



Graceful Laminated Timbers Enhance Library Interiors

Laminated timber roof trusses have been specified for educational buildings for a half century, but they were often concealed by suspended or hanging ceilings in the past. Today, many architects are deliberately leaving the big trusses exposed because of their warmth and aesthetic appeal. For new libraries, many designs are incorporating these concepts to provide a warmer environment for study, reading and research.

Architects and engineers have a choice of many different materials for roof systems in institutional and commercial buildings. Exposed timber beams and trusses are often specified because of wood's strength, competitive cost, and warm appearance.

Four new libraries have been designed with laminated wood beams and laminated roof decking for their aesthetic appeal, and to avoid the expense of suspending or hanging ceilings to cover structural framework. The furring, sheathing and finishing often required with steel or other structural materials is eliminated, which means faster construction at lower cost with wood. And unlike steel, concrete or other materials that deplete natural resources, wood is renewable with 6 million trees planted each day in the U.S.

Today's light, graceful library structures are a far cry from the past when many libraries were built like fortresses with heavy concrete columns and dark, gloomy interiors.

Beaverton, Oregon Library

"People come to libraries seeking knowledge, entertainment and stimulation. Upon entering the recently completed Beaverton City Library in Beaverton, Oregon, it becomes immediately apparent that all of these things and much more are available inside. Funded through a local voter-approved bond measure, the new facility replaced the city's old library which had been located in an overly cramped converted 20,000 square foot supermarket. The new library is a spacious 70,000 square feet appropriately sized to adequately serve the city's growing population. Combined with a new full block city park, the \$21 million project has successfully achieved the city's goal of developing a library that serves as a hub of community activity.

The design of the new Beaverton, Oregon City Library reflects its slogan---"The City of Trees." The interior is a showcase of wood with its **"...the structural system creates the architectural character..."** laminated beam roof supported by graceful tree- shaped glulam timber columns. The building is unique in that, for the most part, the structural system creates the architectural character of the library. The majority of the primary structural elements are exposed to view, which creates a very exciting space that engages visitors from the moment they enter. Through close collaboration with the designers at Thomas Hacker and Associates (Portland, Oregon), KPFF Engineers developed a structural scheme that both exploits the strengths and explores the potential of all of the main building materials.

A precast concrete hollowcore plank floor supported on exposed precast concrete girders and a combination of precast concrete and concrete masonry piers serve as the floor structure of the ground and second floors. The structural and visual strength of the precast system satisfied the need for a high live load capacity, large open spaces and an ordered, modular building grid. Resistance **"...high live load capacity..."** to seismic and wind forces was achieved through combination of concrete masonry piers on the exterior perimeter and four concrete shafts located in each of the four building corners. A highly articulated, naturally lit wood framed stair draws users from the solid integrity of the ground floor to the lofty reaches of the main reading room on the second floor." *Ed Quesenberry, P.E., KPFF Consulting Engineers, Portland, Oregon.*

The visual impact of the wood roof has a basket weave effect with the elegant curved timber "trees" supporting a ceiling of glulam timbers and 6x6-foot herringbone squares of laminated decking. The curved glulam columns are 24' 8" high and are 8-3/4" x 15" at the base. They taper to a 6-1/2" size at the top. The columns support 5-1/8 x 12" laminated timber rafters and purlins and the six-foot squares of 2 x 6" T&G lam decking.



According to Brett Crawford of Thomas Hacker and Associates, "We wanted to achieve a strong structural expression with the warm character of the wood and a strong geometric system with the tapered, tree- shaped supports. Instead of dozens of separate support columns, we created 16 tree shapes, each **"...elegant curved timber 'trees'..."** rising with four bearing points to support an intricate roof structure."

Credits

Structural Engineer – KPFF Consulting Engineers
Architects: Thomas Hacker and Associates
Contractor: J. E. Dunn Construction
Laminated beams and decking: Disdero Lumber Co.

Pahrump, Nevada Library

The new Pahrump Community Library in Pahrump, Nevada, was designed to meet the growing needs of the community, as well as providing services previously not available to patrons. Designed by architects and engineers of Leo A. Daly & Associates Architects, the 20,000 square foot facility will accommodate the library's entire collection and will allow for future growth.

“...a showcase of laminated wood...” The new community library is a showcase of laminated wood, with unusual double glulam trusses that are left exposed to add warmth and ambience to the library's interior. The structural framing combines conventional wood framing, customized glue laminated trusses and steel framing.

