series of monotonic and reversed cyclic tests on CLT shear walls. The test setup was developed to determine the behaviour of these types of shear walls for the project specific application, as well as provide a basis to further develop this type of system for the engineering community. The multi-storey continuous CLT panel shear walls will allow for more efficient and cost-effective construction – reducing construction time, material handling, and the number of connectors required. The lab testing of these shear walls is complete, with data analysis underway. Results are intended to be published in 2021.

Resource Link

https://www.fastepp.com/portfolio/multi-storey-continuous-clt-shear-wall-testing/

Perforated Plate Testing

https://research.thinkwood.com/en/permalink/catalogue2647

Organization:	Fast + Epp
Country of Publication:	Canada
Material:	Glulam (Glue-Laminated Timber)
Application:	Frames
Topic:	Seismic
	Design and Systems
	Connections
Keywords:	Braced Frames
	Dissipation
	Cyclic Tests
	Monotonic Test
	GCWood
Language:	English
Research Status:	In Progress

Summary:

As part of Fast + Epp's ongoing work to push the boundaries of Tall Wood construction in seismic zones, this testing program aims to develop a new dissipative system for use in timber braced frames or other timber lateral systems where the connections provide energy dissipation. The connections are designed to dissipate energy through ductile steel plates to provide robust and well understood dissipative systems. In collaboration with the Advanced Research in Timber Systems' team at the University of Alberta, Fast + Epp is working on a four-phase testing program for cyclic and monotonic testing of various configurations of perforated plate connections. Small scale tests have been completed on perforated plates, and entire connections will be examined in advance of a full-scale timber brace frame test to evaluate the overall behaviour. One phase of physical testing was completed in January 2020, with the next 3 phases intended to be completed in 2021. Initial data analysis of the first phase testing has resulted in tuning of the system in advance of later phase testing. Results on the first two or three phases of testing are anticipated to be completed in 2020 with initial publication of the results in early 2021.

Resource Link

https://www.fastepp.com/portfolio/perforated-plate-testing/

Transferability of 2021 International Building Code Tall Wood Building Provisions to the National Building Code of Canada

https://research.thinkwood.com/en/permalink/catalogue2806

Organization:	GHL Consultants Ltd.
	Fast + Epp
Year of Publication:	2021
Country of Publication:	Canada
Format:	Report

Material:	CLT (Cross-Laminated Timber)
	Glulam (Glue-Laminated Timber)
	NLT (Nail-Laminated Timber)
	Other Materials
Application:	Hybrid Building Systems
	Wood Building Systems
Topic:	Fire
	Design and Systems
	Seismic
Keywords:	National Building Code of Canada
	International Building Code
	Building Code
	Encapsulated Mass Timber Construction
	Encapsulation
	Exposed Mass Timber Elements
	Building Height
	Building Area
	Fire Resistance Rating
Language:	English
Research Status:	Complete

Summary:

The acceptable solutions in Division B of the anticipated 2020 NBCC limit the height of Groups C and D buildings of sprinklered encapsulated mass timber construction (EMTC) to 12 storeys in building height, and a measured building height of 42m. The recently published 2021 IBC contains provisions to permit buildings of mass timber construction under the IBC Type IV construction, surpassing the NBCC provisions by maximum building height, building area, occupancy groups, and interior exposed timber. The IBC mass timber buildings are permitted to have a building height of maximum 18 storeys, depending on the occupancy group. Within Type IV construction, four subdivisions are described to have varying maximum permissible building height, area, fire resistance rating (FRR), and interior exposed timber.

Through a comparison of mass timber provisions of both Codes, relevant research reports, test reports, industry standards, this report documents the consequential and inconsequential differences and developed conclusions on whether the NBCC can adopt the IBC provisions, and with what modifications so that the new provisions may fit the NBCC context.

Online Access: Free

Resource Link

https://www.bcfii.ca/wp-content/uploads/2021/06/2021-06-07-Transferability-Report-GHL-7958.00-FE-GHL.pdf