Addendum to RR-335: Sound Transmission Through Nail-Laminated Timber (NLT) Assemblies

https://research.thinkwood.com/en/permalink/catalogue1868

Author:	Mahn, Jeffrey
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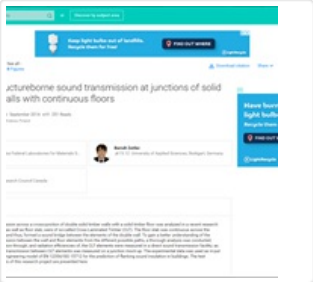
Organization:	National Research Council of Canada
Publisher:	National Research Council Canada. Construction
Year of Publication:	2018
Country of Publication:	Canada
Format:	Report
Material:	NLT (Nail-Laminated Timber)
Application:	Floors
	Walls
Topic:	Acoustics and Vibration
Keywords:	Sound Insulation
	Assembly
	Sound Transmission Class
Language:	English
Research Status:	Complete
Online Access:	Free

Resource Link

https://nrc-publications.canada.ca/eng/view/object/?id=9e3b39be-e0ed-415b-9649-3e7ec228f52c



Analysis on Structureborne Sound Transmission at Junctions of Solid Wood Double Walls with Continuous Floors

https://research.thinkwood.com/en/permalink/catalogue1869

Author:	Schoenwald, Stefan
	Zeitler, Berndt
	Sabourin, Ivan
Organization:	European Acoustics Association
Year of Publication:	2014
Country of Publication:	Poland
Format:	Conference Paper
Material:	CLT (Cross-Laminated Timber)
Application:	Floors
	Walls
Topic:	Acoustics and Vibration
Keywords:	Sound Transmission
	Sound Insulation
	Radiation Efficiencies
Language:	English
Conference:	Forum Acusticum 2014
Research Status:	Complete
Notes:	September 7-12, 2014, Krakow, Poland
Online Access:	Free

Resource Link

https://www.researchgate.net/publication/266079276_Analysis_on_structureborne_sound_transmission_at_junctions_of_solid_wood_double_walls_with_continuous_floors

Guide to Calculating Airborne Sound Transmission in Buildings: Fifth Edition, December 2019

https://research.thinkwood.com/en/permalink/catalogue2617

Author:	Hoeller, Christoph
	Quirt, David
	Mahn, Jeffrey
	Müller-Trapet, Markus
Organization:	National Research Council of Canada. Construction
Publisher:	National Research Council of Canada. Construction
Year of Publication:	2019
Country of Publication:	Canada
Format:	Book/Guide

Material:	CLT (Cross-Laminated Timber)
	Light Frame (Lumber+Panels)
Application:	Floors
	Walls
Topic:	Acoustics and Vibration
	Design and Systems
Keywords:	Apparent Sound Transmission Class
	Sound Insulation
	Sound Transmission
	Concrete
	Building Code
	Impact Sound
Language:	English
Research Status:	Complete

Summary:

In recent years, the science and engineering for controlling sound transmission in buildings have shifted from a focus on individual assemblies such as walls or floors, to a focus on performance of the complete system. Standardized procedures for calculating the overall transmission, combined with standardized measurements to characterize sub-assemblies, provide much better prediction of sound transmission between adjacent indoor spaces. The International Standards Organization (ISO) has published a calculation method, ISO 15712-1 that uses laboratory test data for sub-assemblies such as walls and floors as inputs for a detailed procedure to calculate the expected sound transmission between adjacent rooms in a building. This standard works very well for some types of construction, but to use it in a North American context one must overcome two obstacles – incompatibility with the ASTM standards used by our construction industry, and low accuracy of its predictions for lightweight wood or steel frame construction. To bypass limitations of ISO 15712-1, this Guide explains how to merge ASTM and ISO test data in the ISO calculation procedure, and provides recommendations for applying extended measurement and calculation procedures for specific common types of construction. This Guide was developed in a project established by the National Research Council of Canada to support the transition of construction industry practice to using apparent sound transmission class (ASTC) for sound control objectives in the National Building Code of Canada (NBCC). However, the potential range of application goes beyond the minimum requirements of the NBCC – the Guide also facilitates design to provide enhanced sound insulation, and should be generally applicable to construction in both Canada and the USA. This publication contains a limited set of examples for several types of construction, to provide an introduction and overview of the ASTC calculation procedure. Additional examples and measurement data can be found in the companion documents to this Guide, namely NRC Research Reports RR-333 to RR-337. Furthermore, the calculation procedure outlined and illustrated in this Guide is also used by the software web application soundPATHS, which is available for free on the website of the National Research Council of Canada (see the references in Section 7 of this Guide for access details).

