

**Mitacs**



**S. HANUPRIYAN  
FINAL YEAR, DEPARTMENT OF CIVIL ENGINEERING  
PMIST, VALLAM, THANJAVUR**

**UNBC** UNIVERSITY OF  
NORTHERN BRITISH COLUMBIA

# MITACS GLOBALINK RESEARCH INTERNSHIP 2022

Award Letter Issued by February 28th 2022:



2022-03-01  
Application ID: 109842

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## GLOBALINK RESEARCH INTERNSHIP AWARD DISBURSEMENT INFORMATION AND PLACEMENT TERMS AND CONDITIONS

Dear HANUPRIYAN SELVAGANAPATHI,

Congratulations! You have been selected by Mitacs and Professor Thomas Tannert from University of Northern British Columbia – Prince George to receive a 2022 Globalink Research Internship award. You are therefore invited to participate in a research project at **University of Northern British Columbia – Prince George**. Pursuant to an agreement with University of Northern British Columbia – Prince George, Mitacs will administer your funding grant.

Mitacs Globalink Research Internship is a competitive program that pairs top-ranked international students with specific research expertise with faculty at Canadian academic institutions for a twelve (12) week research project of mutual interest between May and October 2022. You have been selected by your Canadian host faculty project leader due to your background and skills in the research area and the unique contribution you will be making to the research during your stay. **The skills required for your role (as described in the research description below) were found to clearly match your skills set, education, and research experience.**

### Research internship details

<b>University/Institution:</b>	University of Northern British Columbia – Prince George
<b>Host professor:</b>	Thomas Tannert
<b>Research project title:</b>	Research on Self-Tapping-Wood-Screws
<b>NOC code:</b>	4012 Post-secondary teaching and research assistants
<b>Research description:</b>	There is an acute need for research to develop value-added applications for wood and wood products such as Cross-Laminated-Timber (CLT). One prominent target area are mid- and high-rise structures. In seismic regions, such as Western Canada, connectors must provide ductility to otherwise rigid building systems composed of CLT panels. There are a number of options available, one of the most promising are Self-Tapping-Screws (STS). The objective of the project is to develop design guidance for CLT assemblies connected by STS for large structures, considering seismic loads. Experimental, numerical and analytical work on the material, component and system levels will be combined to achieve this objective. The project can contribute to increasing the market share of wood products in the North American construction sector, and thus, the project contributes to reducing the carbon footprint of structures.
<b>During your internship, you will:</b>	The student will be involved in the sampling, fabricating, testing and analyzing of timber assemblies. This will involve selecting test samples from a larger batch of material, using hand and machine tools to cut wood specimens, fabricating the timber assemblies, using advanced materials test equipment to carry out experiments, and applying spreadsheet tools and statistical programs to analyse the results. While previous knowledge and experience in some of these areas is expected, the student will be given all necessary guidance to acquire the necessary skills to successfully contribute to the research project.
<b>Duration of research:</b>	12 weeks — to begin between May 1 and July 31, 2022 (unless otherwise approved by Mitacs) and end no later than October 31, 2022 (unless otherwise approved by Mitacs). Shortened durations must be agreed upon with the host professor and Mitacs. Durations of more than twelve (12) weeks will not be permitted.
<b>Hours of work:</b>	Minimum of forty (40) hours per week.

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# ABOUT THE INTERNSHIP:

## ABOUT MITACS:

Mitacs is a national, not-for-profit research and training organization dedicated to advancing collaborations between industry, academia and government in Canada, and to fostering international research networks between Canadian universities and the world.