Heavy timber construction was selected early in the design process for its warmth and appearance. Connections of wood-to-wood and wood-to-steel were visually exposed and treated as architectural elements, rather than concealed. Diffused sunlight is allowed to filter in across the trusses from clerestory windows above, providing natural lighting throughout the building. An unusual stair-stepped configuration of these trusses was required to accommodate those windows. Architect Tom Findley says the main glulam trusses span 45 feet and are topped by a smaller laminated timber truss that provides for the clerestory window wall that runs the entire 76 ft. length of the structure. The trusses are exposed to achieve a rustic atmosphere in the main reading room of the library. Their height is 15' 10-1/2" above the main floor.

Wood construction consisting of **“...economy and aesthetics.”** conventional roof trusses at two feet on center and stud walls of 2 x 6 Hem-Fir No.2 was chosen for economy and availability. To achieve the airy aesthetics required by the architecture, exposed glue laminated trusses spaced at ten feet on center, supporting exposed wood decking, were designed for the main collection room and the front entry. Glue laminated trusses were selected over structural steel on the basis of economy and aesthetics. Although the custom fabrication of glue laminated members can exceed the cost of structural sections, the need to fire-proof and soffit structural steel trusses made them cost prohibitive. Glue laminated beams were also used for all exposed wood members, and where conventional timber members were not adequate. Structural steel framing was utilized at the center of the building to provide flexibility and the added strength needed to support the truss spans.

Designed for 70 mile per hour winds with exposure C and Zone 3 seismic loads per the 1997 Uniform Building Code, the structure features a flexible plywood roof diaphragm and a combination of wood shear walls and a steel moment frame. STAAD-Pro structural software was **“...lightweight concrete roofing tiles...”** utilized in the design of the moment frames. All other design was done by hand calculations including determination and distribution of the lateral loads. The roof construction over the main reading room is lightweight concrete roofing tiles with 30# building felt on rigid nail-base insulation, over exposed 3x 8" laminated wood decking.

Simpson Strong-ties were incorporated into the design for all standard wood to wood connections. Special saddles featuring steel plate and 3/4-inch diameter bolts were designed for all exposed glue laminated timber connections.

The laminated trusses went into place quickly because they arrived at the job site pre-cut, drilled, fitted, and pre-assembled—ready for erection.



The architect and contractor note that the timber framing gives a warm rustic appearance and saves money, because steel trusses would **“...a warm rustic appearance...”** have been shop-fabricated and would require more time to assemble than wood.

General contractor Ray Hoffman, B & H Contractors, says the glulam beam trusses saved time and money because they can be erected faster than steel. “It's easier to nail and bolt wood components than it is to weld steel,” he notes. Hoffman adds, “If the library had been framed in steel rather than glulam trusses, the cost of steel would have been at least 50% higher because of the extra time required.”

Within the building's 20,000 square feet, separate areas are zoned for the Adult's and Children's Collections, along with administrative space, coffee counter, and private study rooms. Community Meeting Rooms, previously not available, can accommodate larger groups both during and after library operating hours. In addition to the reading room, the library spaces also include a children's area, offices and work areas, community computer internet space, and a community meeting room with a separate entrance. The library is a state of the art facility with extensive electronic network capabilities to serve the community for many years in the future.

Credits

Architects and Structural Engineers:
Leo A. Daly & Associates, Las Vegas NV.
Contractor: B&H Construction, Henderson, NV
Laminated Trusses: Imperial Laminators, Eagar, AZ.

La Vista Library and Metropolitan Community College Sarpy Center

Exposed laminated timber trusses help provide a tranquil environment inside the new La Vista Public Library in La Vista, Nebraska, a bedroom community for the city of Omaha. The building serves the city **"...a unique A-Frame truss system ..."** of La Vista and the local Metropolitan Community College.

Designed by the architectural firm of Zenon Beringer Mabrey Partners, Inc. (ZBM), the \$7.8 million building features a unique A-Frame truss system which combines glued laminated chords and steel tie rods into a unique system.

According to Dave Fischman of ZBM/Partners, "The building's layout is a tailored response to the complex programmatic requirements of both clients." The interior features a warm, relaxed environment enlivened with natural light, with 1,700 voice, data and video jacks and 320,000 feet of fiber optic cable.

Fischman says the glulam beams "provided the opportunity to honestly express the structure of the building at an affordable price."

