

# Improved and NEW

BY  
ALYSSA FEE, S.E.



A suburban Chicago high school improves its swimming facility with a mixture of new framing and spot reinforcement of existing framing.

## RENOVATE THE OLD pool or build a new one?

How about both?

A \$15.1-million renovation and addition to the Niles North Aquatics Center, part of Niles North High School in Skokie, Ill., included two phases: renovation of the 48-year-old existing pool to create a community “warm” pool (85 °F) and building a new addition to create a competition “cold” pool (between 78 °F and 80.5 °F).

The 14,570-sq.-ft renovation of the existing pool includes corridors, locker rooms, new pool and deck surfaces, support spaces, plumbing, roofing and new lighting and mechanical systems. The 25,500-sq.-ft addition is comprised of a two-story building housing an eight-lane stretch pool with a movable bulkhead and a seating area; the mezzanine provides spectator seating for 500 and the pool deck seats 180 athletes. The updated facility, which houses a year-round competitive swim program hosted by the school district, Illinois Swimming and USA Swimming, was built to improve competitive and educational swimming programs as well as promote community participation.



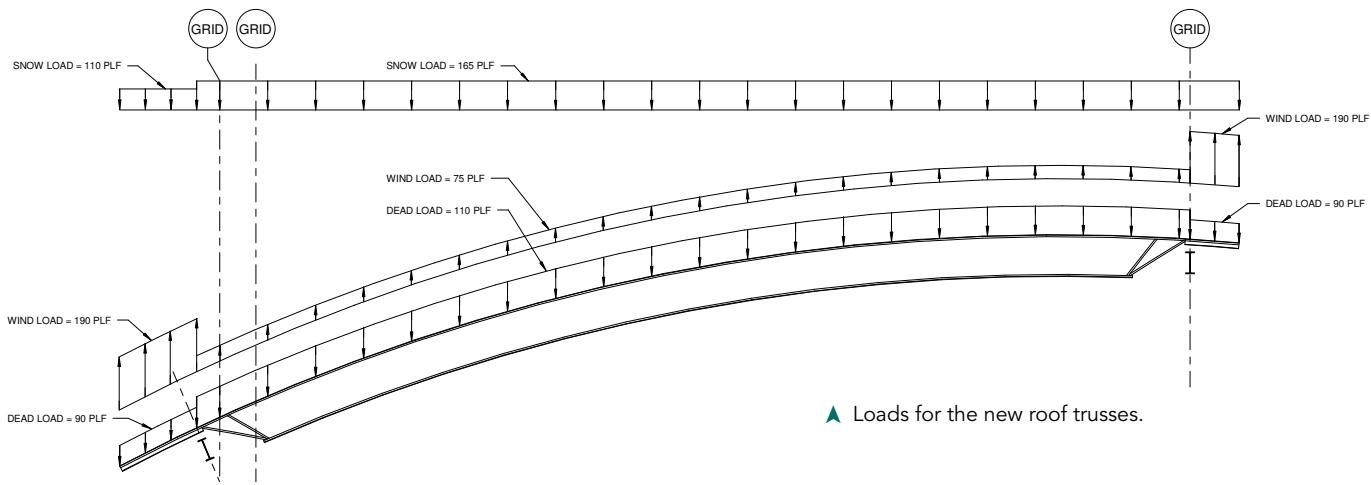
**Alyssa Fee** ([feeam@kjww.com](mailto:feeam@kjww.com))  
is a senior engineer with KJWW Engineering Consultants.

## Out with the Old

A major component of the renovation was removing the existing roof deck and a majority of the steel support beams. At the start of the project, the school district knew there were problems with rusting of the steel and discoloration of the ceiling tiles above the pool, but it was not until project structural engineer KJWW investigated the situation that the extent of the damage was revealed.

The existing roof structure was constructed of long-span steel trusses and steel beams. The steel members and roof deck were unpainted, and there was a ceiling between the pool and the roof deck. This ceiling created a “moisture trap” that captured unconditioned, humid pool air between the ceiling and the steel roof structure, a common problem with indoor pools where the steel is not properly protected and the space is not properly ventilated. In this case, the steel roof deck was so severely corroded that pieces of the deck were breaking off and steel beams and trusses had developed a thick layer of rust that was flaking off onto the ceiling.

