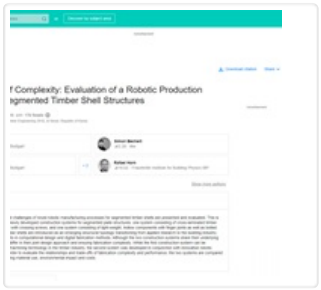


Affordances of Complexity: Evaluation of a Robotic Production Process for Segmented Timber Shell Structures

https://research.thinkwood.com/en/permalink/catalogue1913

Author:	Krieg, Oliver David
	Bechert, Simon
	Groenewolt, Abel
	Horn, Rafael
	Knippers, Jan
	Menges, Achim
Publisher:	Intergrated Digital Conference (INDICO)
Year of Publication:	2018
Country of Publication:	Korea
Format:	Conference Paper
Material:	CLT (Cross-Laminated Timber)
	Light Frame (Lumber+Panels)
Application:	Shell Structures
Topic:	Design and Systems
Keywords:	Robotic Fabrication
	Computational Design
Language:	English
Conference:	World Conference on Timber Engineering
Research Status:	Complete
Notes:	August 20-23, 2018, Seoul, Republic of Korea
Online Access:	Free

Resource Link

https://www.researchgate.net/publication/328531718_Affordances_of_Complexity_Evaluation_of_a_Robotic_Production_Process_for_Segmented_Timber_Shell_Structures

Biomimicry as a Generator of Optimal Volumetrics in Wood

https://research.thinkwood.com/en/permalink/catalogue2195

Organization:	Université Laval
Country of Publication:	Canada
Topic:	Design and Systems
Keywords:	Biomimicry
	Environmental Adaptation
	Digital Fabrication
	Material efficiency
Research Status:	In Progress
Notes:	Project contact is André Potvin at Université Laval

Summary:

The biomimetic approach in architecture explores the genius of organic natural forms resulting from a long process of environmental adaptation. These forms often have a high compactness and an optimal material / volume ratio in line with the importance of reducing the material in the building to limit its environmental impact in terms of energy and resources. What are the natural forms and processes of growth of the form most appropriate to the physical properties of wood? What design process promotes the integration of a biomimetic approach from the earliest stages of design? Based on a review of the main achievements claiming this approach, this project will develop a taxonomy of the different biomimetic typologies and identify the most promising in the context of a wood realization. A digital manufacturing process will be developed to reflect the complexity of natural shapes and flows in an organic architecture that optimizes environmental performance and aesthetics.

Connections for CLT Diaphragms in Steel-Frame Buildings

https://research.thinkwood.com/en/permalink/catalogue1594

Author:	Joyce, Tom
	Smith, Ian
Organization:	NEWBuildS
Year of Publication:	2014
Country of Publication:	Canada
Format:	Report
Material:	CLT (Cross-Laminated Timber)
Application:	Hybrid Building Systems
Topic:	Connections
	Mechanical Properties
Keywords:	Steel
	Connections
	Self-Tapping Screws
	Fabrication
	Strength
	Stiffness
	Ductility
Language:	English
Research Status:	Complete

Summary:

The high performance in-plane of cross laminated timber (CLT) panels has created a potential for the use of CLT members act as diaphragms in steel structures. The behaviour of this diaphragm system depends strongly on the connections involved in linking the panels together and to the steel members. A study of the connections at both locations was made using experimental testing of two connection designs for the panel-to-panel case, and the development of a staggered lag screw connection for the panel-to-steel beam case. The results showed good performance for the double spline and fully-threaded inclined screws panel-to-panel connections. The lag screw connection showed high strength, stiffness, and ductility. The CSA Standard O86-09 was found to best predict the strength of both types of connections. Characteristic design stiffness values were presented for the stiffness at low levels of displacement and the initial, elastic stiffness.

Online Access: Free

Resource Link

https://www.researchgate.net/publication/337063778_Connections_for_CLT_diaphragms_in_steel-framed_buildings

Design Process of a Free-Form Structure Using CLT Panels - Analysis of an Architectural Large Scale Structure

https://research.thinkwood.com/en/permalink/catalogue1640

Author:	Tolszczuk-Leclerc, Zoé Bernier-Lavigne, Samuel Salenikovich, Alexander Potvin, André
Year of Publication:	2016
Country of Publication:	Austria
Format:	Conference Paper
Material:	CLT (Cross-Laminated Timber)
Topic:	Design and Systems
Keywords:	Fabrication CNC Free-Form
Language:	English
Conference:	World Conference on Timber Engineering
Research Status:	Complete
Notes:	August 22-25, 2016, Vienna, Austria p. 3179-3186

Summary:

This research is about the design process, development and fabrication of a free-form structure in crosslaminated timber (CLT) panels. Since sustainability, ecology and structural design are now relevant in any building project, the purpose of this research is to demonstrate that CLT panels can be used as an ecoresponsive strategy based on a building form. This paper presents the use of a tessellation construction system for designing and producing a freeform surface in CLT for a specific regional and industrial context. The research/creation process and the retroactive simulation generated by the parametric modelling software enabled the development of a singular architectural project where the structural aspect and the manufacturing are the inherent part of the integrated design process. Finally, the cutting files can be generated automatically for an easy transfer to CNC machine tools.

