2021 Edition of Technical Guide for the Design and Construction of Tall Wood Buildings in Canada

https://research.thinkwood.com/en/permalink/catalogue2585

Organization:	FPInnovations
Country of Publication:	Canada
Application:	Wood Building Systems
Topic:	Design and Systems
Keywords:	Structural Seismic Fire Performance Vibration Acoustics Building Envelope Sustainability Prefabrication Monitoring
Research Status:	In Progress
Notes:	Project contact is Erol Karacabeyli at FPInnovations

Summary:

To support NRCan's Tall Wood Building Demonstration Initiative, FPInnovations developed and published the 2014 Edition of Technical Guide for the Design and Construction of Tall Wood Buildings in Canada. More than 80 technical professionals comprised of design consultants and experts from FPInnovations, the National Research Council, the Canadian Wood Council and universities were involved in its development. The Guide has gained national and worldwide reputation as one of the most complete and credible documents helping to introduce to the design and construction community, and Authorities Having Jurisdiction the terms "Mass Timber Construction" and "Hybrid Tall Wood Buildings".

Since the publication of the First Edition, a number of tall wood buildings have been designed and constructed. Substantial regulatory changes are expected to happen based on the experience obtained from the demonstration initiative and the extensive research that has taken place domestically and internationally since the publication of the First Edition. These developments highlight a need for the Guide to be updated so that it aligns with efforts currently underway nationally and provincially and continues to lead in providing the design and construction community technical insight into new opportunities for building in wood.

The First Edition of the Guide helped to focus the efforts of the early adopters who participated in NRCan's Tall Wood Building Demonstration Initiative. Updating and aligning the Guide with the release of the new National Building Code of Canada and the Canadian wood design standard (CSA O86), and sharing the experiences gained from tall wood buildings built since the First Edition, will not only continue to expand the base of early adopters, but also help to move aspects of mass timber and hybrid wood buildings into the mainstream.

Advanced Industrialized Construction to Achieve High Building Energy Efficiency

https://research.thinkwood.com/en/permalink/catalogue2828

Author:	Wang, Jieying
Organization:	FPInnovations
Year of Publication:	2021
Country of Publication:	Canada
Format:	Report
Material:	Light Frame (Lumber+Panels)
Application:	Wood Building Systems
	Building Envelope
Topic:	Energy Performance
Keywords:	Prefabrication
	Offsite Construction
	Energy Efficiency
	Retrofit
	New Construction
	Mid-Rise
Language:	English
Research Status:	Complete
Series:	InfoNote

Summary:

Advanced industrialized construction methods enable complex building components and systems to be built with high precision and quality. This manufacturing technique has an advantage to provide cost-competitive and high energy efficient building components and systems for both retrofits and new construction. This document gives an overview of the use of prefabricated panels in building Net Zero Energy Ready wood-frame multi-unit residential buildings (MURBs) in Edmonton.

Online Access: Free

Resource Link

https://library.fpinnovations.ca/en/permalink/fpipub7950

Analysis of the Characteristics of External Walls of Wooden Prefab Cross Laminated Timber

https://research.thinkwood.com/en/permalink/catalogue2694

Author: Švajlenka, Jozef
Kozlovská, Mária
Badida, Miroslav
Moravec, Marek
Dzuro, Tibor
Vranay, František

Publisher: MDPI
Year of Publication: 2020
Format: Journal Article
Material: CLT (Cross-Laminated Timber)
Application: Walls
Topic: Energy Performance
Acoustics and Vibration
Keywords: Acoustic Properties
Thermal Properties
Prefabrication
Language: English
Research Status: Complete
Series: Energies

Summary:

A balanced combination of heat flows creates suitable conditions for thermal comfort—a factor contributing to the quality of the internal environment of buildings. The presented analysis of selected thermal-technical parameters is up-to-date and suitable for verifying the parameters of building constructions. The research also applied a methodology for examining the acoustic parameters of structural parts of buildings in laboratory conditions. In this research, selected variant solutions of perimeter walls based on prefab cross laminated timber were investigated in terms of acoustic and thermal-technical properties. The variants structures were investigated in laboratory but also in model conditions. The results of the analyses show significant differences between the theoretical or declared parameters and the values measured in laboratory conditions. The deviations of experimental measurements from the calculated or declared parameters were not as significant for variant B as they were for variant A. These findings show that for these analyzed sandwich structures based on wood, it is not always possible to reliably declare calculated values of thermal-technical and acoustic parameters. It is necessary to thoroughly examine such design variants, which would contribute to the knowledge in this field of research of construction systems based on wood.

