Cross laminated timber[1] acoustic performance research

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Key components

- **Cross laminated timber mid-rise wooden buildings.**
- **Environmental benefits.**
- **Acoustic testing.**
- **Compliance with the National Construction Code and Building Code of Australia.**
- **Acoustic testing schedules for CLT wall, floor and ceiling components.**
- **Project resulted in additional investment to develop company-specific acoustic predictive software tools.**

Context

It is exciting times for tall wooden buildings in today's cities. City population growth, space availability and infrastructure pressures are contributing to the need for innovative building solutions. An aspect of this direction that takes advantage of timber's dexterity as a building material and environmental credentials is the development of a new generation of super strong engineered timber products.

Besides its popular appeal, and lightness making it suitable for construction in densely built city centres, the range of other environmental benefits for building in wood are substantial. There are significant carbon dioxide savings to be made by using timber in the construction of houses and other buildings, both in terms of embodied energy and in-use energy efficiency, and associated greenhouse gas emission reductions.

Changes to the National Construction Code (NCC) provide 'Deemed-to-Satisfy' solutions for timber buildings up to eight storeys, or 25 metres to be constructed. Timber can also offer quicker build times, with less noise and disruption. Timber can also offer innovative design approaches that apply to both traditional light weight timber framing and innovative massive timber systems, such as cross laminated timber (CLT).

CLT background

CLT is now widely used internationally with the potential to be used in walls, floors and ceilings, particularly for multi-storey residential and commercial buildings. Such buildings have particular acoustic requirements, mandated in Australia by the NCC's Building Code of Australia (BCA).

Previous CLT acoustic research has been conducted across Europe and in North America. Because it is designed to meet local codes and building practises it is not always useful to compare the results of this research with the Australian BCA's acoustic requirements.

The timber industry envisages considerable potential for CLT as a building and construction material. Such buildings do, however, have particular acoustic requirements mandated in Australia by the BCA or by a relevant local government authority.

1 Cross laminated timber or CLT is a prefabricated solid engineered wood product made of several layers of timber boards stacked crosswise (at 90 degrees) and glued together under pressure to form a solid rectangular panel.

Acoustic laboratory testing of wall and floor systems.

Objectives

This cooperative project amongst CLT suppliers was initiated to develop base line information on the sound attenuation performance of CLT floor and wall systems. Further, to provide baseline sound attenuation information on CLT wall and flooring systems that will allow the development of:

1. Information for building professionals to meet building code requirements.
2. Information for acoustic consultants to develop assessments on variations to the baseline tested system.

Methodology

Acoustic laboratory tests on wall and floor systems were carried out to understand the effect of adding traditional construction layers to CLT. Common CLT thicknesses were tested in wall and floor configurations where conventional sound attenuation improvements used in construction were added as a variable to understand the effect of these additional layers.

Other variables, such as change in CLT thickness and joint methods were also investigated. To understand if there was a difference between the performances of various CLT suppliers involved in the project, a 'round robin' test of one sample from each CLT supplier was undertaken. This was conducted in a floor configuration, including the addition of a plasterboard layer.

Research results were both aggregated test data from the actual tests, and a summary report in a format useable for compliance in building regulations. Where a difference in performance was measured between the various CLT suppliers this summary document sets out this range.

The research developed a comprehensive acoustic laboratory testing schedule of CLT wall and floor/ceiling systems that will allow:

1. Compliance with the sound insulation criteria required by the relevant Australian codes using building materials and practices typically employed.
2. A comparison of the test results for multiple CLT products to account for variability between manufacturers.
3. Compilation of comprehensive data for future acoustic assessments. This was achieved using the staged testing approach outlined.

Discussion

This research program is limited to the sound insulation performance of CLT and its associated acoustic treatment conducted within a complaint acoustic testing laboratory. The documented results of this research can be used by design professionals to support compliance with relevant codes.

Some local government authorities have adopted more stringent acoustic requirements beyond the BCA criteria. Where possible CLT acoustic building systems should be designed or developed in recognition of particular local government requirements.

Paul Kremer of XLam Australia confirmed that their funding support for the project resulted in considerable value to the company. He advised that following the completion of the project Xlam invested additional funding to develop an acoustic predictive software tool. The company has now provided copies of this tool to engineers, architectural consultants and builders to enable them to determine acoustic design and build requirements using Xlam Australia CLT products.

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