Online Access:	Free

Resource Link

https://doi.org/10.4224/40001814

Finite Element Modeling for Vibration Transmission in a Cross Laminated Timber Structure

https://research.thinkwood.com/en/permalink/catalogue1633

Author:	Vardaxis, Nikolaos-Georgios
	Hagberg, Klas
	Bard, Delphine
Year of Publication:	2016
Country of Publication:	Austria
Format:	Conference Paper
Material:	CLT (Cross-Laminated Timber)
Application:	Wood Building Systems
Topic:	Acoustics and Vibration
Keywords:	Sweden
	Numerical Model
	Finite Element Model
	Impact Noise Transmission
	Impact Sound
Language:	English
Conference:	World Conference on Timber Engineering
Research Status:	Complete
Notes:	August 22-25, 2016, Vienna, Austria p. 2953-2962

Summary:

This paper deals with a certain type of C.L.T. (Cross Laminated Timber) construction, in a residential building in Fristad, Sweden. The objective is to study impact noise transmission, at the lower frequency range (10-200 Hz), where wooden dwellings perform inefficiently, in terms of acoustic quality. The vibrational behavior of lightweight structures and specifically a multilayered floor separating two vertically adjacent bedrooms are investigated. A numerical model of the multilayered test plate, which includes sound insulation and vibration isolation layers, is developed using the Finite Element Method (F.E.M.) in commercial software. The design process, the analysis and improvement of the calculated outcome concerning accuracy and complexity are of interest. In situ vibration measurements were also performed so as to evaluate the structures dynamic behavior in reality and consequently the validity of the modelled results. The whole process from design to evaluation is discussed thoroughly, where uncertainties of the complex F.E.M. model and the approximations of the real structure are analyzed. Numerical comparisons are presented including mechanical mobility and impact noise transmission results. The overall aim is to set up a template of calculations that can be used as a prediction tool in the future by the industry and researchers.

Online Access: Free

Resource Link

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

In Situ Measured Flanking Transmission in Light Weight Timber Houses with Elastic Flanking Isolators

https://research.thinkwood.com/en/permalink/catalogue231

Author:	Ågren, Anders
	Ljunggren, Fredrik
Organization:	Inter-noise
Year of Publication:	2013
Country of Publication:	Austria
Format:	Conference Paper
Material:	CLT (Cross-Laminated Timber)
Application:	Floors
	Wood Building Systems
Topic:	Acoustics and Vibration
Keywords:	Modules
	Prefabrication
	Sound Insulation
	Elastomer Isolators
Language:	English
Conference:	Inter-noise 2013
Research Status:	Complete
Notes:	September 15-18, 2013, Innsbruck, Austria

Summary:

There is a strong trend to industrially produce multi-storey light weight timber based houses. This concept allows the buildings to be manufactured to a more or less prefabricated extent. Most common types are volume/room modules or flat wall and floor modules. When assembling the modules at the building site, elastomer isolators are used in several constructions to reduce flanking transmission. The sound insulation demands in the Nordic countries are relatively high and therefore the flanking transmission must be well controlled, where elastomer isolators are an alternative. Decoupled radiation isolated walls is another. There are though no working studies or mathematical models of the performance of these isolators. They are only treated as simple mass-springs systems that operate vertically, i.e. one degree of freedom. In this paper there is an analysis of experimentally data of the structure borne sound isolating performance of elastomer isolators that are separating an excited floor from receiving walls. The performance dependence of structure type is also presented. An empirically based regression model of the vibration level difference is derived. The model is based on measurements of six elastomer field installations, which are compared to five comparable installations without elastomers. A goal is that the model can be used for input in future SEN prediction models for modeling of sound insulation.