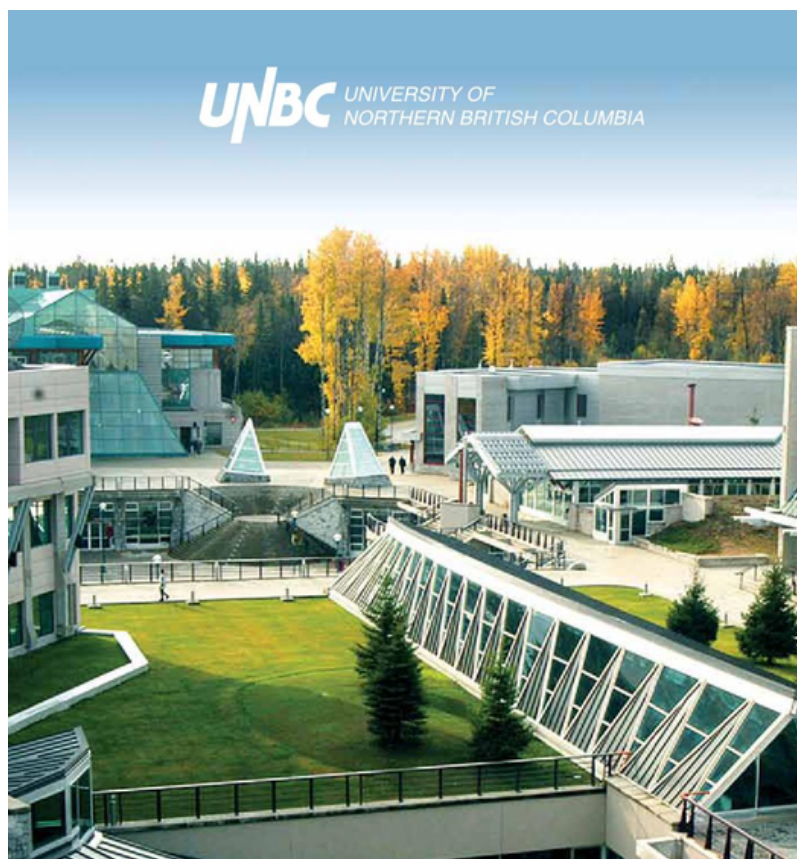
Mitacs Globalink: Offers funded research internships for top international undergraduates to study in Canada, or for Canadian students to conduct research in a Mitacs partner country.

Mitacs programs are supported jointly by provincial and federal governments and agencies, industry and universities within Canada, as well as governments and universities overseas.

## ABOUT UNBC:

The University of Northern British Columbia (UNBC) is a small, research-intensive public university in British Columbia, Canada. The main campus is located in Prince George, with regional campuses farther north in Prince Rupert, Terrace, Quesnel, and Fort St. John.

UNBC is ranked by Maclean's magazine as the number one university of its size in Canada, in the Primarily Undergraduate category.[2] UNBC also finished first in the rankings in 2015 and 2016 and routinely finishes in the top three in its category. In 2007, the university obtained the trademark for "Canada's Green University".



## **ABOUT PROFESSOR:**



Thomas Tannert joined the University of Northern British Columbia in 2016 as BC Leadership Chair in Tall Wood and Hybrid Structures Engineering. Thomas received his PhD from the University of British Columbia in Vancouver, a Master's degree in Wood Science and Technology from the University of Bio-Bio in Chile, and a Civil Engineering degree from the Bauhaus-University Weimar in Germany. Before coming to UNBC, he worked in multi-disciplinary teams in Germany, Chile, and Switzerland and was Associate Chair in Wood Building Design and Construction at UBC. Thomas is an expert in the development of design methods for timber joints and structures, is actively involved in fostering collaboration between industry and academia, and is a member on multiple international committees as well as the Canadian Standard Association technical committee CSA-O86 "Engineering design in wood".

**Research Fields:** Natural Resources

**Areas of Expertise:** Wood Engineering, Timber Joints, Hybrids Structures, Structural Analysis

**Languages Spoken:** English German Spanish

# TRAVEL TO CANADA:

## ITINERARY / ITINÉRAIRE

Date	Departure	Arrival	Flight	Latest check-in time	Total baggage**	Cabin	Class	Status*
Date	Départ	Arrivée	Vol	Fin enregistrement	Total bagages**	Cabine	Classe	Statut*
13MAY	01:20 Chennai MAA Chennai Airport 4	→ + → Paris CDG Aéroport Charles de Gaulle 2E	AF0121 Flight operated by Air France/ Vol effectué par Air France	00:20	2		U	OK
13MAY	10:15 Paris CDG Aéroport Charles de Gaulle 2E	→ + → Vancouver YVR Vancouver Intl Airport M	AF0374 Flight operated by Air France/ Vol effectué par Air France	09:15	2		U	OK

Total roundtrip for the internship travel is booked by Periyar maniammai institute of science and technology.

