Engineered Wood In School Design

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Engineered wood inspires with warm, friendly spaces and cost-effective design.

The need for new and renovated educational facilities is huge, and demand continues to grow as the children of baby boomers crowd existing schools. The U.S. Department of Education reports that enrollment in public and private K-12 schools reached 52.7 million students in 1999. Future student population will continue to increase, with public school enrollment expected to hit a record-breaking 54.3 million students by 2008.

Despite the crunch, school districts, architects and builders remain mindful of the need to build quality, durable school buildings with warm spaces that encourage learning instead of just house students. Engineered wood composites such as glued laminated timber (glulam), I-joists, laminated veneer lumber (LVL), plywood and oriented strand board (OSB) allow school districts to cost effectively meet design and in-service criteria by offering warmth, strength, quality and durability.

FAMILIARITY WITH WOOD'S ADVANTAGES VARIES

School design has come a long way since the "quick and cheap" concrete structures of the 1950s. Today, architects work to create large, open spaces that meet project-oriented teaching styles instead of traditional, classroom-centered "chalk and talk" presentations. Wood is used to design warm, friendly learning spaces and add visual value when left exposed – providing structural integrity as well as eye-catching design.

But because familiarity with wood's advantages is regional, use of structural wood in schools varies across the country. Wood is frequently used for schools located in western states, but is less common elsewhere.

Tom Bates is vice president of Burr Lawrence Rising + Bates architectural firm in Tacoma, Washington. Bates sits on two key design groups: the Committee on Architecture for Education (a national AIA committee) and the Council of Educational Facility Planners International.

"Attitudes towards use of structural wood products in educational facilities varies across the country and is completely dependent on location," Bates observed. "School designers in some states, such as Texas, use masonry instead of wood because that's what they're familiar with, it's readily available and therefore a cost-effective material. Architects in many other areas are more in tune with the cost effectiveness of wood and the design flexibility it provides."

Designed by DLR Group in Seattle, the Robert Gray Elementary School in Longview, Washington featured wood and aluminum to reflect the importance of local employers, Weyerhaeuser and Reynolds Aluminum.

WHAT DRIVES THE DECISION TO USE ENGINEERED WOOD?

Once familiar with its advantages, architects find many reasons to incorporate wood into educational facilities.

Jonathan Crump, principal architect for the Minneapolis offices of DLR Group, said they used wood in the new Albert Lea, Minnesota High School building to add warmth to a very large (270,000 square feet) facility. "The structure was built with cost effective pre-cast tilt-up concrete panels, so we needed something that would help us avoid a big warehouse look. By using glulam and leaving the beams and columns exposed in the common areas, we were able to soften the interior spaces."

Another trend is toward using environmentally friendly building materials made from sustainable resources. "Environmental sensitivity drives designers toward engineered wood products

ENGINEERED WOOD PRODUCTS – WELL SUITED FOR USE IN SCHOOL CONSTRUCTION

Glulam – often used in roof structures where they can be left exposed to feature the warmth of wood. Pound for pound, glulam is stronger than steel. This means glulam members can span long distances with minimal need for intermediate supports, making them ideal for use in gymnasiums, cafeterias, media centers, auditoriums and other large common areas.

Wood structural panels such as plywood and oriented strand board (OSB) – provide durability and shear strength for roof and wall structures, particularly important when renovating a facility to improve its seismic performance or its ability to resist high winds.

I-joists and LVL – used in floor and some roof applications; valued for their quality, consistency and ease of installation.

such as glulam and oriented strand board (OSB), which can be manufactured from second growth trees in managed forests," added Bates.

The DLR Group in Seattle uses wood primarily for structural reasons. "We use glulam to achieve long spans in gymnasiums; we also use it in sloped roofs and shed roofs, which we're seeing a lot more of," said **Craig Mason,** principal architect in charge of educational facilities. "However, wood is also cost effective and faster to install, which also benefits the school district."

Two schools in Carmel, Indiana (Cherry Tree Elementary and Smoky Row Elementary), feature exposed glulam roof trusses and laminated wood decking in the cafetorium and media centers. According to **Ron Farrand,** director of facilities for Carmel Schools, the large group spaces needed a more expansive feel than could be found with a typical drop ceiling. "We wanted to give them different textures and a richer atmosphere than the standard concrete block and steel or acoustical ceilings found in a typical gym or library. The resulting space is much more aesthetically pleasing and quite unique."

Architects featured exposed glulam trusses and laminated wood decking in the cafetorium and media center of Smoky Row Elementary School in Carmel, Indiana.

The student commons at Thunder Mountain Middle School in Enumclaw, Washington acts as a popular 'town center' for 650 students.

WOOD ADDS WARMTH

The use of structural engineered wood products enables architects to design high quality and durable schools that provide a warm and friendly place for children to learn. The ability of exposed wood to soften what could otherwise be a cold, institutional facility is undisputed.

