CASE STUDY

Santiam Canyon Junior/Senior High School Gym

Unique mass timber facility becomes a point of civic pride

Even with growing enrollment and aging facilities, it can be challenging for small communities like Mill City in rural Oregon to fund new school buildings. Voters in the Santiam Canyon School District (SCSD) had never passed a bond measure in the district's decades-long history. "When you have a big need but a small tax base, there's only so much you can ask a community to do," said Todd Miller, SCSD Superintendent. "We needed to upgrade our facilities but knew we'd face an uphill battle getting support."

While there were other school structures in the proposed project, the so-called 'heart' of the $17.9 million bond measure was a new gymnasium, which would give 300 junior and senior high school students much-needed space for PE class and sports practices. SCSD's original plan was to build a barebones, prefabricated metal building, described as 'just a dry space for kids to practice.' But the proposal got a boost when local mass timber manufacturer Freres Engineered Wood donated their innovative mass timber panels, beams and columns for the construction.

PROJECT DETAILS

Santiam Canyon School District Junior/Senior High School Gym

LOCATION:	Mill City, Oregon
STORIES:	One story
SIZE:	9,800 square feet
CONSTRUCTION TYPE:	Type V-B
COMPLETED:	2021

PROJECT TEAM

CLIENT/OWNER:	Santiam Canyon School District
ARCHITECT:	Soderstrom Architects
STRUCTURAL ENGINEER:	ZCS Engineering & Architecture
CONTRACTOR:	Gerding Builders, LLC
MASS TIMBER SUPPLIER:	Freres Engineered Wood

Connect with the Santiam Canyon School District Junior/Senior High School Gym project team at *www.woodworksinnovationnetwork.org/projects/669*

WOODWORKS INNOVATION NETWORK

The bond measure passed, and the distinctive gymnasium has since become a point of pride for the community. "When we first opened, one of the kids told me he felt like he was now attending a fancy private school," remembers Miller. "It's pretty powerful to be able to offer an experience like this in a small, rural community."

New Product, New Opportunities

The gym includes a full-sized competition court with built-in bleachers, team rooms, support spaces, and a lobby with restrooms. Soderstrom Architects designed a simple structure with a sloped shed roof over the gym volume and clerestory windows at one end for daylighting. The building's form was well-suited to the structural capabilities of the mass timber provided by Freres Engineered Wood.

Known as mass ply panels, or MPP, Freres' veneer-based cross-laminated timber (CLT) roof panels are certified under the ANSI/APA PRG 320 *Standard for Performance-Rated Cross-Laminated Timber.* Panels were 4 inches thick and 11 feet 10 inches wide, all custom cut at the Freres plant less than 10 miles away. Panels were constructed of 1/8-inch wood veneers, oriented to maximize their strength and stability.

Freres also provided columns and beams, known as mass ply lams, manufactured using the same veneer-based mass timber technology but with the veneers layered in the same direction.

The veneer-based mass timber elements were new to the design team. "The panels have a different aesthetic than CLT made from dimensional lumber, but they still have the warmth, character and variation of wood," said Marlene Gillis, President of Soderstrom Architects. "And, like other wood products, they will age well over time."

Gillis said they initially evaluated other structural options for the gym, including traditional wood-frame and steel-frame construction and pre-engineered metal. "We determined that

mass timber was the best solution, particularly since it had the community connection and Freres' offer to donate the timber," she said. "The fact that it was also a good structural solution, and it was locally sourced and sustainable, made the decision even easier. And because the city has such a strong timber background, the goal of having an all-wood gym was very appealing."

Using Wood Panels for Lateral Resistance

The veneer-based material was also new to ZCS Engineering. "At first, we didn't know how to approach it from a code path perspective," said Kristofer Tonning, Lead Engineer. "But the Building Codes Division of the State of Oregon had issued a Statewide Alternate Method, an alternative to the Oregon Structural Specialty Code number 15-01, *Cross-Laminated Timber Seismic Force-Resisting Systems*, which gave us the seismic design parameters and code path we needed."

Kyle Mullen, Lead Designer at ZCS, added, "The panels themselves are like solid 4-inch-thick sheets of plywood, and the columns and beams are like laminated veneer lumber (LVL), which simplified diaphragm design. The columns were the same widths as the beams above, which required a simple bearing connection with no embedded structural steel—just some hidden knife plates. And because the veneer layers line up vertically and horizontally at the connection, it's a clean, distinctive look."

For lateral resistance, ZCS used the panels as shear walls, tied into the roof. There, they used plywood splines, which were nailed in some places and screwed in others, to connect the panels. They also used splines to connect wall panels to the sill plates at the base of the building.