13AUG	19:30 Prince George YXS Prince George Airport	→ + → Vancouver YVR Vancouver Intl Airport M	WS3298 Flight operated by WESJET/ Vol effectué par WESJET		2		Y	OK
14AUG	13:30 Vancouver YVR Vancouver Intl Airport M	→ + → Paris CDG Aéroport Charles de Gaulle 2E	AF0379 Flight operated by Air France/ Vol effectué par Air France	12:30	2		E	OK
15AUG	10:10 Paris CDG Aéroport Charles de Gaulle 2E	→ + → Chennai MAA Chennai Airport 4	AF0108 Flight operated by Air France/ Vol effectué par Air France	09:10	2		E	OK

# DETAILED PROJECT PLAN:



## Mitacs Globalink 2022 - Research Project Plan

Last modified at Sun Feb 20 2022 20:44:10 GMT-0800 (Pacific Standard Time)

Project ID: 26148  
Project Title: Research on Self-Tapping-Wood-Screws  
Professor Name: Thomas Tannert  
Intern Name: HANUPRIYAN SELVAGANAPATHI

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Project Goals:	Determine failure modes and load-carrying capacity of self-tapping screw connections
Student activities and timeline:	weeks 1-2: become familiar with topic, receive lab training and get settled in new environment weeks 3-4: prepare test program and test set-up with support of lab technicians weeks 5-8: conduct tests weeks 9-12: analyze results
Deliverables:	weeks 1-2: become familiar with topic, receive lab training and get settled in new environment weeks 3-4: prepare test program and test set-up with support of lab technicians weeks 5-8: conduct tests weeks 9-12: analyze results
Interaction:	weekly meetings with supervisor bi-weekly meetings with supervisors research team daily interactions with other team members and lab technicians

Generated by HANUPRIYAN SELVAGANAPATHI at 2022-09-07 09:00 PT

AFTER I REACHED CANADA, MY PROFESSOR CHANGED THE PROJECT TITLE TO

## "EXPERIMENTS ON NOTCHED CLT PANELS FOR SHEAR FAILURE"

### OTHER INTERN OF THE PROJECT:

Sivanathan S  
Madras Institute of Technology Chennai, TN, India

# EXPERIMENTS ON NOTCHED CLT PANELS FOR SHEAR FAILURE

## Test Method

The test setup of the 3 point monotonic bending tests, the geometry of the specimens and the 2 different orientations are depicted in the figure 2. In total 8 different notch geometries were tested, 4 each for the 100mm & 140mm thick specimens in both 0° & 90° orientations(Figure 2 ). Testing was performed in a servo-hydraulic testing machine under displacement control.

