Adaptation of Advanced High R-Factor Bracing Systems into Heavy Timber Frames

https://research.thinkwood.com/en/permalink/catalogue1760

Author:	Gilbert, Colin
	Erochko, Jeffrey
Year of Publication:	2016
Country of Publication:	Austria
Format:	Conference Paper
Material:	Glulam (Glue-Laminated Timber)
Application:	Frames
Topic:	Seismic
	Design and Systems
	Mechanical Properties
Keywords:	Quasi-Static
	Cyclic Testing
	Ductility
	Damping Devices
	R-factors
Language:	English
Conference:	World Conference on Timber Engineering
Research Status:	Complete
Notes:	August 22-25, 2016, Vienna, Austria p. 5068-5077

Summary:

Timber provides attractive earthquake performance characteristics for regions of high seismic risk, particularly its high strength-to-weight ratio; however, current timber structural systems are associated with relatively low design force reduction factors due to their low inherent ductility when compared to high-performance concrete and steel...

Online Access: Free

Resource Link

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

Advanced Wood-Based Solutions for Mid-Rise and High-Rise Construction: In-Situ Testing of the Origine 13-Storey Building for Vibration and Acoustic Performances

https://research.thinkwood.com/en/permalink/catalogue1474

Author:	Hu, Lin
	Cuerrier-Auclair, Samuel
Organization:	FPInnovations
Year of Publication:	2018
Country of Publication:	Canada
Format:	Report
Material:	CLT (Cross-Laminated Timber)
Application:	Wood Building Systems
	Floors
	Walls
Topic:	Acoustics and Vibration
	Serviceability
Keywords:	Origine
	Natural Frequencies
	Damping Ratios
	Sound Insulation
	Ambient Vibration Tests
	Static Deflection
	Apparent Sound Transmission Class
	Apparent Impact Insulation Class
Language:	English
Research Status:	Complete

Summary:

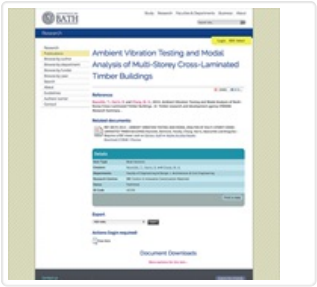
Serviceability performance studied covers three different performance attributes of a building. These attributes are 1) vibration of the whole building structure, 2) vibration of the floor system, typically in regards to motions in a localized area within the entire floor plate, and 3) sound insulation performance of the wall and floor assemblies. Serviceability performance of a building is important as it affects the comfort of its occupants and the functionality of sensitive equipment as well. Many physical factors influence these performances. Designers use various parameters to account for them in their designs and different criteria to manage these performances. Lack of data, knowledge and experience of sound and vibration performance of tall wood buildings is one of the issues related to design and construction of tall wood buildings.

In order to bridge the gaps in the data, knowledge, and experience of sound and vibration performance of tall wood buildings, FPInnovations conducted a three-phase performance testing on the Origine 13-storey CLT building of 40.9 m tall in Quebec city. It was the tallest wood building in Eastern Canada in 2017.

Online Access: Free

Resource Link

https://www.bcfii.ca/sites/default/files/report/fpi/16795.pdf



Ambient Vibration Testing and Modal Analysis of Multi-Storey Cross Laminated Timber Buildings

https://research.thinkwood.com/en/permalink/catalogue237

Author:	Reynolds, Thomas
	Bolmsvik, Åsa
	Vessby, Johan
	Chang, Wen-Shao
	Harris, Richard
	Bawcombe, Jonathan
	Bregulla, Julie
Year of Publication:	2014
Country of Publication:	Canada
Format:	Conference Paper
Material:	CLT (Cross-Laminated Timber)
Application:	Wood Building Systems
Topic:	Acoustics and Vibration
	Wind
	Serviceability
Keywords:	Modal Properties
	Multi-Storey
	Damping
Language:	English
Conference:	World Conference on Timber Engineering
Research Status:	Complete
Notes:	August 10-14, 2014, Quebec City, Canada

Summary:

The ambient movement of three modern multi-storey timber buildings has been measured and used to determine modal properties. This information, obtained by a simple, unobtrusive series of tests, can give insights into the structural performance of these forms of building, as well as providing information for the design of future, taller timber buildings for dynamic loads. For two of the buildings, the natural frequency has been related to the lateral stiffness of the structure, and compared with that given by a simple calculation. In future tall timber buildings, a new design criterion is expected to become important: deflection and vibration serviceability under wind load. For multi-storey timber buildings there is currently no empirical basis to estimate damping for calculation of wind-induced vibration, and there is little information for stiffness under wind load. This study therefore presents a method to address those gaps in knowledge.

