Home Team Advantage

By Michael Gustafson, P.E.

Exposed structural steel was a key player in the design of this one-of-a-kind collegiate soccer stadium for Creighton University in Omaha, NE.

The Creighton University Bluejays of Omaha, NE have reason to sing after getting what many collegiate soccer teams would yearn for: a European-style stadium designed only for the use of soccer. In November 2004, Creighton hosted its first game in Michael G. Morrison, S.J. Stadium, which is considered to be the first collegiate soccer-only stadium in the country. Exposed structural steel, with a corrosion protection coating, was used to construct this one-of-a-kind facility.

A Top-Notch Stadium

Creighton University had a vision of building a soccer facility for years. The university wanted a facility as top-notch as their program, which is NCAA-ranked and an important part of the school's culture. In August 2002, the $12 million project was initiated and became part of Creighton University's master plan to expand its campus infrastructure.

For most of the stadium's superstructure, structural steel was chosen for its long-span capabilities, architectural expression, and ability to stand up to the harsh Midwest winters.

The structural steel package was approximately 700 tons. Precast plank, in conjunction with structural steel framing, was used as the primary elevated floor system. Both materials allowed for faster construction through the winter months. Retaining walls and precast plank were used for most of the at-grade construction and seating areas.

To help block westerly winds, seating areas are oriented on the east and west sides of the field. Steep seating design was used to create an intimate feeling for the spectators and an intimidating experience for the opposing team.

The stadium's location near downtown Omaha and its flexible design will enable its use for other events, such as commencements and tournaments.

Design Features & Challenges

A key feature of the stadium's structural design is a canopy that cantilevers over the spectator seating area. Each canopy frame supports HSS purlins and a metal deck roof system. Located at 30′ increments, each canopy frame consists of a tower, horizontal cantilever, and two diagonal strut members. Due to wind uplift forces induced on the canopy structure, the design of the canopy was a challenge. Using finite-element analysis software, the structural design team used a 3D model to design an economical and elegant canopy

The cantilevers span more than 50′ over the spectator seating area. To avoid using tension cables that would have anchored down to the seating area, designers used W-shape diagonal struts to connect the top of the tower to the horizontal cantilever member.

The structure has a unique lateral system for each direction of lateral loading. For the transverse direction (in the direction of the canopy frame), the canopy frame provides lateral resistance through the use of a cantilever supported by a king post. For the longitudinal direction (perpendicular to the canopy frame), braced frames were used to pick up wind loads from the stadium. They also pick up wind loads from wind screens located at the ends of the seating areas.

Much of the project's exposed structure consisted of exposed structural steel. Because AISC AESS requirements were not specified, the project team hosted pre-design and pre-construction meetings to make sure the fabricated steel met the appearance expectations of the owner and architect (refer to **www.aisc.org/aess** for more information).

No Nesting!

Though the stadium was built to be home for the Creighton Bluejays, designers took special measures to deter the nesting of other bird species, specifically pigeons. The design team specified that no more than a 1″ "roosting area" be allowed at every steel connection. This was a unique requirement for the design team. HSS 12x6 purlin members were used in lieu of W-shapes in the longitudinal direction of the canopy to make it difficult for birds to nest. Seat angles that connected the purlins to the canopy girders were detailed to meet the "roosting" requirement. The W-shape cantilever members supporting the purlins were designed with "pigeon plates," or plating that protected the beam bottom flanges from bird occupancy.

Coating System

Aesthetics and durability of the exposed structural steel were both concerns for the owner. To protect the steel from the Nebraska climate, a two-part coating system was chosen. A painted system was chosen over galvanizing because of the potential inconsistencies in color that can occur when galvanizing steel shapes of different sizes. For this project, the heavier canopy girders would have colored much differently than the thinner HSS purlin members when galvanized.

