ICE Time

BY JOHN M. SAVAGE, SE, PE

Small structural adjustments add up to big gains for a university ice hockey arena.

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HOCKEY REIGNS AT THE University of Nebraska Omaha's (UNO) new Baxter Arena.

The 220,000-sq.-ft, 7,800-seat venue has not one but two ice sheets: the competition ice for the school's home team, the Mavericks, and the community ice, which is designated for public ice skating, curling and other activities. Although designed with hockey as its main tenant, the arena also hosts UNO's basketball and volleyball games, along with concerts and graduations.

Early construction packages were essential to the success of the project. A grading package, foundation package and mill order package were provided to the contractor three months prior to any architectural drawings being issued. Close collaboration between the design team and the contractor concluded that a steel-framed structure would be the best option to meet the aggressive project schedule.

The floor composition is 4½-in.-thick concrete on 3-in. composite metal deck, supported by composite structural steel framing. The lateral system is comprised of exposed steel frames, which add to the industrial aesthetic. Four different truss configurations make up the main roof, providing a column-free 225-ft by 340-ft space. Four typical main trusses, spaced at 41 ft on center, span over the main arena floor. The truss spacing was dictated by the need to fit three suites between column lines. Due to the domed shape of the roof, the truss orientation was rotated 90° to frame the ends of the dome. Two types of sub-trusses were used to frame the ends of the dome and are supported by two transfer trusses, one at each end of the arena. In addition to the roof, the trusses support a 13.5-ton scoreboard and provide 50 tons of concert rigging load capacity. In total, the project uses more than 2,000 tons of structural steel.

Typical trusses are 25 ft deep, deeper than what was required structurally, with the extra depth allowing the scoreboard to fully retract within the depth of the truss. Due to their significant depth, the trusses were not able to be fully assembled in the fabrication shop. To accommodate this issue, special erection jigs were built on-site to maintain the alignment of the various pieces while assembling the trusses. The size and weight of the four typical trusses and the transfer trusses necessitated that they be built in two pieces, and a shoring tower was used to facilitate erection.

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Bright Above

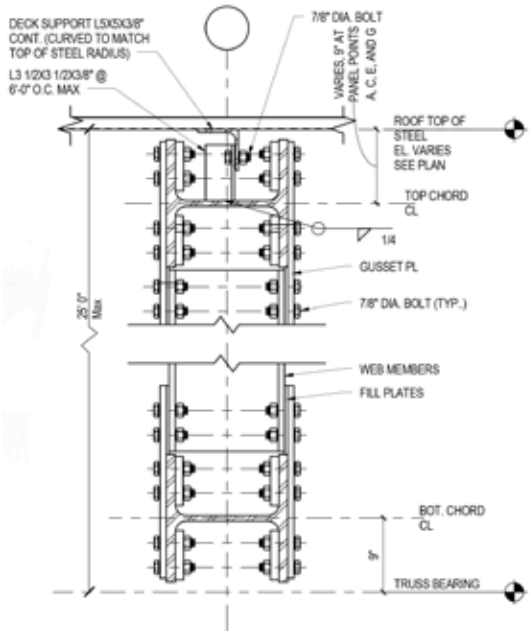
The structure of the main arena roof was to remain exposed as part of the architecture. In most arenas, the ceiling is painted black so that all of the HVAC, electrical conduit and sound baffles are visually minimized. At Baxter Arena, the roof structure was painted white and the roof deck left galvanized to serve as design elements. As a result, the trusses not only had to be aesthetically pleasing but also arranged to allow mechanical elements, including 5-ft-diameter ductwork and catwalks, to pass through in an aesthetically pleasing manner; all of these elements were coordinated via a 3D Revit model.

The new 220,000-sq.-ft Baxter Arena in Omaha seats close to 8,000 and includes two ice rinks. Though geared toward hockey, it also hosts basketball games and other events.

Four different truss configurations are used for the roof.

Steel framing for the seating.

A cross section of the facility, with the community rink on the left and the arena on the right.



▲ The cantilevered monumental stair.

▲ A detail of a radiused angle on top of a truss chord.