Online Access: Free

Resource Link

http://opus.bath.ac.uk/42195/

Ambient Vibration Tests of a Cross-Laminated Timber Building

https://research.thinkwood.com/en/permalink/catalogue313

Author:	Reynolds, Thomas
	Harris, Richard
	Chang, Wen-Shao
	Bregulla, Julie
	Bawcombe, Jonathan
Publisher:	ICE Publishing
Year of Publication:	2015
Country of Publication:	United Kingdom
Format:	Journal Article
Material:	CLT (Cross-Laminated Timber)
Application:	Wood Building Systems
	Shear Walls
Topic:	Wind
Keywords:	Damping
	Dynamic Movement
	In Situ
	Multi-Storey
	Stiffness
	Modal Properties
	Ambient Vibration Method
Language:	English
Research Status:	Complete
Series:	Proceedings of the Institution of Civil Engineers - Construction Materials
ISSN:	1747-6518

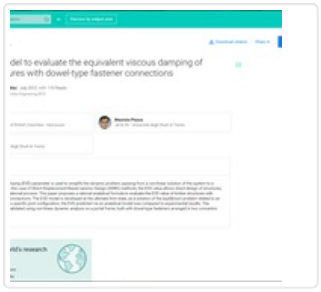
Summary:

Cross-laminated timber has, in the last 6 years, been used for the first time to form shear walls and cores in multi-storey buildings of seven storeys or more. Such buildings can have low mass in comparison to conventional structural forms. This low mass means that, as cross-laminated timber is used for taller buildings still, their dynamic movement under wind load is likely to be a key design parameter. An understanding of dynamic lateral stiffness and damping, which has so far been insufficiently researched, will be vital to the effective design for wind-induced vibration. In this study, an ambient vibration method is used to identify the dynamic properties of a seven-storey cross-laminated timber building in situ. The random decrement method is used, along with the Ibrahim time domain method, to extract the modal properties of the structure from the acceleration measured under ambient conditions. The results show that this output-only modal analysis method can be used to extract modal information from such a building, and that information is compared with a simple structural model. Measurements on two occasions during construction show the effect of non-structural elements on the modal properties of the structure.

Online Access: Free

Resource Link

https://doi.org/10.1680/coma.14.00047



Analytical Model to Evaluate the Equivalent Viscous Damping of Timber Structures with Dowel-Type Fastener Connections

https://research.thinkwood.com/en/permalink/catalogue1893

Author:	Loss, Cristiano
	Piazza, Maurizio
	Zonta, Daniele
Year of Publication:	2012
Country of Publication:	New Zealand
Format:	Conference Paper
Application:	Frames
Topic:	Connections
Keywords:	Equivalent Viscous Damping
	Moment Resisting Joints
	Dowel-Type Connections
	Non-linear Dynamic Analysis
	Metal Fasteners
Language:	English
Conference:	World Conference on Timber Engineering
Research Status:	Complete
Notes:	July 16-19, 2012, Auckland, New Zealand
Online Access:	Free

Resource Link

https://www.researchgate.net/publication/259758514_Analytical_model_to_evaluate_the_equivalent_viscous_damping_of_timber_structures_with_dowel-type_fastener_connections

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

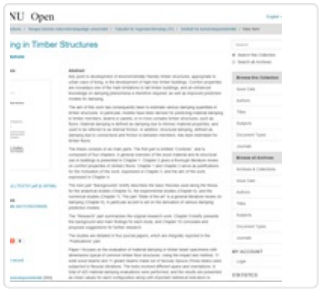
Summary:

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



Damping in Timber Structures

https://research.thinkwood.com/en/permalink/catalogue106

Author:	Labonnote, Nathalie
Organization:	Norwegian University of Science and Technology
Year of Publication:	2012
Country of Publication:	Norway
Format:	Thesis
Material:	Glulam (Glue-Laminated Timber)
Application:	Wood Building Systems
	Floors
	Beams
Topic:	Design and Systems
Keywords:	Damping
	Model
	Panels
	Spruce
	Testing
	Vibrations
Language:	English
Research Status:	Complete