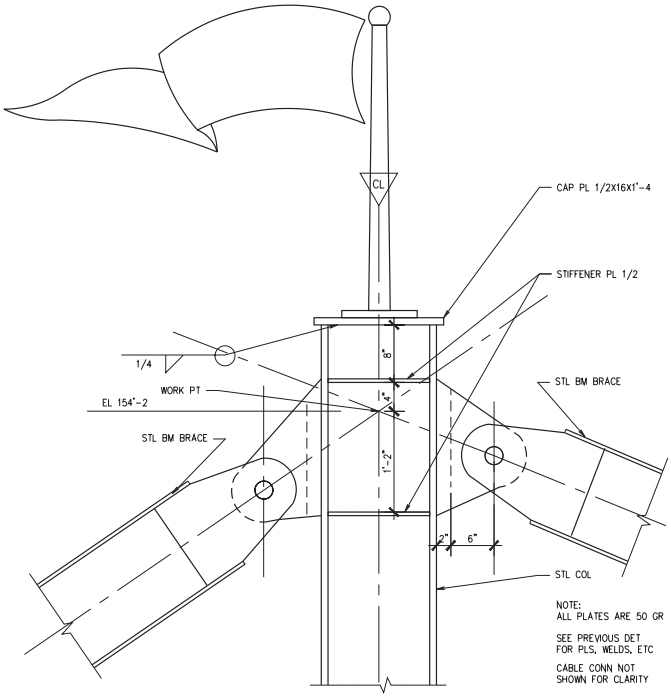
The paint supplier, designers, and the steel fabricator played an active role in correctly specifying and applying the correct coating system. Prior to paint application, the steel was given a SSPC-SP6 commercial blast surface finish. Two coats of Sherwin Williams Fast-Clad zinc-rich primer were then applied, followed by a Sherwin Williams polyurethane topcoat. The coatings were both applied in the fabrication shop, with minimal touch up required in the field. The fabricator, Paxton & Vierling Steel Company, is an AISC certified fabricator with an AISC Sophisticated Paint Endorsement-Enclosed (P1), which allowed them to apply the high-performance coatings within their facility.

After the steel was painted and ready to ship to the site, special care was taken by Paxton & Vierling to ship the steel to project site. With the steel on site, the erector took special care not to damage the coating during erection.

A Winning Team

Both cost and schedule savings were brought to the Morrison Stadium project through the early involvement and collaboration of the steel specialty contractors. Early project team meetings between the designers and builders determined what steel members were available and which were the most economical to use. The designers then designed around this selection of members.

Early involvement of the steel erector also brought value



W-shape struts are used as the primary tension members to support the canopy over the spectator seating area. By using W-shapes, the struts also act in compression to counteract wind uplift forces on the canopy.

In the longitudinal direction, braced frames featuring rods in tension resist lateral loads, particularly those imparted by wind screens at either end of the spectator seating area.

to the project. Bolted end-plate connections recommended by the fabricator were the primary type of moment connection used, which minimized paint application in the field and shortened the erection schedule. The erector also recommended HSS purlins connections that accelerated steel erection.

The steel fabrication schedule was shortened by an early mill order. The fabricator began detailing the stadium in early January 2004, sent the first steel to site by the end of April, and shipped the balance of the structural steel in September.

Not only did early team collaboration save time and money, it also ensured that the Creighton Bluejays were given an impressive, well-protected structural steel stadium. The stadium was completed in November 2004—just in time for the Bluejays to host the Missouri Valley Conference championship tournament.

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Owner
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Engineering Software
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Steel Fabricator
Paxton & Vierling Steel Company, Omaha (AISC member)

Specialty Fabricator & Detailer
Puritan Manufacturing, Inc., Omaha (AISC member)

Steel framing supports precast concrete seating risers.

Steel Erector
Davis Erection Company, Inc., Omaha (AISC member)

Contractor
Kiewit Construction Company, Omaha

Paint Supplier
Sherwin-Williams, Omaha