Long-Span Beams

From a structural engineering standpoint, one of the most interesting aspects of the project was the long-span beams, said Austin Basl, Engineering and Technical Sales at Freres Engineered Wood. "Our plant is limited to 48-foot members, but the design team needed a 72-foot clear span across the gym. They were able to achieve that by splicing together three 47-inch-deep mass ply beams."

Matt Smith, principal in charge of the project at ZCS, added, "The key was to keep the connection out of the midspan because that had the highest demands. So, we used a 48-foot center beam connected to two shorter beams on either side. In all, seven beams were connected like this on site and lifted into place."

Three metal plates formed the connection. Two rectangular 3/8-inch-thick knife plates, one at the top and the other at the bottom, were bolted to each beam. The plate on the bottom has another plate welded underneath, which extends up through the center to transfer shear. Each connection used 152 1-inch-diameter bolts; 66 on each of the top and bottom plates and 20 for the center.

Two-Week Installation

Speed of construction was another benefit of using mass timber. "Whenever you're working on a school site, it's all about getting students back to class quickly," said Mullen. Because everything was prefabricated, the primary structure of the gym went up in just 15 days with two crane operators and six carpenters. The walls alone took less than a week to install.

Miller added, "The gym site went from a concrete slab to a fully enclosed structure in that two-week span. One day, someone from the community walked up to me with a confused look on his face and asked, "What just happened?" That's how fast it all went together."

Rallying Point for the Region

SCSD draws students from several nearby towns, so it was an added benefit for members of the community to walk into the new gym and see wood everywhere. Frank Lumber is located right in Mill City, and nearby Freres Engineered Wood has more than 450 employees, so people appreciated that the facility was put together by their friends and neighbors using wood from nearby forests.

Today, the new gym is in use virtually every school period, including lunchtime. On weekends, it's also used by community youth sports leagues. "It's a great collaboration when schools, community and businesses all come together for kids," said Miller. "This project exemplifies that partnership."

Santiam Canyon Junior/Senior High School Gym | Freres Family Gymnasium

Volume of wood products used:
8,736 cubic feet

U.S. and Canadian forests grow this much wood in:
1 minute

Carbon stored in the wood:
221 metric tons of CO_2

Avoided greenhouse gas emissions:
86 metric tons of CO_2

TOTAL POTENTIAL CARBON BENEFIT:
307 metric tons of CO_2

EQUIVALENT TO:

65 cars off the road for a year

Energy to operate 32 homes for a year

Source: US EPA

Estimated by the Wood Carbon Calculator for Buildings, based on research by Sarthre, R. and J. O'Connor, 2010, A Synthesis of Research on Wood Products and Greenhouse Gas Impacts, FPInnovations.
Note: CO_2 on this chart refers to CO_2 equivalent.

Reducing Carbon Footprint

The use of wood lowers a building's carbon footprint in two ways. Wood continues to store carbon absorbed by the trees while they were growing, keeping it out of the atmosphere for the lifetime of the building—longer if the wood is reclaimed at the end of the building's service life and re-used. Meanwhile, the regenerating forest continues the cycle of carbon absorption. Wood products also require less energy to produce than other building materials, and most of that comes from renewable biomass (e.g., bark and sawdust) instead of fossil fuels. Substituting wood for fossil fuel-intensive materials is a way to avoid greenhouse gas emissions and reduce embodied carbon.

Investment for the Future

Mass timber offered many advantages, including fast construction, warm aesthetics and sustainability. Yet early in their planning, Miller said there was still some fear and reluctance about using a new product like the veneer-based mass timber from Freres. "We even had people recommending that we stick with a metal building because they'd know what to expect. But we were adamant about using wood, and looking back, it's one of the best decisions we made. This gym is a real point of pride for us because we know how much it means to our community to have an important building like this constructed with a local product."

Gillis agreed, adding, "School construction is such a budget-driven process; there's so much community scrutiny that you must justify every dollar. But the advantages of using this unique timber material paid off in so many ways."

The team at Freres Engineered Wood knew that passing a bond of any sort would be a challenge but publicly urged those in the community to invest for the generations to come. "We know the needs, issues and unique challenges that our Santiam Canyon community faces," said Tyler Freres, Vice President of Sales. "We wanted to see the bond measure passed for the long-term health and well-being of our community. That's why we agreed to donate our mass ply products, to decrease project costs and therefore reduce costs to the community and demonstrate our support for Santiam Canyon."

Miller said he was grateful to Freres and everyone in the community who contributed. "A big portion of our population is involved with timber products; they may have logged the forest, hauled the trees, produced the mass timber, or provided other services to help this project get built. This gym is a point of pride for so many here, including the kids who get to play every day in this beautiful wood facility."