Online Access: Free

Resource Link

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

Development of Novel Standardized Structural Timber Elements Using Wood-Wood Connections

https://research.thinkwood.com/en/permalink/catalogue2747

Author:	Gamerro, Julien
Publisher:	Lausanne, EPFL
Year of Publication:	2020
Format:	Thesis

Material:	CLT (Cross-Laminated Timber)
Topic:	Design and Systems
	Connections
Keywords:	Timber Construction
	Connections
	Digital Fabrication
	Design for Manufacturing and Assembly
	Structural Design
	Structural Frameworks
	Semi-Rigid Connection
	Experimental
	Shear Strength
	Compression Strength
	Wood-Wood Connections
	Bending Test
	Bending Stiffness
	Numerical Model
	Load Carrying Capacity
	Slip Modulus
Language:	English
Research Status:	Complete

Summary:

Traditional wood-wood connections, widely used in the past, have been progressively replaced by steel fasteners and bonding processes in modern timber constructions. However, the emergence of digital fabrication and innovative engineered timber products have offered new design possibilities for wood-wood connections. The design-to-production workflow has evolved considerably over the last few decades, such that a large number of connections with various geometries can now be easily produced. These connections have become a cost-competitive alternative for the edgewise connection of thin timber panels. Several challenges remain in order to broaden the use of this specific joining technique into common timber construction practice: (1) prove the applicability at the building scale, (2) propose a standardized construction system, (3) develop a convenient calculation model for practice, and (4) investigate the mechanical behavior of wood-wood connections. The first building implementation of digitally produced through-tenon connections for a folded-plate structure is presented in this work. Specific computational tools for the design and manufacture of more than 300 different plates were efficiently applied in a multi-stakeholder project environment. Cross-laminated timber panels were investigated for the first time, and the potential of such connections was demonstrated for different engineered timber products. Moreover, this work demonstrated the feasibility of this construction system at the building scale. For a more resilient and locally distributed construction process, a standardized system using through-tenon connections and commonly available small panels was developed to reconstitute basic housing components. Based on a case-study with industry partners, the fabrication and assembly processes were validated with prototypes made of oriented strand board. Their structural performance was investigated by means of a numerical model and a comparison with glued and nailed assemblies. The results showed that through-tenon connections are a viable alternative to commonly used mechanical fasteners. So far, the structural analysis of such construction systems has been mainly achieved with complex finite element models, not in line with the simplicity of basic housing elements. A convenient calculation model for practice, which can capture the semi-rigid behavior of the connections and predict the effective bending stiffness, was thus introduced and subjected to large-scale bending tests. The proposed model was in good agreement with the experimental results, highlighting the importance of the connection behavior. The in-plane behavior of through-tenon connections for several timber panel materials was characterized through an experimental campaign to determine the load-carrying capacity and slip modulus required for calculation models. Based on the test results, existing guidelines were evaluated to safely apply these connections in structural elements while a finite element model was developed to approximate their performance. This work constitutes a firm basis for the optimization of design guidelines and the creation of an extensive database on digitally produced wood-wood connections. Finally, this thesis provides a convenient design framework for the newly developed standardized timber construction system and a solid foundation for research into digitally produced wood-wood connections.

Online Access: Free

Resource Link

https://infoscience.epfl.ch/record/279630

Fire Testing for Framework Office Building in Portland, OR

https://research.thinkwood.com/en/permalink/catalogue1828

Organization:	SWRI
Year of Publication:	2017
Country of Publication:	United States
Format:	Report
Material:	CLT (Cross-Laminated Timber)
	Glulam (Glue-Laminated Timber)
Application:	Wood Building Systems
	Beams
	Columns
Topic:	Fire
Keywords:	Fire Endurance Tests
	Connections
	Assembly
	Fabrication
	Thermocouples
	Beam Column Connection
Language:	English
Research Status:	Complete
Series:	Framework: An Urban + Rural Design

Summary:

A. Fire Test Results Summary
B. Test 1a (Test 1): Beam-Exterior Column Connection Report
C. Test 1a (Test 2): Beam-Exterior Column Connection Report
D. Test 1a (Test 3): Beam-Exterior Column Connection Report
E. Test 1a (Test 4): Beam-Exterior Column Connection Report
F. Test 1b (Test 1): CLT Deck to Beam Report
G. Test 1b (Test 2): CLT Deck to Beam Report
H. Test 1b (Test 3): CLT Deck to Beam Report
I. Test 1c: Penetrations Fire Resistance Rating Report (TBD)
J. Test 1d: Wall Fire Resistance Rating Report