Online Access: Free

Resource Link

https://doi.org/10.3390/en13225974

An Innovative Connection System for CLT Structures: Experimental – Numerical Analysis

https://research.thinkwood.com/en/permalink/catalogue460

Author:	Polastri, Andrea
	Angeli, Albino
Year of Publication:	2014
Country of Publication:	Canada
Format:	Conference Paper
Material:	CLT (Cross-Laminated Timber)
Topic:	Connections
Keywords:	Prefabrication
	Self-Tapping Screws
	X-RAD
Language:	English
Conference:	World Conference on Timber Engineering
Research Status:	Complete
Notes:	August 10-14, 2014, Quebec City, Canada

Summary:

The paper describes experimental and numerical analyses on a completely new connection system developed for CLT (Cross Laminated Timber) constructions. The innovative solution herein proposed, named X-RAD, consists of a point-to-point mechanical connection system, fixed to the corners of the CLT panels. This connection, that is designed to be prefabricated, is made of a metal wrapping and an inner hard wood element which are fastened to the panel by means of allthreaded self-tapping screws. Such system permits to reduce significantly the number of bolts/fasteners required to assemble two or more panels together or to connect them to the foundation. This results in the enhancement of the installation process in terms of speed, quality and safety. One of the reasons that fuelled the development of the presented system, is the desire of offering a solution to those issues (e.g. to satisfy ductility and energetic dissipation requirements) commonly related to the seismic safety of timber structures. In other words there was the will of defining a system able to guarantee an adequate level of ductility and energetic dissipation.

Online Access:	Free

Resource Link

http://schd.ws/hosted_files/wcte2014/f2/ABS511_Angeli_web.pdf

Calculative Cost and Process Analysis of Timber-Concrete-Composite Ceilings with Focus on Effort and Performance Values for Cost Calculations of Multi-Storey Timber Buildings

https://research.thinkwood.com/en/permalink/catalogue1753

Author:	Koppelhuber, Joerg
	Leitenbauer, Alexander
	Heck, Detlef
Year of Publication:	2016
Country of Publication:	Austria
Format:	Conference Paper
Material:	Timber-Concrete Composite
	CLT (Cross-Laminated Timber)
Application:	Ceilings
Topic:	Cost
Keywords:	Prefabrication
	Multi-Storey
Language:	English
Conference:	World Conference on Timber Engineering
Research Status:	Complete
Notes:	August 22-25, 2016, Vienna, Austria p. 5006-5014

Summary:

Composite structures use the advantages of two materials – timber and concrete – and improve the efficiency of a material application. Especially the concept of timber-concrete-composite ceilings has synergetic effects to achieve an effective ratio of thickness to span with high cost effectiveness simultaneously. Following the systematic...

Online Access: Free

Resource Link

http://hdl.handle.net/20.500.12708/172

Case Study: An 18 Storey Tall Mass Timber Hybrid Student Residence at the University of British Columbia, Vancouver

https://research.thinkwood.com/en/permalink/catalogue2120

Author:	Fast, Paul
	Gafner, Bernhard
	Jackson, Robert
	Li, Jimmy
Year of Publication:	2016
Country of Publication:	Canada
Format:	Conference Paper
Material:	CLT (Cross-Laminated Timber)
Application:	Wood Building Systems
Topic:	Design and Systems
Keywords:	Tall Wood
	Mass Timber
	Rolling Shear
	Prefabrication
	Damping
	Tolerances
Language:	English
Conference:	World Conference on Timber Engineering
Research Status:	Complete

Summary:

This article outlines the structural design approach used for the Brock Commons Student Residence project, an 18-storey wood building at the University of British Columbia in Vancouver, Canada. When completed in summer 2017, it will be the tallest mass timber hybrid building in the world at 53 meters high. Fast + Epp are the structural engineers, working in conjunction with Acton Ostry Architects and Hermann Kaufmann Architekten. Total project costs, inclusive of fees, permits etc. are $51.5M CAD.

Online Access:	Free

Resource Link

http://www.fastepp.com/wp-content/uploads/WCTE-Tallwood-House-at-Brock-Commons-Case-Study-Credit-Fast-Epp.pdf

CNC-Fabricated Dovetails for Joints of Prefabricated CLT Components

https://research.thinkwood.com/en/permalink/catalogue1124

Author:	Robeller, Christopher
	Hahn, Benjamin
	Mayencour, Paul
	Weinand, Yves
Publisher:	Springer-Verlag
Year of Publication:	2014
Country of Publication:	Germany
Format:	Journal Article
Material:	CLT (Cross-Laminated Timber)
Topic:	Connections
Keywords:	Prefabrication
	CNC
	Dovetail
Language:	German
Research Status:	Complete
Series:	Bauingenieur
ISSN:	0005-6650

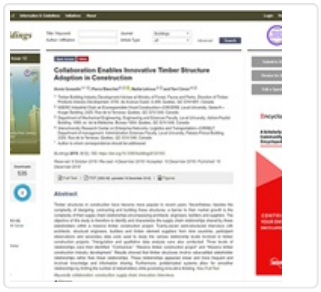
Summary:

The widely available automated prefabrication in timber construction companies, as well as modern CAD software with application programing interfaces, allow for the design and production of increasingly geometrically complex building components. This development also enables and demands at the same time advanced joinery techniques. Analog to the developments in timber framing, this article presents the adaptation of a traditional wood-wood joinery technique from cabinetmaking, on the casestudy of a shell structure built from curved cross-laminated timber (CLT) panels. The dovetail-joints allow for a load-bearing glued joint between the CLT panels. They provide an aesthetic, visible connection and simplify the assembly through their integrated locator features.