"A desire to create a friendly environment is the single biggest factor in our decision to use engineered wood products in educational facilities," says **Bill Payne,** executive director for the Indianapolis architectural/engineering office of Fanning/Howey Associates. "Our design process is very interactive with clients. When we sense that a community is looking for a facility with more warmth – one that goes beyond the standard acoustical ceilings – we turn to wood."

The desire to create a friendly school environment is not limited to new construction. **Ralph Rohwer** is with Seattle's Heery International, Inc., the construction manager for Seattle Public Schools. "In the district's renovation projects, we're noticing that architects like to take what used to be an old gym, tear out the intermediate finishes and leave the existing wood structure exposed," he explained. "Doing so brings a nice warmth to the building instead of just a drop ceiling with fluorescent lights."

TREND TOWARD SMALLER SCHOOLS COULD INCREASE WOOD USE OVER TIME

Another key factor cited as criteria for using structural wood building systems is facility size. According to a report from the U.S. Department of Education, *Schools as Centers of Community: A Citizen's Guide for Planning and Design,* an effort is being made to reduce overall school size to less than 800 students in order to foster a "more positive learning process." The tremendous growth of smaller-sized charter schools from less than 200 in 1995 to almost 2000 in 2001, is adding to this demand for more community-oriented facilities.

Architects at Burr Lawrence Rising + Bates of Tacoma, Washington design wood-framed school buildings frequently. They find wood to be the most straightforward, cost-competitive choice when used in facilities 50,000 to 60,000 square feet and smaller.

"That benchmark is driven by Uniform Building Code requirements for type of construction and allowable areas," explained Tom Bates. "If we want to use wood in larger buildings, we simply compartmentalize the structure into smaller buildings to meet UBC's allowable area allowance for that type of construction."

Architects combined exposed structural wood elements with various ceiling heights to create the Tahoma, Washington School District's boardroom.

That works well, since Bates acknowledged the trend towards designing smaller, more compartmentalized, learning-centered buildings. "There is definitely a notion of creating schools within schools," he added. "We're continuously looking for ways to design a facility that will also help personalize education and avoid student anonymity. Wood helps us achieve those goals."

INTEGRATING SCHOOL DESIGN INTO THE COMMUNITY

A strong community connection with schools is also cited by the U.S. Department of Education as an important goal. By building smaller schools closer to where people live, experts say more livable communities will result. But, school facilities must therefore do a better job of blending into their surroundings.

Chloe Clark Elementary in Dupont, Washington is a perfect example. Located in an affluent planned community known as Northwest Landing, the DLR Group in Seattle needed to design a school that would fit in with the 1920s bungalow style of surrounding homes.

"The front entry to the school was designed to look like the front porch of a home, to help children feel welcome," said Mason. "The community also wanted a sloped roof to help the school fit in with the neighborhood. So, we framed the roof structure using glulam beams and left many of them exposed to the space below. The result is a school that integrates very well into the surrounding area."

The entrance to Chloe Clark Elementary School in Dupont, Washington welcomes children while complementing the surrounding community.

Glulams were used in the Cherry Tree Elementary School library because the Carmel, Indiana school district wanted a space with more warmth than an acoustical ceiling.

WOOD CONSISTENTLY REQUESTED BY PARENTS AND TEACHERS

Along with a strong community connection comes heavy involvement from parents, faculty and other community leaders in school design. The result is a very collaborative approach – one that overwhelmingly favors wood. In fact, nine out of ten parents involved in the school design process ask that wood be used to add warmth.

Tom Bates said his firm frequently conducts public meetings to solicit school design input. "The request to use wood is a normal outcome of a community-based design process, because most people favor a natural look for their child's school," he said. "By leaving the wood structure exposed, we can create a design that reflects the community's desires while meeting the district's budget."

Many times, their interest in using wood is also driven by a desire to echo local and cultural values. Burr Lawrence Rising + Bates recently finished a middle school serving the communities of Enumclaw and Black Diamond, Washington. The 80,000-square-foot project featured glulam trusses and other natural wood features. "The community's economy is strongly tied to the wood products industry, so it made sense to celebrate that in our design," said Bates. The firm took a similar approach with Lewis & Clark Elementary School in timber-dependent Astoria, Oregon.

A community-based design process also often results in a call to use local building products. During the design phase of the Albert Lea, Minnesota High School, a community design team consisting of parents, administrators and community leaders specifically asked that local suppliers, labor and materials be used where possible. Engineered glulam beams and wood decking were a logical choice since there was a manufacturer of these products located right in Albert Lea.

CONSIDER SYSTEM COSTS WHEN COMPARING WOOD TO OTHER BUILDING MATERIALS

Wood's cost competitiveness as a building material depends on many factors. However, when calculating the cost of using engineered wood for a roof structure, consider the entire system cost, stressed Craig Mason from DLR Group in Seattle. "For example, structural steel systems require rigid insulation, where batt insulation can be used with wood roof structures," said Mason. "Since batt insulation is so much cheaper than rigid insulation, a wood roof structure

Materials and detailing were carefully chosen for the two-story wood frame Goodman Middle School, located in Gig Harbor, Washington.

can save the school district significant money while providing the same energy efficiency."

