

CIVIL ENGINEERING NEWS

BUILDINGS

Picasso Work Inspires New Art School Building

By the spring semester, the University of Iowa's School of Art and Art History will be enjoying an innovative new building. Designed by New York City-based Steven Holl Architects in association with HLKB Architecture, of Des Moines, Iowa, the project was inspired by Picasso's 1912 folded sheet metal *Guitar* and was conceived by the architect as a "formless" instrument in rust-red steel that "represents a hybrid vision of the future—half bridge, half loft; half theory, half practice; and half human, half scientific." The team also

prepared a master plan for the renovation of the building currently used by the school, a red brick edifice dating from the 1930s.

The new building comprises three distinct sections: a rectangular section cantilevered over a flooded rock quarry—its structural elements exposed—which houses a library; a shorter perimeter section that accommodates an auditorium and a small theater; and a main, nearly rectangular section that incorporates classrooms and work space. It was originally to be built on a site slightly to the north, but that site was considered too far from the current building, which continues to be used. Although the site finally chosen was small, the architects accommodated the structure to it by cantilevering the rectangular section of the building over the quarry and converting the quarry into a scenic pond.

But the site has proved challenging for the building's architects and its engineering firm, Guy Nordenson

and Associates, of New York City. For example, because it is situated near the Iowa River, the risk of flooding is high. So the designers were required to raise the level of the main floor approximately 4 ft (1.2 m) above the natural grade. Moreover, the basement of the building has been waterproofed. Located beneath parts of the main and auditorium sections of the building, the basement could become buoyant in a flood, causing serious damage. The upward hydrostatic pressure could cause serious cracking in the foundation and could damage the superstructure through differential upward deflection. To overcome this challenge, the engineers designed the building's foundation to include rock anchors in the basement slab to counteract any buoyancy during a flood. The steel reinforcing bars of the anchors form two rows, the bars in each row spaced approximately 8 ft (2.4 m) apart. The bars are grouted into 10 ft (3 m) deep drilled holes



Renowned for his thought-provoking art museum architecture, Steven Holl designed the building for the University of Iowa's School of Art and Art History to represent "a hybrid vision of the future." Holl's watercolor rendering of the building, top, is somewhat reminiscent of Picasso's *Guitar*, which inspired the building's design. Perhaps the most striking feature of the building is its cantilevered section, which extends over a scenic pond, above. Supported by trusses atop a concrete column on one side and a concrete pier on the other, the section will house an extensive art library.



5 in. (127 mm) in diameter. The caps of the reinforcing bars are of steel and are embedded in the basement's concrete footing. Interior columns that support the main floor slab are placed between the anchors. The portions of the building that have no basement are supported by drilled piers reaching depths of 5 to 12 ft (1.5 to 3.6 m).

The building makes use of an atypical, asymmetrical design to emphasize—rather than conceal—its steel and concrete structural elements. In the main building section—which measures approximately 284 ft (87 m) long and 231 ft (70 m) wide and is three stories tall—21 in. (533 mm) deep steel beams are exposed and extend longitudinally east to west. In the north-south direction, precast hollow concrete planks—planks that include four parallel cylindrical voids—rest upon the steel beams. The planks support a 3 in. (76 mm) thick top slab that serves as the floor of the story above. Sections of the slab have been ground down to expose the native white limestone aggregate.

The undersides of the exposed concrete planks are stained white, and the steel beams are rust red.

The exposed elements presented the engineers with the challenge of creating space for such utilities as ventilation, sprinkler, and electrical systems. The purpose of the voids in the hollow concrete planks is to reduce weight, and the engineers decided to use these voids for the utilities. Conduits for the utilities occupy a narrow section of ceiling space built longitudinally in the center of the main section. Like a large spine, this space connects to the voids in the planks, and through those voids the utilities extend laterally to reach their intended areas.

In addition to the striking aesthetic effect created by the exposed elements, the main section of the building also features a staircase created from a series of folded steel plates. The tread and riser system of the 30 ft (9 m) tall staircase relies on bent $5/16$ in. (8 mm) thick steel plates. The plates are supported by stringers that connect the

staircase to the main building and by suspension cables hung from the ceiling's steel beams. The staircase is composed of seven steel plates welded into place.

Like the main section, the cantilevered section is composed of exposed steel beams and precast-concrete planks, two steel trusses forming its sides. The truss on the west side is supported by a concrete column located approximately at the midpoint of the length of the section. The truss on the other side is supported near its end by a concrete pier perpendicular to the length of the bridge. The pier provides lateral resistance in addition to gravity support. From this pier, the building section cantilevers approximately 40 ft (12 m) over the pond.

The auditorium section of the building is relatively conventional. It measures 3,000 sq ft (279 m²) and seats 260 people. A small multimedia room is located behind the main stage of the auditorium.

—Brett Hansen