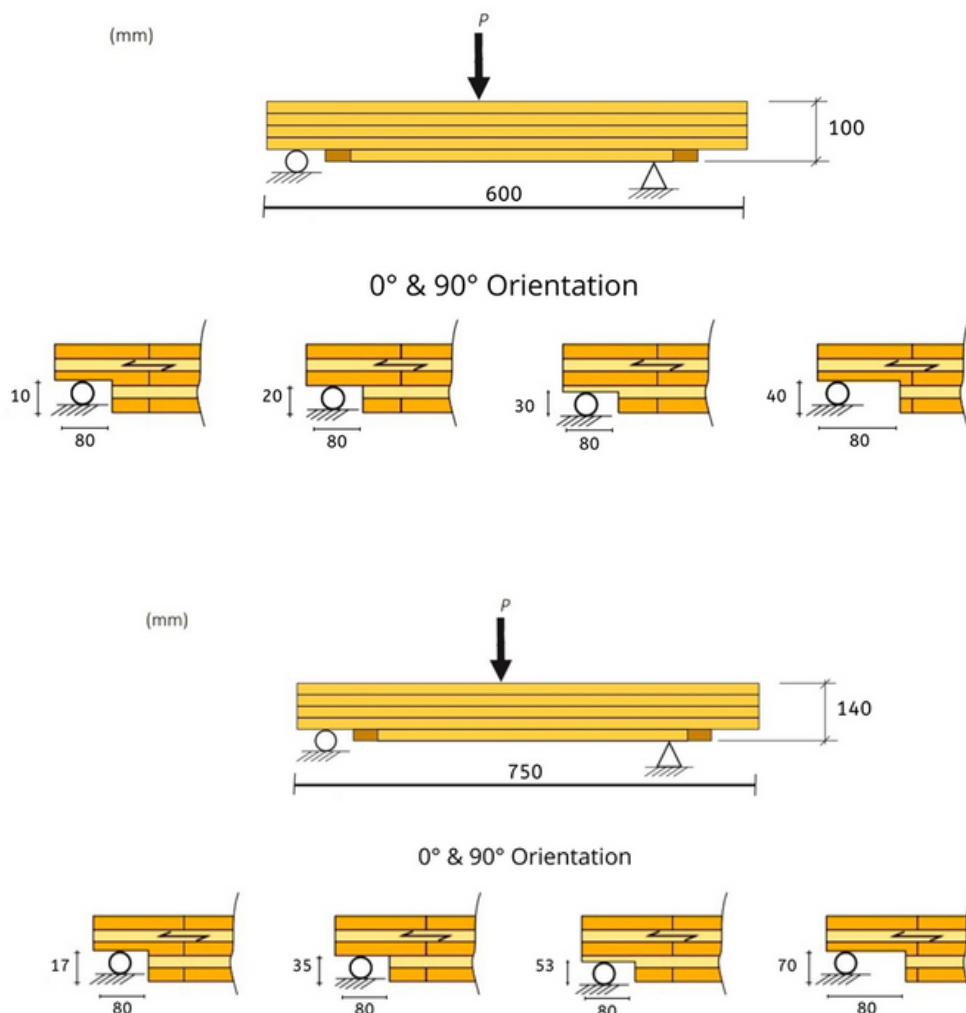


Figure 2: Test setup used and notch geometries for the different test series.

Step 1	Preload	40% of Maximum Theoretical Load/Expected Load	<b>rate -&gt; 5 mm/min</b>
Step 2	Idle Time	20 seconds	
Step 3	Retract Load	25% of Calculated Preload	
Step 4	Idle Time	20 seconds	
Step 5	Till Failure	Displacement 120mm (As it is the distance b/w base of the machine and lower end of the specimen)	

Table 1: Test Procedure

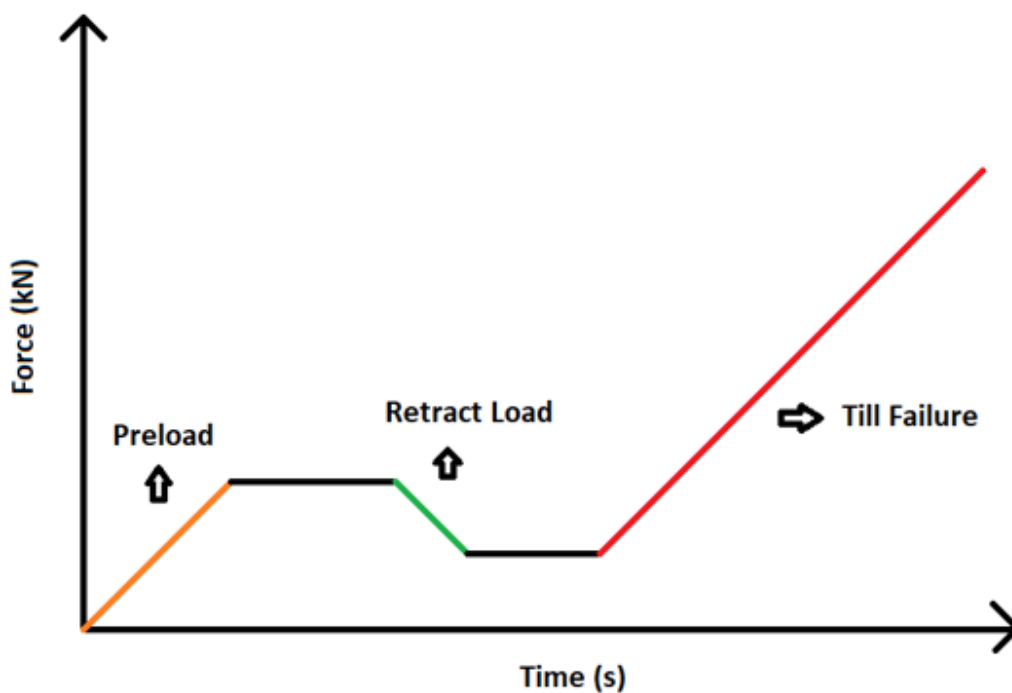


Figure 3: Model Graph



In total 174 CLT specimens without glued edge bonding, split up into 17 series with unreinforced notches and 8 series with reinforced notches were tested.

To quantify the reduction in load bearing capacity of CLT plates with notches in comparison to plates without notches, the reference tests (in total 4 series referred in Table 2&3 )were carried out. All the 36 specimens of these series failed in rolling shear.