Online Access:	Free

Resource Link

http://ltu.diva-portal.org/smash/get/diva2:1011925/FULLTEXT01.pdf

Experimental Analysis of Flanking Transmission of Different Connection Systems for CLT Panels

https://research.thinkwood.com/en/permalink/catalogue1632

Author:	Speranza, Alice Barbaresi, Luca Morandi, Federica
Year of Publication:	2016
Country of Publication:	Austria
Format:	Conference Paper
Material:	CLT (Cross-Laminated Timber)
Application:	Wood Building Systems
Topic:	Acoustics and Vibration Connections
Keywords:	Vibration Reduction Index Fasteners Flanking Transmission
Language:	English
Conference:	World Conference on Timber Engineering
Research Status:	Complete
Notes:	August 22-25, 2016, Vienna, Austria p. 2904-2911

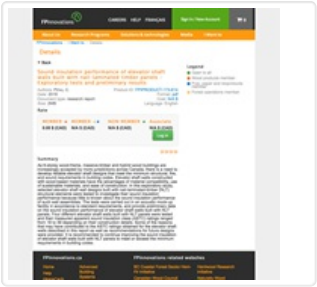
Summary:

This paper presents the first results of the flanksound project, a study promoted by Rotho Blaas srl regarding flanking transmission between CLT panels jointed with different connection systems. The vibration reduction index Kij is evaluated according to the EN ISO 10848 standard by measuring the velocity level difference between CLT panels. The performance of the X-RAD connection system is compared to the performance of a traditional connection system made of shear angle bracket and hold-down, both the configurations being tested with and without a resilient material placed between the construction elements. Concerning the traditional system, the influence of the difference sizes and types of fasteners - including the method of nailing or screwing - was also evaluated. The results of the measurements exposed in this work will hopefully contribute to the development of the acoustic design of timber buildings by providing a solid database of Kij values, which can be used to forecast the acoustic performance of the building according to the prediction models proposed in EN 12354-1.

Online Access: Free

Resource Link

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



Sound Insulation Performance of Elevator Shaft Walls built with Nail-Laminated Timber Panels - Exploratory Tests and Preliminary Results

https://research.thinkwood.com/en/permalink/catalogue364

Author:	Pirvu, Ciprian
Organization:	FPInnovations
Year of Publication:	2016
Country of Publication:	Canada
Format:	Report
Material:	NLT (Nail-Laminated Timber)
Application:	Shafts and Chases
Topic:	Acoustics and Vibration
Keywords:	Building Codes Canada Sound Insulation Apparent Sound Insulation Class
Language:	English
Research Status:	Complete

Summary:

As 6-storey wood-frame, massive-timber and hybrid wood buildings are increasingly accepted by more jurisdictions across Canada, there is a need to develop reliable elevator shaft designs that meet the minimum structural, fire, and sound requirements in building codes. Elevator shaft walls constructed with wood-based materials have the advantages of material compatibility, use of sustainable materials, and ease of construction.

In this exploratory study, selected elevator shaft wall designs built with nail-laminated-timber (NLT) structural elements were tested to investigate their sound insulation performance because little is known about the sound insulation performance of such wall assemblies. The tests were carried out in an acoustic mock-up facility in accordance to standard requirements, and provide preliminary data on the sound insulation performance of elevator shaft walls built with NLT panels.