Additional cost savings can be achieved during construction. Heery International's Rohwer says that lightweight I-joists and laminated veneer lumber (LVL) allow them to use a boom truck instead of a heavy crane for roof system installation, saving both time and money.

QUALITY AND DURABILITY ARE KEY CONSIDERATIONS, KEY BENEFITS OF WOOD

Do school districts question the fire safety, quality or durability of engineered wood structures?

"Not at all," answered Farrand, describing the Indiana school districts he works with. "Administrators and parents are more sophisticated than that here, and very comfortable with the fact that engineered wood provides a safe, high quality structure."

Tacoma's Tom Bates agreed, saying that school administrators are more concerned with maintainability, durability and longevity. "Schools get so much abuse," he admitted. "What drives school design from our perspective is the need to use products that are easy to maintain. Wood is a quality, durable product that can cost effectively meet seismic design issues. That's what sells here in Washington."

Two K – 8 schools in the Evansville, Indiana area confirm that wood's fire durability is recognized and respected elsewhere in the country. The libraries and the gymnasiums at the Owensville and Haubstadt Community Schools (116,000 and 106,000 square feet respectively) were constructed with exposed glulam beams and laminated decking.

Exposed glulam support structures welcome visitors to the west lobby of the Albert Lea High School in southern Minnesota.

Students enjoy view dining in the cafeteria/commons area of the Albert Lea High School in Albert Lea, Minnesota.

Tim Henning, principal with Architecture + PC of Evansville, Indiana says administrators and parents there raised little concern over the use of wood due to fire risk. "However, when it is brought up, I always tell people about that famous picture taken after the fire at the Chicago Convention Center, where the glulam beam is holding up a melted steel girder," he explained. "I'm familiar with the fact that wood chars and therefore protects itself. So in my opinion, heavy timber is superior to steel when it comes to fire safety."

Henning goes on to say that Heavy Timber has the same allowable heights and areas as type II, one-hour construction. "Non-combustible (steel) type II construction must be covered with gypsum board, plaster, etc. in order to meet the same fire classification as exposed heavy timber," he added. "Glulam gives us the fire rating classification we need, so it's never an issue."

NEVER-ENDING NEED FOR RENOVATION

Moving forward, quality and durability continue to be key factors in school construction. School buildings are simply worn out, which increases demand for long-lasting building components. The U.S. Department of Education says that overuse and consistent delays in regular maintenance have taken their toll. The life span of most school buildings is approximately 40 years, after which schools begin to rapidly deteriorate. Today, the average American school building is 42 years old.

Ralph Rohwer says the Seattle School District, like others across the country, faces a tremendous need for renovation. "Since districts are so reliant on voter passage of funding for their capital improvements, they are always behind the curve in terms of repair and renovation. As a result, they have many

Architects took advantage of wood's design flexibility when adding a multi-purpose room onto the historic Maplewood Elementary School near Puyallup, Washington.

buildings that are past their useful life. This creates a huge demand for remodeling that won't go away soon."

What is engineered wood's role in renovation? Some say future remodeling and renovation will be easier with a wood framed building. Others say it will be less expensive to do so.

"It is generally easier to modify a wood structure than a steel structure, but so much depends on original structure," qualified Mason from DLR Group in Seattle. "But, much of the renovation out here involves seismic upgrades, and wood is very well suited for that. We use plywood and OSB for shear walls and to tie the roof diaphragm together. Engineered wood is perfectly suited for this."

Rohwer agreed, saying "Generally, the least expensive means of dealing with lateral loads and seismic issues is to add plywood shear walls where they don't exist. There is a tremendous need here for that alone."

Cost-wise, Evansville's Henning points out that long-term maintenance needs to be considered when comparing wood roof systems to other options. "If you cover a steel roof structure with an acoustical ceiling, you must account for the fact that the ceiling will also have to be replaced at some point, which can be expensive," he explained. "If you decide to leave a steel roof structure exposed, you must factor in the cost of painting it, to make it more attractive, and then having to repaint it again over time. A wood roof looks good on its own without modification. So, from a life-cycle value engineering standpoint, we found it to be less expensive to use glulam and leave the natural warmth and beauty of the beams exposed."

To learn more about the use of engineered wood in school design, or for more information about engineered wood products, contact *APA - The Engineered Wood Association* at (253) 565-6600. Or visit www.apawood.org http://www.apawood.org.

Engineered wood makes the grade

"Wood is a wonderful structural product that can cost effectively meet seismic design issues – that's what school districts are looking for here," said Tom Bates. "It's a high quality and durable product. We like using wood, but the key is to use it properly and thoughtfully. If you do that, it's amazing how it can impact the aesthetics, ambience and overall quality of the school space."

Bill Payne from Fanning/Howey Associates in Indianapolis agreed, adding "Wood is always a welcome finish within any building, particularly when you have kids. While it's intuitive to use wood, engineered wood products just take it to another level from a structural and a design standpoint."

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