Series	Layer	No. of Tests	Mean (kN)	CoV (%)	Min/Max (kN)
N_100_00	20 x 20 x 20 x 20 x 20	12	74.42	11.57%	63.9/90.1
N_100_10	20 x 20 x 20 x 20 x 20	6	70.86	6.67%	62.8/75.9
N_100_20	20 x 20 x 20 x 20 x 20	6	44.91	10.66%	39/51.7
N_100_30	20 x 20 x 20 x 20 x 20	6	45.23	8.05%	40.8/50
N_100_40	20 x 20 x 20 x 20 x 20	6	44.12	11.14%	38.3/52.1
N_100_20_R	20 x 20 x 20 x 20 x 20	6	66.73	5.76%	61.9/71.3
N_100_40_R	20 x 20 x 20 x 20 x 20	6	63.78	4.94%	60.3/67
N_100_P_00	20 x 20 x 20 x 20 x 20	12	55.20	3.75%	39.2/58.9
N_100_P_10	20 x 20 x 20 x 20 x 20	6	46.14	6.59%	40.7/49.7
N_100_P_20	20 x 20 x 20 x 20 x 20	6	44.85	8.15%	39.7/49.6
N_100_P_30	20 x 20 x 20 x 20 x 20	6	37.42	8.01%	34.7/43
N_100_P_40	20 x 20 x 20 x 20 x 20	6	14.16	18.98%	10.7/18.4
N_100_20_PR	20 x 20 x 20 x 20 x 20	6	51.80	7.11%	46.3/57.8
N_100_40_PR	20 x 20 x 20 x 20 x 20	6	23.57	13.07%	19.5/27

Table 2: Summarised Results of 100mm Thick Specimens

Series	Layer	No. of Tests	Mean (kN)	CoV (%)	Min/Max (kN)
N_140_00	35 x 17 x 35 x 17 x 35	6	96.04	14.09%	73/107.6
N_140_17	35 x 17 x 35 x 17 x 35	6	79.09	18.80%	60.2/93.6
N_140_35	35 x 17 x 35 x 17 x 35	6	61.67	22.44%	38.1/80.8
N_140_53	35 x 17 x 35 x 17 x 35	6	39.66	11.88%	34.6/46.4
N_140_35_R	35 x 17 x 35 x 17 x 35	6	76.72	4.25%	73/81.1
N_140_53_R	35 x 17 x 35 x 17 x 35	6	79.45	5.90%	72.1/85.6
N_140_70	35 x 17 x 35 x 17 x 35	6	30.84	13.08%	26.2/36.2
N_140_35_AR	35 x 17 x 35 x 17 x 35	6	80.44	4.71%	75.3/85
N_100_00_P	35 x 17 x 35 x 17 x 35	6	33.95	10.95%	30.6/39.6
N_100_17_P	35 x 17 x 35 x 17 x 35	6	35.12	12.42%	30.3/42.5
N_100_35_P	35 x 17 x 35 x 17 x 35	6	40.48	11.39%	36.4/49.4
N_100_53_P	35 x 17 x 35 x 17 x 35	6	12.98	13.47%	11.3/15.3
N_140_53_PR	35 x 17 x 35 x 17 x 35	6	21.11	8.20%	18.3/23

Table 2: Summarised Results of 140mm Thick Specimens



Figure 4: Different types of Shear Failures in 100mm series



Figure 5: Different types of Shear Failures in 140mm series

# LETTER OF APPRECIATION :



**Thomas Tannert, PhD, PEng**  
Professor, School of Engineering  
BC Leadership Chair, Canada Research Chair  
3333 University Way  
Prince George, BC, Canada, V2N 4Z9  
Email: [thomas.tannert@unbc.ca](mailto:thomas.tannert@unbc.ca)  
Tel: 1-250-960-6710

August 30, 2022

To whom it may concern,

**Re: Attendance record Mr. Hanupriyan Selvaganapathi**

This is to confirm that Mr. Hanupriyan Selvaganapathi successfully completed a Mitacs Globalink Internship under my supervision at the University of Northern British Columbia, Prince George, Canada.



Details of attendance are as follows:

Monday- Friday	16.05. – 20.05.
Monday- Friday	23.05. – 27.05.
Monday- Friday	30.05. – 03.06.
Monday- Friday	06.06. – 10.06.
Monday- Friday	13.06. – 17.06.
Monday- Friday	20.06. – 24.06.
Monday- Friday	27.06. – 31.06.
Tuesday - Friday	05.07. – 08.07.
Monday- Friday	11.07. – 15.07.
Monday- Friday	25.07. – 29.07.
Tuesday- Friday	02.08. – 05.08.

Please feel free to contact me if you need any further information.

Sincerely,

A handwritten signature in black ink, appearing to read 'T. Tannert', is written over a light blue horizontal line.