

## **Home for the Homeless using Cross-Laminated Timber Waste Stream Abstract**

**Project Description:** To alleviate the homelessness crisis in our city, a non-profit organization (NPO) builds detached 125 sq ft accessory dwelling units (ADU) in the backyards of willing homeowners using unskilled volunteers. The surrounding community provides the support to the occupant until they get back on their feet. Ten ADUs have been built since the NPO's inception, using traditional light wood frame construction as with residential homes. The NPO partnered with our university to investigate if waste stream from cross laminated timber (CLT) could be used to build future ADUs.

Five civil engineering seniors took this challenge on as their capstone project. They researched the nature of the CLT waste stream, developed and evaluated three options for the ADUs and selected a preferred alternative. They carried out the entire structural design of the preferred alternative from foundation to the roof along with all hardware required to connect the structural members.

**Collaboration of Faculty, Students, Licensed Professional Engineers and other Allied Professionals:** The students worked under the supervision of a faculty member who is a licensed structural engineer (SE). The PE of record of the current ADU served as a professional mentor to the team and explained the current design and the concerns about switching to the CLT construction. The capstone course is taught by a professional engineer (PE). The students presented their project to a panel of judges, all PEs, as part of an annual ASCE local section competition which was held in the virtual setting due to pandemic.

An architect from the NPO served as the client for the project. The team visited a CLT plant and met with factory personnel to understand the CLT manufacturing process and the nature and amount of waste stream. The students volunteered their time to help with the construction of an ADU to understand the ability and limitations of unskilled volunteers.

**Benefits to Public Health, Safety and Welfare:** The project made the students aware of how engineering skills could be applied to ameliorate societal problems. The team focused on the health, safety and welfare of the homeless community throughout the project. The team learned to perform a fire safety check and a floor vibration check to ensure serviceability.

**Knowledge and Skills Gained:** The students used a wide range of design guidelines and software to complete the project. In addition, they were exposed to the concept of Living Building Challenge, a sustainable and environmentally friendly design concept. The team learned to design the various hardware and connections, and also performed cost analysis.

The students learned how to apply the technical knowledge gained in the classroom to a real-life project and to develop professional skills in the area of oral and written communication, team work and project management. They became aware of the multi-faceted nature of the engineering profession – the students had to interact with engineering and non-engineering personnel to develop the final project deliverable, a process which involved structural design, construction management and environmental considerations.