Technical Session 7:
Durability of Mass Timber

The Current Status of Hardwood Cross-Laminated Timber

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ABSTRACT

In this presentation, Dr. Sailesh Adhikari will discuss the efforts of the Department of Sustainable Biomaterials at Virginia Tech in implementing hardwood lumber for use in Cross Laminated Timber (CLT). He will introduce the current limitations of using hardwood lumber in CLT manufacture, which can be overcome. He will introduce our approaches to producing visual strength grade hardwood lumber relative to visual appearance grades. Dr. Adhikair will then provide an overview of the production of yellow poplar CLT panels at the SmartLam CLT manufacturing facility and the mechanical testing results of the panels at the APA. He will discuss our current work with Texas CLT in developing a hybrid yellow poplar and southern yellow pine CLT and thoughts about the future of hardwood CLT. Finally, he will discuss our current collaboration with industry stakeholders to include yellow poplar in PRG 320, the APA/ANSI standard for CLT manufacture.

Design and Prototyping of Mass Timber Noise Barriers for Highways

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ABSTRACT

The objective of this research was to design a mass timber noise barrier as an alternative to typical concrete construction and assess its cost-competitiveness, environmental impact, and durability. First, a suggested mass timber noise barrier design is presented that leverages typical details to leverage similar construction processes to concrete noise barriers. The design is shown to be viable for a wide range of wind and seismic loads using typically manufactured sizes of cross-laminated timber (CLT). Next, a cost comparison study is presented to examine the difference in cost between concrete noise barrier construction and the proposed CLT noise barrier design. On a per panel basis, an environmental impact study was also carried out. Finally, a full-scale prototype was erected and different coatings for the CLT were assessed via monitoring of moisture data at various depths and spatial locations of the CLT panel. The results show that the proposed design would be cost-competitive with concrete noise barriers while significantly decreasing carbon footprint. Finally, the moisture monitoring results indicate the coatings kept the wood moisture content below 30% for the duration of monitoring.

Assessment of Termite and Decay Damage to Mass Timber Elements in AWPA Ground Proximity and Above Ground Field Tests in Southern Mississippi

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ABSTRACT

The ability of soil insecticidal drenches or spray-on insecticide/fungicide treatments to protect mass timber elements was assessed using two modified AWPA ground proximity tests established in 2017 and 2019. The 2017 test evaluated 3-ply Douglas-fir cross-laminated timber using a modified AWPA Standard E26 while the 2019 test used a modified AWPA E21 protocol to evaluate three ply Douglas-fir or southern pine cross-laminated timber as well as Douglas-fir mass plywood panels. Both tests were installed at the Harrison Experimental Forest (HEF) (Saucier, Mississippi) and will be assessed for five years. Treatments include an initial soil termiticide drench, spray-on borate at initiation, borate rods at initiation, remedial boron spray treatment 2 years after installation, and untreated controls. Samples were left undisturbed for one or two years and then rated for degree of termite and fungal damage. Moisture content of the test materials increased greatly over the non-disturbance period. Untreated control samples were attacked by both decay fungi and termites. Soil termiticide treated plots showed no sign of termite attack, but decay was evident on some samples compared to non-soil termiticide treated plots. Samples treated with borates at test initiation showed limited decay or termite attack. The test will continue to be evaluated for a period of at least 5 years or longer and serve as critical baseline data for field evaluation methods of mass timber in areas of high subterranean termite pressure.

Service life prediction of coated CLT: Is it possible to estimate when it's time to recoat?

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ABSTRACT

Mass timber panels such as mass plywood panels (MPP) and cross laminated timber (CLT) have gained popularity in the last few decades in the construction of tall timber buildings. The growth of mass timber construction in North America requires the development of methods and solutions to secure its use without compromising the safety of building occupants and environmental sustainability. Like any wood structure,

mass timber structures are susceptible to biodegradation if they are located in high decay hazard zones i.e., areas where the conditions are conducive to decay and consequently higher fungal activity. Low mammalian-toxicity preservatives protect wood materials against microorganisms with little to no impact to the environment; however, some pressure treatment chemicals impact serviceability of metal connections. The objective of this project is to understand the behavior of L-bracket connections in treated and untreated mass timber subjected to moist and hot conditions. Herein, southern pine lumber, untreated and treated with commercial preservative, will be used to manufacture cross laminated timber panels. Mass timber connections will be evaluated according to their mechanical properties and degradation rate over time. This project is important because it brings together wood preservation, building construction, and artificial intelligence to leverage the use of mass timber as a renewable building material that has environment, aesthetic, and economic advantages. As southern pine is the largest lumber resource in the U.S. South, it will open new markets for investors in mass timber production, construction, and adoption. Consequently, this work seeks to expand the mass timber building market by providing durability solutions in locations where it may not yet have been introduced because of biodegradation concerns. The project may also contribute to the development of new preservatives and wood protection systems designed specifically to attend the needs of mass timber products.

Resistance of Cross-Laminated Timber (CLT) to Subterranean Termites

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ABSTRACT

Cross-laminated timber (CLT) is part of a wood composite category called mass(ive) timber, and it is a driver of innovation not only inside the wood industry, but also for the building industry. Its design allows the industry to meet a higher range of specifications, sizes, and grades, while maintaining or exceeding natural strength of solid wood. CLT is considered a “green” or “eco-friendly” product, being a great alternative for the building industry to reduce carbon emissions and become an important player in the solution for climate change. Although CLT is more homogeneous compared to traditional wood framed structures, the factors that impact its strength cannot be ignored. To achieve safer and more durable buildings, degradation risks must be studied. The objective of this study was to outline guidance for the laboratory scale testing of CLT under termite attack. Untreated commercially available CLT was used. The recommendations presented in this study serve as a beginning for further testing of CLT and other mass timber products. Future studies are being conducted and other variables such as MC of wood, MC of adhesive, thickness of glue line, wood density, and wood grain orientation will be included.