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A NEW STANDARD

The use of mass timber gave an elementary school several structural advantages. BY PAM WEAN



PHOTO CREDIT: MSES Architects

» Franklin Elementary School is the first of its kind to be built with cross-laminated timber.

In 2013, West Virginia's School Building Authority (SBA) began planning the construction of a new elementary school in Franklin, W.V., a rural community of less than 1,000 people. The school district needed a fixed-cost project that could be finished within a short construction window through the harsh West Virginia winter, while meeting high expectations from the community for a quality product. After considering traditional options for the area like steel, concrete and masonry, an innovative mass timber system was chosen for its low cost, speed of construction and environmental benefits.

First of its Kind

Franklin Elementary School is a 45,200-square-foot structure that houses 300

students from pre-kindergarten through grade six. Given the small size of the community, it was significant that the owner was willing to try a new design and become the first school in the United States to be constructed with cross-laminated timber (CLT) – a panelized lumber product that has been embraced in Europe for years. The design/build team of MSES Architects and City Construction Co. worked with the German firm Timber Concept GmbH to design and construct this cutting-edge facility.

Consisting of multiple layers of either dimensional or structural composite lumber, CLT offers strength, stability and rigidity. In the case of Franklin Elementary, CLT was used for the structural framing including exterior walls, interior load bearing walls, shear walls and gymnasium walls, as well as in the roof and above-grade floor structures. Load-bearing walls were about five inches thick and interior non-load-bearing partitions were framed in light gauge metal.

Speedy Installation

Perhaps the greatest advantage of using CLT for the project was incredibly fast installation, which was required to meet the school's



tight timeline. Foundation installation began in late November 2013 and was finished in March 2014. The first CLT panel was set in April of that year, and the last one was set in mid-June. The crew's best day saw 33 panels erected, amounting to approximately 10,000 square feet in a single day with just four laborers and a crane operator. The project was completed in January 2015 in time for the school's second semester.

The short timeline is even more impressive when considering the harsh winter weather project crews were forced to contend with. On several occasions, the snow at the job site was one to two feet deep, yet crews were still able to lift and place CLT panels. It would have been extremely difficult to work through the winter that West Virginia experienced that year with another material.

Mass Timber Design

The decision to use mass timber at Franklin Elementary brought several structural advantages. The CLT panels provided high axial load capacity for the walls and a floor span-to-depth ratio of 20:1 to 30:1. Because panel thickness is dependent on span and loads, architects and engineers worked to increase thickness of the floor and roof panels to allow longer spans, thus reducing the quantity of steel columns and beams. The same was done for the roof panels, which ranged in thickness from approximately five to just over nine inches, and were nearly eight feet wide and 40 feet long.

However, because the CLT was sourced through Timber Concept in Germany, the length of the panels were limited to a size that would fit in the shipping containers crossing the Atlantic Ocean. This encouraged the design team to incorporate glued laminated timber (glulam) beams and columns for some of the longer roof spans in the gymnasium and cafeteria.

Meeting Code Requirements

Because this project was the first of its kind in the region, special approval from state fire

marshals was required to move forward. All schools in West Virginia must include sprinklers, and the fire marshals required sprinklers both below and above the drop ceilings where CLT was exposed. A layer of drywall was installed on each side of the CLT walls where they were required to be fire rated.

Mass timber products perform well in fire testing because they are thick and char on the outside at a slow and predictable rate while retaining strength. This helps to slow combustion and allow time to evacuate a building. In the event of a fire, the charring created on the surface of mass timber helps protect and insulate unburnt wood beneath.

Inherent Environmental Benefits

Recently, more and more schools have been working to reduce the environmental impact of their buildings. This makes wood an even more attractive choice, as it has a significant carbon benefit. Wood products continue to store carbon absorbed by the trees while growing, and require less energy to manufacture than fossil fuel-intensive building materials. For Franklin Elementary, the use of 818,736 board feet (equivalent) of CLT and glulam resulted in a total potential net carbon benefit of 3,169 metric tons of CO₂, the same amount needed to operate an average home for 269 years (based on the Carbon Calculator for Wood Buildings, www.woodworks.org).

Setting an Example

The success of Franklin Elementary has sparked a desire to continue working with mass timber. Franklin Elementary proved to be a worthwhile and rewarding project in which the community can take pride. MSES Architects is extremely proud to have been a part of this building, the first of its kind in the U.S., and the company hopes it will become a model for future projects around the country.

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PHOTO CREDIT: MSES Architects

The use of CLT panels in the school allowed it to be built in a short period of time. <<