Four different elevator shaft walls built with NLT panels were tested and their measured apparent sound insulation class (ASTC) ratings ranged from 18 to 39 depending on their construction details. Some of the reasons that may have contributed to the ASTC ratings obtained for the elevator shaft walls described in this report as well as recommendations for future designs were provided.

It is recommended to continue improving the sound insulation of elevator shaft walls built with NLT panels to meet or exceed the minimum requirements in building codes.

Online Access: Free

Resource Link

https://library.fpinnovations.ca/en/permalink/fpipub40172

Experimental Study on Air Tone Interruption Performance of CLT Panel Wall

https://research.thinkwood.com/en/permalink/catalogue1802

Author:	Tanaka, Manabu
	Kasai, Yusuke
	Murakami, Tsuyoshi
	Kawaya, Shoji
Publisher:	J-STAGE
Year of Publication:	2016
Country of Publication:	Japan
Format:	Journal Article
Material:	CLT (Cross-Laminated Timber)
Application:	Walls
Topic:	Acoustics and Vibration
Keywords:	Sound Transmission
	Panels
	Experimental Tests
	Sound Insulation
Language:	Japanese
Research Status:	Complete
Series:	Japanese Architectural Institute Environmental Papers
ISSN:	1881 - 817 X
Online Access:	Free

Resource Link

https://doi.org/10.3130/aije.81.1075

Measurement of Airborne Sound Insulation of 8 Wall Assemblies Measurement of Airborne and Impact Sound Insulation of 29 Floor Assemblies

https://research.thinkwood.com/en/permalink/catalogue1864

Author:	Sabourin, Ivan
Organization:	National Research Council of Canada
Publisher:	National Research Council Canada. Construction
Year of Publication:	2015
Country of Publication:	Canada
Format:	Report
Material:	CLT (Cross-Laminated Timber) Glulam (Glue-Laminated Timber)
Application:	Floors Walls
Topic:	Acoustics and Vibration
Keywords:	Transmission Loss Impact Sound Pressure Level
Language:	English
Research Status:	Complete
Series:	Nordic Engineered Wood Report
Online Access:	Free

Resource Link

http://doi.org/10.4224/23000205

Correlation between Sound Insulation and Occupants' Perception – Proposal of Alternative Single Number Rating of Impact Sound

https://research.thinkwood.com/en/permalink/catalogue79

Author:	Ljunggren, Fredrik
	Simmons, Christian
	Hagberg, Klas
Publisher:	ScienceDirect
Year of Publication:	2014
Country of Publication:	Netherlands
Format:	Journal Article
Material:	CLT (Cross-Laminated Timber)
Application:	Floors
Topic:	Acoustics and Vibration
Keywords:	Airborne Sound
	Frequency
	Insulation
	Lightweight
	Sound
	Sweden
Language:	English
Research Status:	Complete
Series:	Applied Acoustics

Summary:

Traditionally, multi-family houses have been constructed using heavy, homogenous materials like concrete and masonry. But as a consequence of the progress of lightweight building systems during the last decades, it has been questioned whether standardized sound insulation evaluation methods still are appropriate.

An extensive measurement template has been applied in a field survey where several vibrational and acoustical parameters were determined in ten Swedish buildings of various constructions. In the same buildings, the occupants were asked to rate the perceived annoyance from a variety of natural sound sources. The highest annoyance score concerned impact sounds, mainly in the buildings with lightweight floors.

Statistical analyses between the measured parameters and the subjective ratings revealed a useful correlation between the rated airborne sound insulation and R0 w þ C50—3150 while the correlation between the rated impact sound insulation and L0 n;w þ CI;50—2500 was weak. The latter correlation was considerably improved when the spectrum adaptation term with an extended frequency range starting from 20 Hz was applied. This suggests that frequencies below 50 Hz should be considered when evaluating impact sound in lightweight buildings.

Online Access:	Free

Resource Link

https://www.traguiden.se/globalassets/forskning/akustik/applied-acoustics/ljunggren-et-al-correleation-between-sound-insulation.pdf