During meetings with Legat Architects, the architect of record, and IHC Construction, the construction manager, it was decided that the best solution would be to remove and replace the entire roof deck. In addition, because new mechanical units were going to be placed on the roof, the team also chose to remove all the steel beams and reinforce the existing long-span trusses as required. The existing roof trusses—70 ft long and 6 ft, 3 in. deep—were analyzed assuming a capacity of 75% of the original member design strength due to the loss of sections from corrosion. The trusses were reinforced with new steel plates and angles as required for both the existing roof loads and for the weight of the new rooftop mechanical units. Because the steel columns were encased in masonry for the entire height of the structure and were, for the most part, in the ven-

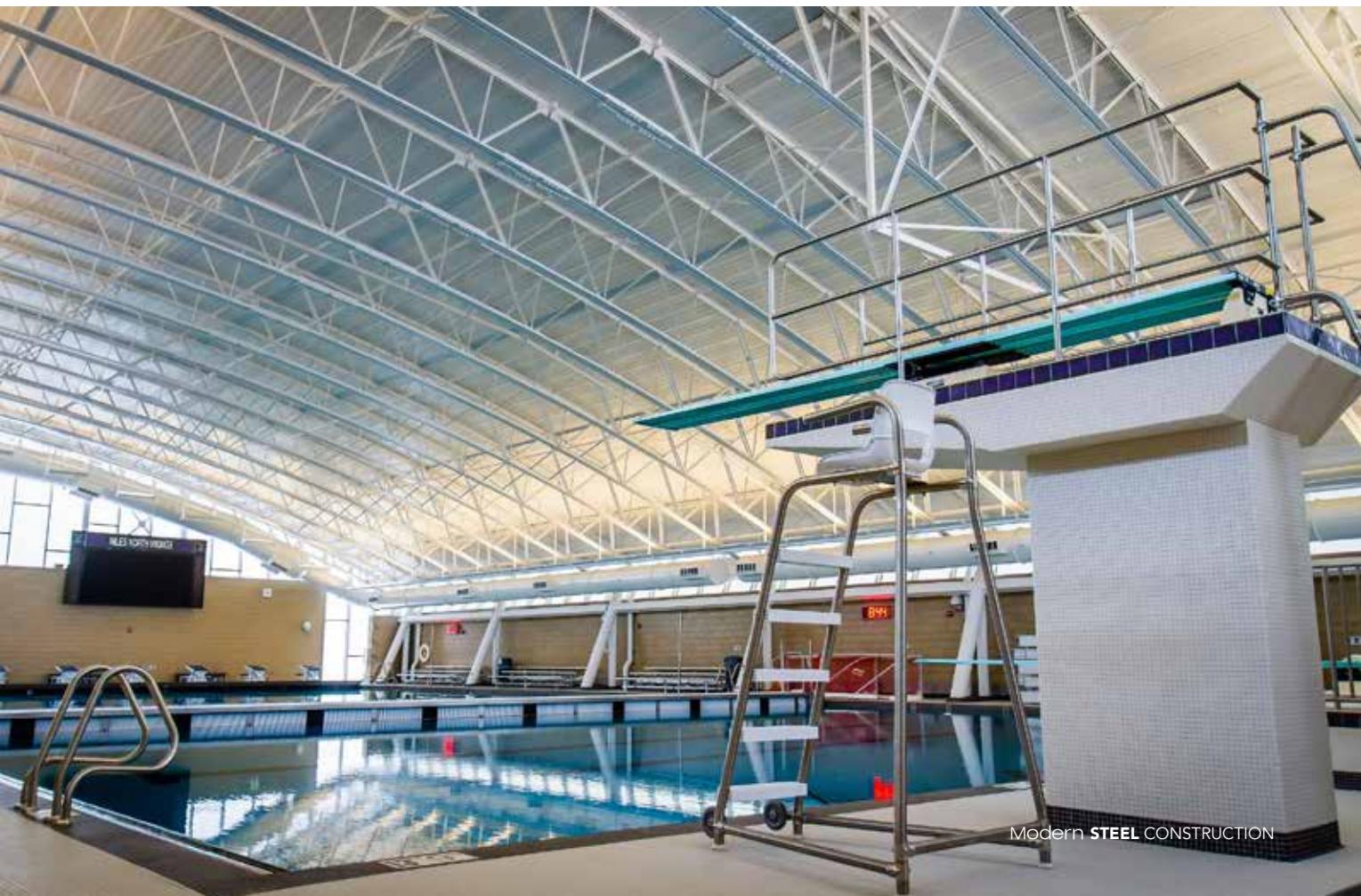


- ▲ The new roof joists are 52 in. deep and 101 ft long.  
◀ Joists being attached to joist seats.



