

Climate Pledge Arena

Seattle, Washington

HISTORY

The Key Arena was built in 1962 for the Seattle World's Fair. From the beginning, the plan was to convert the Washington Pavilion, as it was known when it was built, into a 15,000-seat sports arena, once the fair ended. The building has a long history of renovations and name changes to meet the needs of the Seattle area residents.

PROBLEM

As the population of the area grew, so did the need to once again update the historic building that has served as home to the Seattle Supersonics, the Seattle Storm, and now the new Seattle NHL hockey team, the Kraken.

However, the roofline of the building is an iconic feature in the City of Seattle and there was pressure to keep the look of the building, while increasing seating capacity to 19,000 seats.

The team who developed the project was led by a partnership between the City of Seattle and Oak View Group and includes the Engineer of Record, Thornton Tomasetti and General Contractor, M. A. Mortenson.

SOLUTION

To accomplish this large project, the team leading the renovations needed to excavate 65 feet to increase the square footage of the interior by 750,000 feet. Keeping the existing, iconic roofline was a challenge. Even more of a challenge was the hard opening date that coincided with the 2021 NHL season. This fixed date stressed the schedule with every step, including sequencing, access, constructability, and an ever-evolving design.

A Joint Venture between Malcolm Drilling and DBM Contractors was formed to face the unique challenge of excavating the site, while keeping the roofline intact. Malcolm/DBM chose Nucor Skyline for their ability to provide



“Nucor was a tremendous partner on a project that had an evolving design, accelerated schedules, and a hard deadline to open for the Kraken Hockey Season. I couldn’t imagine doing this project with someone else.”

— Adam Running, Project Manager,
Malcolm Drilling Co., Inc.

many of the steel products that would be needed to accomplish the tasks ahead. Nucor Skyline is able to produce wide flange beams in almost any size and grade and has an extensive history with support of excavation.

One of the first steps in the excavation process was to install a temporary roof support bracing system to sustain the weight of the 44-million-pound roof prior to excavating below its existing footing. The roof needed to be supported while 60 feet of soil was excavated around the supports. The temporary support system was designed to be utilized through many phases of construction, including construction of

the perimeter shoring walls, permanent roof supports, and the building itself.

The shoring system relied on 3-foot diameter spiralweld pipe piles with mechanically-bolted connections as temporary drilled shafts. These were installed in low overhead conditions which transferred the loads of the roof into the subgrade of the future arena.

Next came the permanent shoring system for the project, which consisted mainly of soldier piles. The soldier piles had 5-6 rows of permanent double corrosion protected tie back anchors to provide lateral support. Over

CASE STUDY

Climate Pledge Arena



PROJECT PARTNERS

Owner

Oak View Group – New York, NY

General Contractors

M. A. Mortenson – Minneapolis, MN

Engineer

Thornton Tomasetti – New York, NY

Driving Contractors

Malcolm Drilling Company – Kent, WA

DBM Contractors – Federal Way, WA

PRODUCT

Wide flange beams: 2,000 tons

Spiralweld pipe piles: 1,000 tons

Permanent strand anchors: 600,000 LF.

PROJECT TIME FRAME

2019 through 2021

2,000 tons of Nucor Skyline wide flange beams, and another 600,000 feet of permanent strand anchors were used for the soldier pile walls.

The permanent strand anchors were supplied by Nucor Skyline’s Geostructural Group. This phase of construction needed to be accomplished around the bracing steel, which required shifting and redesigning tie back anchors to internally-mounted channel walers where they fell in line with the roof support structures.

Once the permanent shoring was complete, the permanent shafts to support the roof and new building foundation needed to be installed. There were 117 permanent shafts in all and these 1-meter diameter shafts, in groups of 2 to 3 per footing were installed directly beneath the old footings, some of which were permanently enclosed with Nucor provided casing.

The site was extremely congested, with temporary support shafts, permanent support shafts, low headroom, and equipment. Custom fabricated Kelly bar extensions were used to achieve the design depth of 113 feet in the low headroom conditions. When the permanent

shafts were installed, rebar cages were added at each site and Thermal Integrity Profile testing was done on half of the shafts.

On the south side of the site, where the buttress footings for the roof support interfered with the new structure of the arena, a large steel collar and steel pipe piles were used to transfer both the lateral and vertical loads to the permanent shoring wall so that the buttress footing could be removed. Six-foot diameter tangent shafts connected by a cap beam and two large pipe pile supports were used to replace the original beam and lagging wall on the south side, which transferred the weight of the south pylon to the tangent wall. This option proved to be the best as it could be installed faster and with much smaller equipment at the site.

The new Climate Pledge Arena, the first International Living Future Institute Zero Carbon certified professional sports venue, is now open and operational, thanks to the partnerships of Nucor Skyline, DBM Contractors, Malcolm Drilling, and the development team.