The exposed trusses span 38 feet 4 inches and are 30 feet above the main floor. The top chords are 6-3/4" x 10-1/2" laminated timber. The bottom "chord" is a one-inch steel tie rod. Purlins between the trusses are 6-3/4" x 19-1/2" and are 22 feet long. A major design feature is a rotunda that is 40 feet high.

Kim Kelly, P. E., of Nielsen-Baumert Engineering, says specifying steel rods rather than conventional timber bottom chords **"...several new challenges..."** provided several new challenges, particularly in resisting lateral load normally accomplished by the bottom chord acting in compression.

"Lateral load normally resisted by the bottom chord acting in compression needed to be resisted in other ways, such as using stiff columns," Kelly noted. The combination timber-steel trusses were the only roof components considered **"...their unique aesthetics ..."** because of their unique aesthetics as selected by the architect, he adds. RISA computer software was used to develop the truss engineering.

The truss connections at the columns were made using rigid steel side and bearing plates connected to wide flange steel columns bolted to the top chord of the truss, and allowing the steel tie rod to be tied directly to the columns.

The new 68,000 square foot facility replaces the former library, which was housed in a 25 year old, 4,000 square foot facility. It contains college classrooms, computer laboratories, student bookstore, and meeting room with kitchen facilities.



Credits

Structural Engineer: Nielsen-Baumert Engineering

Architects: Zenon Beringer Mabrey Partners, Inc.

Contractor: Meco-Henne Contracting

Glulam Beams: Timberweld Manufacturing and Leslie Structural Sales.

Dee Brown Library

The new Dee Brown Branch of the Little Rock Library system, located in southwest Little Rock, is a showcase of exposed laminated beams. The \$2.3 million facility is the first of three branches to be constructed.

The branch is named after the late Dee Brown, a little Rock historian and author of 29 books. He is best known for writing *Bury My Heart at Wounded Knee*. The building's 13,500 square feet capacity is nearly twice the size of the old library it replaced. Functioning as a quiet retreat within its residential and commercial neighborhood, the building is oriented so no direct sunlight hits its windows or its vertical skylight clerestory.

The Dee Brown Library sits on densely forested ground that is plagued by expansive clays that quickly transformed the construction site into a veritable swamp. The site was selected because of its close proximity to the community center. A 150 foot boardwalk gives students from nearby Cloverdale elementary and middle schools a safe path through the woods to the library, and connects the entry to the adjacent highway.

The building is a single story barn shaped structure. The exposed structure and clerestory windows give the building an open feel that makes a visit to this library a memorable experience. The look of the laminated wood and natural stone along with the metal siding add to the aesthetic appeal. The open floor plan allows a small library staff to easily monitor the use of the facility from the circulation desk.

The floor structure is a composite steel and concrete slab that is elevated above the swampy soil. Under reamed drilled piers and cast-in-place concrete grade beams support the composite steel floor structure. Void forms were required below the grade beams to prevent damage due to the swelling pressures of the expansive clay.

The superstructure is a combination of structural steel columns and laminated wood beams supporting trusses assembled with glue-laminated wood and structural steel. The exposed roof trusses in the new library are a unique combination of steel and laminated timbers. The trusses are spaced at 10' on center, span 30' and have 5" wide by 8-1/2" deep glulam chord members and 2-L3x2-1/2x1/4 steel angle web members. The gusset plates are rounded for aesthetics and are attached to the chord members with bolts oriented vertically through the glulam sections. This bolt configuration presented one of the most challenging design features. The trusses are supported by laminated 8 x 13-3/4" glulam girders. Laminated wood decking provides the finish roof and the interior ceiling.

Another challenging and innovative feature is the support structure for the large eave overhangs, the entry canopy and the sidewalk canopy. All of these features form a continuous extension of the roof structure. Diagonal pipe braces attached to a continuous eave member support the long overhanging truss extensions and give the building its unique appearance.



"Glulam trusses and beams were used to add warmth to the exposed structure in combination with steel columns. The use of wood and steel allowed the structure to be fairly open and light, without appearing flimsy or heavy," according to Tom Fennell of Fennell Purifoy Architects in Little Rock.

The building recently received an honor award from the Arkansas Chapter of the American Institute of Architects (AIA).

Credits

Structural Engineer: Engineering Consultants, Inc.
Architects: Fennell Purifoy Architects
Contractor/Erector: Flynco, Inc.
Glulam Beam Producer: Structural /Wood Systems
Building Code: SBCCI
Photographer: Nathan Kirkman Photography

Additional Information Available

For more information on building with glued laminated beams and timbers, contact

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