- ▲ ▼ The new pool addition is distinguished by its curved ceiling—one story high at one end and two stories high at the other to accommodate seating and capture natural daylight.

Images: Courtesy of KWW



tilated pool space, they did not have as much corrosion as the roof steel. Therefore, they did not require any additional reinforcing as they already had enough capacity for the new loads.

The final design of the renovated space included eliminating the ceiling and exposing the steel and roof deck to create a more comfortable and lighter space for the swimmers and spectators. It also included properly protecting the existing steel, which was painted with Sherwin Williams Pro Industrial Zero VOC Water Based Epoxy paint; white paint was used for reflection from the indirect fixtures preferred in pools to prevent glare.

### Cool Curves

The new pool addition is distinguished by its curved ceiling—one story high at one end and two stories high at the other to accommodate seating and capture natural daylight (the sloped roof also reduces the volume of the addition to decrease demands on the mechanical system). Legat Architects was able to achieve the height needed to accommodate the spectator seating and three-meter diving board along the north side of the addition, while reducing the height (where it is not needed) for the athletic seating along the south pool deck. On the south side of the building at the low end of the curved joist, the roof also overhangs the sidewalk on the exterior to provide shading and canopy coverage for students and staff on the sidewalk.

Steel joists (52 in. deep and 101 ft long) were chosen to support the curved roof as they economically provided the light and airy feeling that the architect was trying to achieve and were easy to fabricate in the curved shape. However, the curved shape also dictated that the joists needed to be designed as pinned on one side and as a roller on the other side. This was due to horizontal deflection of the arched chords under dead and snow load, which was calculated to be around 1¼ in.

The roller connection was achieved by fabricating slide bearing connections consisting of polytetrafluoroethylene (PTFE) coated plates. The PTFE provides a frictionless surface for the movement to occur, and the typical connection construction consists of an upper and lower element, sandwiching the PTFE. The upper element is larger than the lower element, and the low-

er element is sized based on the required bearing while the upper element is sized for the bearing area plus expected movement. This is to ensure that the lower element remains under uniform bearing throughout movement, and it also provides a layer of protection from anything falling on the sliding surface. Steel bars are placed on either side of the connection to prevent movement in one direction and allow for movement only in the specified direction, leaving the joists free to move in the parallel direction to accommodate the horizontal deflection due to snow load.

Another challenge with the new addition was the angled columns and beams on the south end of the building, where the joists curved down to form the one-story space. Legat Architects wanted an angled structure as it not only followed the curve of the roof but also worked in conjunction with the angled curtain wall to create a dramatic contrast in form from the perimeter masonry walls that helped to define each of the athletic seating sections. However, supporting the end of a joist on an angled column and beam adds significant moment to the column, thus increasing its size. To help keep the round column size small (HSS14×0.500), the architect allowed for the addition of a HSS10×0.500 vertical column hidden behind the angled column to brace the column and reduce the moment. This column did not extend to the top of angled column but rather braced it a quarter of the way down from the top. However, in order to fabricate the 1½-in.-deep by 10-in.-long joist seat as flat and also allow for the roller connection on this end of the joist, a steel seat (constructed from plate steel) was required to be fabricated at each of the joist bearing locations to allow for easy erection of the joists.

As with the original pool, battling corrosion in a humid environment was another major consideration, and it was clear that a “moisture trap” ceiling wouldn’t be incorporated into the design. Tnemec primer and Series 133 paint were applied to the Epic Metals Wideck WP450A acoustical roof deck (which was also used in the renovation portion). The fiberglass acoustic batts were individually encapsulated and the galvanized deck was primed in the shop, then a final coat of paint was added in the field over all exposed steel to protect it from the humid air.

The school district was very pleased with the final outcome of the addition and renovations to the existing pool, and the building was recently awarded LEED Gold certification. Leaving the steel structure exposed keeps the space open and comfortable—and thanks to better design and planning, the new roofs shouldn’t suffer the same fate as the original one. ■

#### Owner

Niles Township High School District 219, Skokie, Ill.

#### Construction Manager

IHC Construction, Cicero, Ill.

#### Architect

Legat Architects, Chicago

#### Structural Engineer

KJWW Engineering Consultants, Naperville, Ill.

◀ Roof trusses for the original pool. Some members were reinforced while others were replaced.