Online Access: Free

Resource Link

https://infoscience.epfl.ch/record/200994/files/X%20261a%20Robeller%20FINAL.pdf



Collaboration Enables Innovative Timber Structure Adoption in Construction

https://research.thinkwood.com/en/permalink/catalogue2007

Author:	Gosselin, Annie
	Blanchet, Pierre
	Lehoux, Nadia
	Cimon, Yan
Publisher:	MDPI
Year of Publication:	2018
Country of Publication:	Switzerland
Format:	Journal Article
Application:	Wood Building Systems
Topic:	Market and Adoption
Keywords:	Supply Chain
	Construction
	Prefabrication
	Procurement
Language:	English
Research Status:	Complete
Series:	Buildings
ISSN:	2075-5309
Online Access:	Free

Resource Link

https://doi.org/10.3390/buildings8120183

Compression Perpendicular to Grain Behavior for the Design of a Prefabricated CLT Facade Horizontal Joint

https://research.thinkwood.com/en/permalink/catalogue1540

Author:	Gasparri, Eugenia
	Lam, Frank
	Liu, Yingyang
Year of Publication:	2016
Country of Publication:	Austria
Format:	Conference Paper
Material:	CLT (Cross-Laminated Timber)
Application:	Wood Building Systems
	Hybrid Building Systems
Topic:	Connections
	Design and Systems
Keywords:	Envelope
	Joints
	Self-Tapping Screws
	Finite Element Analysis
	Prefabricated
	Vertical Loads
Language:	English
Conference:	World Conference on Timber Engineering
Research Status:	Complete
Notes:	August 22-25, 2016, Vienna, Austria p. 1088-1098

Summary:

The present work aims to define horizontal joint dimension tolerances for newly proposed prefabricated façade systems for applications in tall cross laminated timber (CLT) buildings based on the compression perpendicular to grain characteristics of the component. This requires a thorough understanding of structural settlement under vertical loads which can vary at each floor height. An experimental program has been carried out with reference to the case of a platform frame building construction, where major perpendicular to grain compression of the floor can occur under high loads. Five-layer CLT specimens have been tested under compression via the application of a line load with steel plate as well as actual CLT wall specimens. Strengthening contribution using full threaded self-tapping wood screws has also been investigated. Results of deformation characteristics have been validated through a non-linear finite element analysis and further elaborated in order to outline implications in the design of a prefabricated façade.

Online Access: Free

Resource Link

http://hdl.handle.net/20.500.12708/172

Construction Management for Tall CLT Buildings: From Partial to Total Prefabrication of Façade Elements

https://research.thinkwood.com/en/permalink/catalogue224

Author:	Gasparri, Eugenia
	Lucchini, Angelo
	Mantegazza, Gabriele
	Mazzucchelli, Enrico
Publisher:	Taylor&Francis Online
Year of Publication:	2015
Country of Publication:	United Kingdom
Format:	Journal Article
Material:	CLT (Cross-Laminated Timber)
Application:	Wood Building Systems
Topic:	Cost
	Design and Systems
Keywords:	High-Rise
	Prefabrication
	Tall Wood
Language:	English
Research Status:	Complete
Series:	Wood Material Science & Engineering
Notes:	http://dx.doi.org/10.1080/17480272.2015.1075589

Summary:

Cross-Laminated Timber is one of the most widely used engineered wood products, thanks to its numerous advantages, among which construction speed is the most appreciated, both by clients and by designers. However, construction scheduling compression refers exclusively to CLT structures, while the rest of the construction process still requires a longer phase to complete vertical enclosures. The aim of the research work presented in this paper is to outline advantages brought about when the degree of envelope prefabrication of tall timber buildings is increased. Results are presented in two sections. The first includes the definition of a case study together with an overview of possible technical details for entirely prefabricated façade solutions, ready to be installed without the need to work via scaffolds. The second deals with construction site management analysis for the case study building, where the determination of specific factors having an influence on time and costs is achieved by varying the prefabrication degree of the various façade configurations and repeating the analysis process. The main findings of this research work demonstrate that comprehensive façade prefabrication allows not only consistent compression of construction scheduling to be achieved, but also for immediate protection of wooden elements from weather agents.

Online Access: Free

Resource Link

https://www.researchgate.net/profile/Eugenia_Gasparri/publication/282271239_Construction_management_for_tall_CLT_buildings_From_partial_to_total_prefabrication_of_facade_elements/links/57da6e4708ae4e6f18421d2f.pdf