Online Access:	Free

Resource Link

https://www.thinkwood.com/wp-content/uploads/2018/10/17-Framework-Fire-Testing.pdf

Mass Timber, Small Format: Creative Applications of Fabrication Off-cuts

https://research.thinkwood.com/en/permalink/catalogue2798

Organization:	TallWood Design Institute
	University of Oregon

Country of Publication:	United States
Material:	CLT (Cross-Laminated Timber)
	MPP (Mass Plywood Panel)
Topic:	Environmental Impact
	Cost
	Market and Adoption
Keywords:	Fabrication
	Off-cuts
	Cutouts
	Furniture
	Joinery
	Open Source
	Digital Design
	Digital Fabrication
Research Status:	In Progress
Notes:	Project contacts are Linda Zimmer and Cory Olsen at the University of Oregon

Summary:

During the testing and fabrication of mass timber projects a natural byproduct inevitably occurs in the form of offcuts and cutouts. In the case of new mass timber structures, the engineered wood materials are typically fabricated and prepared off site, allowing for the majority of the leftover materials to be made into useful products at the same facility already ideally set up for further digital fabrication. While the thickness of many of the spare panelized elements under investigation/production at TDI might seem excessive for smaller scale elements, the digital design and production techniques already being used allow for a fine degree of precision commensurate with furniture joinery. We propose to experiment with designing and fabricating furniture scale components and furniture prototypes as a way to reclaim these otherwise unused timber products. This project captures off cuts and remaindered materials from structural testing at TDI in both CLT and MPP panels.

Our focus is the design and fabrication of freestanding furnishings (ex: stools, benches, tables, chairs) that will exploit the technologies available at the Emmerson Lab. We come at this with two perspectives: in the first, products could be made directly from the materials available; in the second, the output will act as a formwork or “jig” to facilitate construction of an entirely new prototype that could expand into additional material languages. In either case it is important to us to share digital files of prototypes as “open source” designs so that production facilities and design professionals can work together to reduce waste and/or use our designs as a springboard to customize their own pieces. In this way we address the stated program goals to expand and develop new products and building components and to foster markets for these. Our iterative approach to digital design and digital hybrids utilizes CNC/robotic fabrication and assembly and we will be testing our ideas in a design-build format.

Resource Link

http://tallwoodinstitute.org/projects/mass-timber-small-format-creative-applications-fabrication-cuts

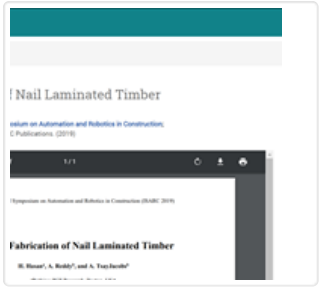
Performance of Glue-Laminated Beams from Malaysian Dark Red Meranti Timber

https://research.thinkwood.com/en/permalink/catalogue1822

Author:	Ong, Chee Beng
Organization:	University of Bath
Year of Publication:	2018
Country of Publication:	United Kingdom
Format:	Thesis
Material:	Glulam (Glue-Laminated Timber)
Application:	Beams
Topic:	Mechanical Properties
Keywords:	Malaysian Dark Red Meranti (DRM) Production Phenol-Resorcinol Formaldehyde Fabrication Bonding Performance Carbon Fiber Reinforced Polymer Tension Face Unreinforced Fire Test Failure Finger Joints Softwood Europe Density End Pressure Cramping Pressure Strength Charring Rate Fire Performance Polyurethane Bending Strength
Language:	English
Research Status:	Complete
Online Access:	Free

Resource Link

https://ethos.bl.uk/OrderDetails.do?uin=uk.bl.ethos.760973



Robotic Fabrication of Nail Laminated Timber

https://research.thinkwood.com/en/permalink/catalogue2493

Author:	Hasan, H. Reddy, A. TsayJacobs, A.
Year of Publication:	2019
Country of Publication:	United States
Format:	Journal Article
Material:	NLT (Nail-Laminated Timber)
Application:	Wood Building Systems
Topic:	Design and Systems
Keywords:	Robotic Fabrication Mass Timber Automated Construction Digital Fabrication Architectural Robotics Advanced Timber Structures Sustainable Structures
Language:	English
Research Status:	Complete
Series:	Proceedings of the International Symposium on Automation and Robotics in Construction
Online Access:	Free

Resource Link

https://search.proquest.com/openview/9641dc9ed4c7e571f706fe92518c9b69/1?pq-origsite=gscholar&cbl=1646340