Form and Function

BY GEOFF WEISENBERGER

Manitou Springs, Colorado's new Shared Integrated Learning Center uses steel to create an aesthetic structure for this arts-oriented mountain community.

THE COMMUNITY OF MANITOU SPRINGS, ADJACENT TO COLORADO SPRINGS AND IN THE SHADOW OF PIKE'S PEAK, IS KNOWN FOR ITS FOCUS ON NATURE AND THE ARTS. Considering the inspirational surroundings, that's not too surprising. Not by coincidence, a very strong emphasis is placed on the arts in the Manitou Springs School District.

However, the district dealt with an ongoing issue involving its art staff. Since the 1960s, art and music teachers had to transfer back and forth between its middle and high schools. And beginning in the 1980s, computer staff shuffled with them.

All this changed in 2000 thanks to a new vision shared by the district's superintendent and school board. The plan called for renovating the district's four school buildings while continuing to share the arts, music, and computer technology programs between the middle and high schools—but with the added component of integrating these programs into a single facility. Instead of requiring teachers to move from school to school, students would move from the existing middle and high schools to the Shared Integrated Learning Center (SILC), a new arts building that would be constructed between both schools. The district's central administration offices would be included in the new building as well.

A Signature Building

The school board requested a "signature" building that would reflect the character and values of Manitou Springs. In essence, they emphasized, the building itself should be a work of art.

To bring this vision to life, the architect and the engineer determined that steel was the logical material choice. "While comprised of rigid pieces, steel provided a plastic medium that enabled us to create a sculptural form reflecting the arts orientation of the community," says Gregory Friesen, AIA, director of design for CSNA Architects. "The three-story transparent link joining the two parts of the building, including a dramatic entry hood, the angled windows, and the sprinkled windows in the stairways, could only have been possible through the use of steel framing."

Taking a closer look at the 44,000-sq.-ft building's layout, the ground level contains a 21-car parking structure and the administration offices. The floor system is concrete slab-on-grade.

The second floor, which houses the music and computer programs, is framed with precast concrete over the parking garage and with a composite system of steel beams and steel purlins combined with a 4½-in.-thick concrete slab over the administration area. The slab is placed over 1½-in-deep galvanized composite steel deck.

Approximately two-thirds of the third level footprint houses the arts program, with the remaining third being a low-roof area, a portion of which is used as an outdoor art deck. The art classrooms are located along a glass gallery corridor with sweeping views of Pikes Peak, the captivating rock formations of the nearby Garden of the Gods, and Manitou Springs.

Both the low roof beneath the art deck and the upper roof above the art rooms are framed with open-web steel joists and steel roof deck. The roof deck over the art studios is an exposed, high-performance acoustical deck. The building is enclosed with a stucco system over steel studs, and the stairs are steel pans with concrete-filled treads. All interior exposed structural steel framing was covered with intumescent paint to meet fire resistance ratings.

In addition, design criteria for the building were based on the 1997 UBC along with modifications developed and adopted by the

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One entry features a glass and steel "tunnel" framed with HSS 10×6 members.

local Pikes Peak Regional Building Department. The controlling lateral loads were determined utilizing a basic wind speed of 85 mph combined with Wind Exposure C.

A Good First Impression

For the sake of practicality, entrances were provided on the two sides of the building that faced the middle and high schools; the central administrative office and community room entrance were located on the high school side of the building.

The dramatic, steel-framed entry that serves the high school students is perhaps the most prominent feature of the SILC. To control cold penetration, the entry's design works like the entry of an igloo. While an igloo entry includes a small depression to pool cold air, the SILC entry—a glass tunnel that's enclosed on five sides—uses a stairway to move students up over the administration offices and into a steel and glass enclosure that collects solar gain.

According to Ed Samberson, P.E., of Samberson & Associates, structural engineer for the SILC, the primary structural concern with the glass box entry structure was to achieve lateral stability and limit lateral deflection of individual members and the overall framing system in order to avoid cracking or other performance problems with the window walls. "Due to its versatility and the architect's desire to minimize the bulk of the framing members to maximize transparency, structural steel was the obvious choice," he says.

The design concept for the entry hood called for the structural framing system, including the roof members, to be exposed from the interior and the window system to be an uninterrupted plane set in front of the framing. Structural properties and the desired appearance of the exposed framing called for the use of hollow structural tubes in lieu of other shapes.

The lateral deflection of the columns due to wind load drove the selection of the HSS 10×6 members for the columns and roof beams. A uniform size was required for all of these members to achieve the desired appearance and simplify the connections.

In order to minimize the lateral deflection, the design team decided on a braced frame for the 17-ft-6-in.-long x 28-ft-4-in.-high east wall. Due to the wall being supported at the end of cantilevered concrete beams and with no floor diaphragms at this end of the structure, the overall lateral deflection of the system is a summation of the deflection of the steel frames, the concrete beams, and their supporting concrete columns. The east wall frame consists of the HSS 10×6 end columns and roof beam and HSS 6×6 horizontal girts at approximate third point of the column height, combined with three bays of 1-in.-diam. rod X-braces.

North-south lateral stability for the remainder of the three-sided glass enclosure, as well as east-west lateral stability, was obtained through connections to the main building's lateral force-resisting system.

To avoid bulky or unattractive connections between the framing members, direct member-to-member field-welded connections were specified. Mitered joints, with full penetration welds, between the tops of the columns and the roof beams were specified so that the roof edge beams could fit flush against the face of both members for field welding. The added stiffness provided by the mitered and welded joints was accounted for in the deflection calculations.

"Obviously, the direct member-to-member field-welded connections made the steel erection more difficult for the contractor," says Samberson, "but the desired end result was achieved." MSC

Owner
Manitou School District No. 14

Architect
CSNA Architects

Structural Engineer
Samberson & Associates

Engineering Software
RISA-3D

General Contractor
J. E. Dunn Construction Company