Summary:

Key point to development of environmentally friendly timber structures, appropriate to urban ways of living, is the development of high-rise timber buildings. Comfort properties are nowadays one of the main limitations to tall timber buildings, and an enhanced knowledge on damping phenomena is therefore required, as well as improved prediction models for damping.
The aim of this work has consequently been to estimate various damping quantities in timber structures. In particular, models have been derived for predicting material damping in timber members, beams or panels, or in more complex timber structures, such as floors. Material damping is defined as damping due to intrinsic material properties, and used to be referred to as internal friction. In addition, structural damping, defined as damping due to connections and friction in-between members, has been estimated for timber floors.

Online Access:	Free

Resource Link

http://hdl.handle.net/11250/236926

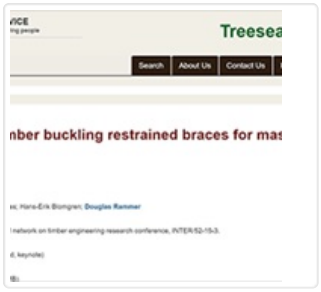
Designing Pedestrian Stress-Laminated Timber Bridges for Multiple Spans: Parameters Related to Dynamic Response

https://research.thinkwood.com/en/permalink/catalogue2576

Author:	Amundsson, Linnea
	Fasth, Sabiha
Organization:	Chalmers University of Technology
Year of Publication:	2019
Country of Publication:	Sweden
Format:	Thesis
Application:	Bridges and Spans
Topic:	Design and Systems
Keywords:	SLT
	Brigade/PLUS
	Eurocode
	Vibrations
	Eigenfrequency
	Damping
Language:	English
Research Status:	Complete
Online Access:	Free

Resource Link

https://odr.chalmers.se/bitstream/20.500.12380/257429/1/257429.pdf



Development of Timber Buckling Restrained Braces for Mass Timber Braced Frames

https://research.thinkwood.com/en/permalink/catalogue2544

Author:	Murphy, Colton
	Pantelides, Chris
	Blomgren, Hans-Erik
	Rammer, Douglas
Year of Publication:	2019
Country of Publication:	United States
Format:	Conference Paper
Application:	Frames
Topic:	Seismic
	Design and Systems
Keywords:	Brace
	Buckling
	Damping
	Fuse
	Seismic
	Structure
	Timber
Language:	English
Conference:	International Network on Timber Engineering Research
Research Status:	Complete

Summary:

Buckling Restrained Brace Frames (BRBF) are a proven and reliable method to provide an efficient lateral force resisting system for new and existing structures in earthquake prone regions. The fuse-type elements in this system facilitate stable energy dissipation at large load deformation levels. Currently, the new trend towards mass timber vertical structures creates a need for a lightweight compatible lateral force resisting system. A Buckling Restrained Brace (BRB) component is possible to construct and feasible to implement when combining a steel core with a mass timber casing herein named the Timber-Buckling Restrained Brace (T-BRB). T-BRBs when combined with mass timber beam and column elements can create a system that will have advantages over the current steel framed BRBF system when considering recyclability, sustainability, framing compatibility, and performance. This paper presents findings on small scale testing of candidate engineered wood products for the T-BRB casing and testing of six full scale 12 ft long 60 kip braces according to code prescribed loading protocols and acceptance criteria.

Online Access: Free

Resource Link

https://www.fs.usda.gov/treesearch/pubs/59081

Direct Displacement-Based Seismic Design of Timber Structures with Dowel-Type Fastener Connections

https://research.thinkwood.com/en/permalink/catalogue1899

Author:	Loss, Cristiano
	Piazza, Maurizio
	Zonta, Daniele
Publisher:	Sociedade Portuguesa de Engenharia Sismica (SPES)
Year of Publication:	2012
Country of Publication:	Portugal
Format:	Conference Paper
Application:	Frames
	Walls
	Wood Building Systems
Topic:	Seismic
	Connections
Keywords:	Direct Displacement-Based Design
	Equivalent Viscous Damping
	Dowel Type Fastener
Language:	English
Conference:	15WCEE
Research Status:	Complete
Notes:	September 24-28, 2012, Lisbon, Portugal
ISBN:	978-1-63439-651-6
Online Access:	Free

Resource Link

https://www.iitk.ac.in/nicee/wcee/article/WCEE2012_4895.pdf