ALBERTA INNOVATES

CLEAN RESOURCES

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GREEN BUILDING TECHNOLOGIES

Use of Cross Laminated Timber in Basement Construction

Concrete dominates low-rise residential building basement construction in North America due to its durability and strength. Yet concrete basements have frequent performance problems, such as dampness, foundation cracking and leakage, high thermal loss, and long construction time. Cross-laminated timber (CLT), a mass timber technology, shows potential as an alternative to concrete and existing alternative wood products in basement construction. This Project will advance commercialization of CLT in basement construction by optimizing performance and installation, followed by field trials to assess performance. Project success could pave the way for CLT to out-perform concrete in terms of environmental footprint, thermal performance, and construction timelines.

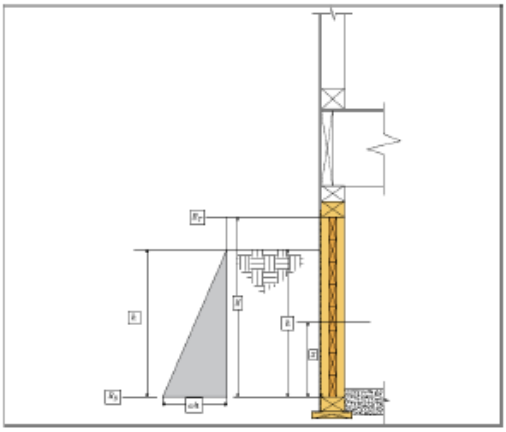

Figure 3 Foundation Walls with Basement Resisting Lateral Soil Load

FUNDING DETAILS

RECIPIENT:
University of Alberta

PARTNERS:
Landmark Group of Builders

TOTAL BUDGET:
$360,000

AI FUNDING:
$200,000

PROJECT DATES:
JAN 2019 – DEC 2021

PROJECT TRL:
Start: 4
End: 7

APPLICATION

This technology targets basement construction in low-rise residential buildings, as a sustainable, cost-effective, high-performance alternative to concrete and existing alternative basement construction materials in North America. Technology testing will consider performance in northern temperate conditions with colder winters, with a focus on residential home configurations marketed by Landmark Homes.

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PROJECT GOALS

Dr. Ying-Hei Chui, Professor and NSERC Industrial Research Chair in Engineered Wood and Building Systems, will lead a team in achieving the following Project goals:
Phase 1: Structural and hygrothermal analysis to optimize CLT panel thickness; establish panel fastening details in basement construction.
Phase 2:
(a) Develop a water barrier envelope system to prevent water in soil from penetrating the CLT wall and floor slab;
(b) Develop soil drainage details, based on existing Permanent Wood Foundation guidelines, to reduce water pressure build-up around the basement perimeter; and
(c) In the laboratory, evaluate the envelope system's resistance to water penetration and to potential damage during construction and under anticipated loading conditions.
Phase 3: Set up and complete 6 months of field trials. Install systems with sensors to monitor water barrier performance, heat transfer through the CLT wall, and structural movement. Field trials will continue up to three years beyond the Project.

BENEFITS TO ALBERTA

- If successfully commercialized, a CLT production facility would be established in Alberta, creating new job opportunities.
- A new value-added product and market for Alberta's and Canada's forest products sector. Potential market in Canada could utilize the equivalent of 25 per cent of Alberta's annual lumber production.
- Reduce GHGs and environmental footprint by reducing the use of concrete in housing construction.
- Further reduction of GHGs as a result of improved thermal performance of CLT basements, compared to concrete basements.
- Improved comfort and reduced risk of foundation damage and repairs for owners and occupants of single-family homes.

1 Publication

2 Students Trained

2-3 Project Jobs

10 Future Jobs

1 New Product/Service

21 kt/yr Future GHGs Reduced

CURRENT STATUS

NOV 2021

Structural design has determined that 3-ply (105 mm) CLT panel thickness is adequate for integrity in most cas team has designed a test apparatus for the water barrier system, including several sensors to measure temper relative humidity at multiple locations throughout the setup. Water barrier materials have been selected for th demonstration structure, which is currently under construction. Once completed, the structure will be monitor performance to validate the concept.