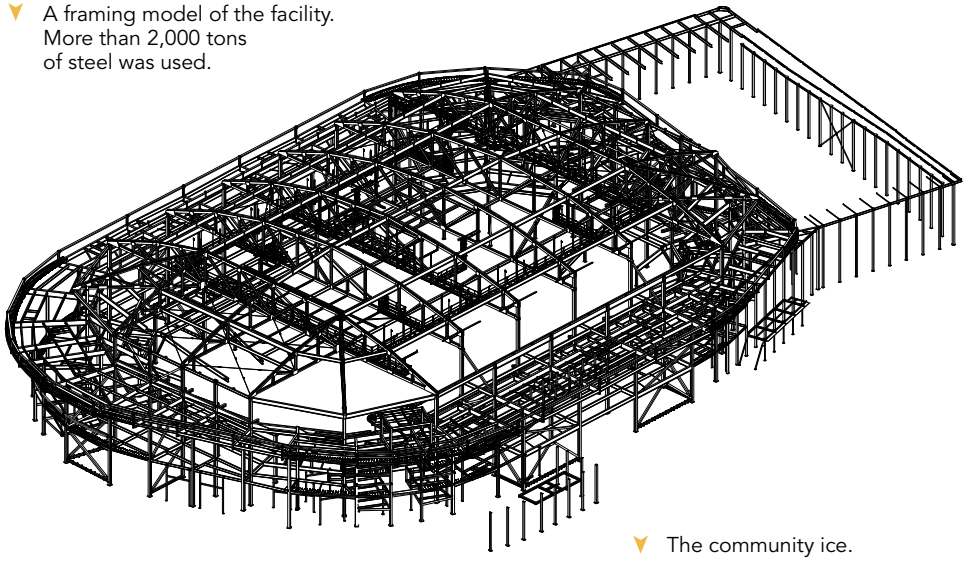
▼ The roof structure was painted white and the roof deck was left galvanized to serve as design elements.

An overhead look at the building's site and surrounding area.

The roof trusses were positioned high enough so as not to require fireproofing.

With the structure exposed throughout the arena, the question of fire protection received detailed consideration. Due to the cost and appearance trade-offs between intumescent paint and traditional spray-applied fire protection materials, the design team evaluated where the steel framing should be exposed versus areas where it shouldn't. Also, the elevation of the roof trusses relative to the seating bowl was carefully coordinated to ensure that the roof trusses were high enough to not require application of fire-protection material.

As the design began to take shape, developing the façade became critical. The exterior walls are curved, both in plan and in elevation, which impacted the location of the steel framing members. For most projects, the schematic design is completed before the production (Revit) model begins. One of the more challenging things to perform in Revit is a façade, especially if it is curved and uses custom metal panels. HDR developed a custom computer script to allow the team to connect the design model from Rhino to the production model in Revit; the script allowed the exterior walls to be exported from Rhino directly into Revit. With the numerous curved exterior walls, each with a different radius, this interoperability sped up the coordination of the structural frame with the architectural façade.



A framing model of the facility. More than 2,000 tons of steel was used.

Reduced Roof Costs

One of the challenges the design team faced was balancing the hockey team's desire for a very loud and boisterous space with other events like graduations, where it is critical to have intelligible sound. For the roof, 3½-in.-deep acoustical metal deck was used because of its superior acoustical performance. In addition, this deeper deck is able to span farther than typical metal roof deck. This greater span capacity allowed the team to reduce the number of roof joists, so only two roof joists are used between each main truss. The wider joist spacing adds to the open feeling of the roof structure and the acoustic deck absorbs unwanted sound and reverberations.

Originally, the top chords of the roof trusses were to be rolled to match the roof radius, which was estimated to cost more than $300,000. To provide a more economical solution, the top chords of the trusses

The community ice.

One of the concourses, featuring exposed steel framing for the seating.

were redesigned to use straight chord members. At every other panel point, there was a "kink" in the chord where the chord members were spliced. The smooth curvature of the roof was then achieved with a rolled L5×5×¼ angle positioned above the top chord of the truss and supported by smaller angles. This allowed the roof to remain curved—and saved more than $250,000.

The design team wanted to make the community ice a focal point of the building. The community rink is prominently placed at the front of the building and incorporates large expanses of glass within the exterior wall, framed by exposed HSS12×6 columns at 10 ft on center behind the curtain wall. Each column supports a roof joist above and serves as the vertical mullion for the curtain wall, which eliminates the need for any horizontal structural girts and provides unobstructed views into the community rink from outside the building.

Another focal point, the monumental entry stair assembly, had to extend into the community ice arena and interrupt several building columns in order to fit into the entry atrium. Without a structural solution, the stair would have created a pinch point in the main concourse that wraps around the lower seating bowl. To solve the restriction issue, the design team implemented 11-ft-long tapered W36×248 transfer cantilevers to support the stairs and the roof framing above, maintaining the 25-ft-wide concourse.

Baxter Arena was completed more than a month ahead of schedule and under budget and is designed to engage both UNO students and residents of Omaha. The arena has already had a positive impact on UNO's athletic programs and has elevated the position of UNO in the community, even hosting President Obama as one of its first speakers. ■

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