JANUARY/FEBRUARY 2020
scaffold & access magazine

SAIA SCAFFOLD & ACCESS INDUSTRY ASSOCIATION

THE GIFT OF SAFE ACCESS

NEARLY IMPOSSIBLE SHORING

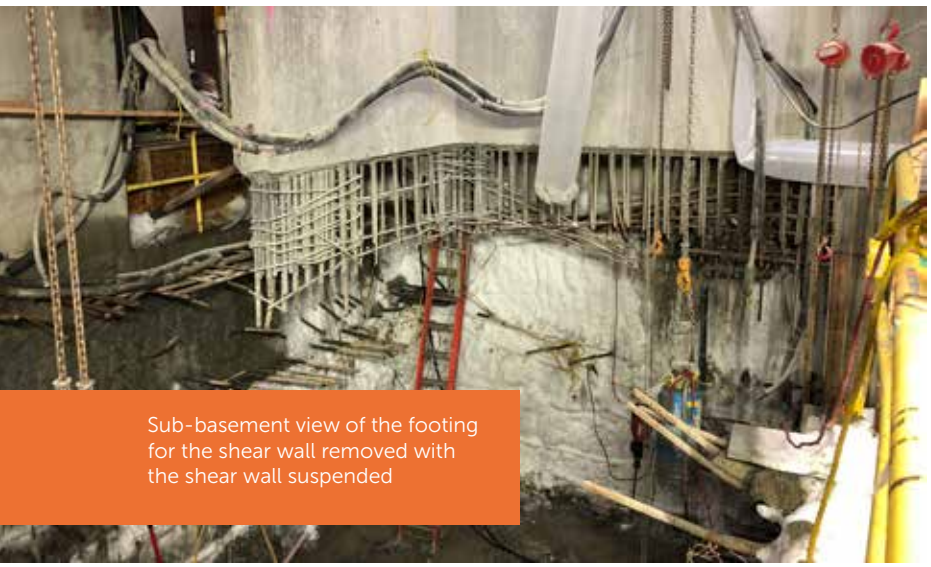
THE 2019 SCAFFOLD & ACCESS INDUSTRY ASSOCIATION (SAIA) SHORING PROJECT OF THE YEAR WENT TO PCI SCAFFOLD'S SEATTLE HEADQUARTERS FOR THE ENHANCED CIRCULATION/ ELEVATOR RELOCATION PROJECT.

BY DARRELL KING

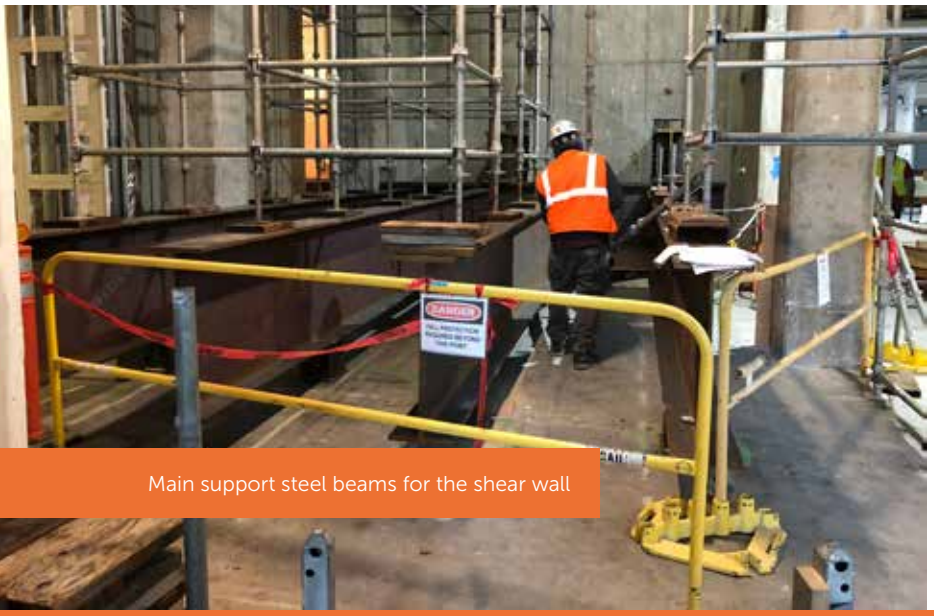
This project began when GLY Construction was approached by their client with a challenging request that seemed nearly impossible in the beginning, to create a shoring system to fully support the disconnection of a shear wall from the foundation. The request was to take an existing C-shaped shear wall/elevator shaft that was approximately 80 feet tall and 2 feet wide and rotate it 90 degrees. In order to do this, the shear wall would need to be completely supported and disconnected from the foundation below.

Shear walls have one main purpose: to transfer the building's lateral wind and seismic loading from each floor level back to grade. Therefore, if the attachment is removed between a shear wall and the foundation, the wall will not only turn into a massive amount of dead weight but will also lose the ability to provide the needed support. This specific shear wall weighed in at roughly 1,500,000 pounds and needed to be supported by a complex shoring system that would not allow any portion of the wall to move more than 1/16th of an inch at any given time.

GLY Construction approached PCI Scaffold who quickly brought on D.H. Charles Engineering, Inc. in order to develop a plan for supporting this structure. The idea was to cut holes in



Sub-basement view of the footing for the shear wall removed with the shear wall suspended



Main support steel beams for the shear wall

the shear wall and run beams through the holes to support the load once the shear wall was disconnected from the foundation below.

PCI Scaffold worked with D.H. Charles Engineering to design a structural shoring system to support a C-shaped shear wall and allow for a 10-foot-deep excavation to take place underneath the wall itself. The shear wall was 19 feet by 13 feet by 12 to 18 inches thick and five building levels tall. To accomplish this, PCI Scaffold used a combination of W40x431 and W27x281 beams to penetrate through the wall at different angles to support the shear wall at Level 1, while allowing it to hang down one level into the basement.

A Complex Shoring System Required

Multiple factors had to be considered when designing the shoring system for this task. Not only was it imperative that the beam layout provide adequate support for the shear wall, the wall itself needed to be able to span between the shoring beams. Another factor was that the excavation of the frozen soil would not be overloaded by the surcharge loading of the HSS10x10 columns supporting each corner of the W40x431 beams. Several iterations of the beam layout and countless calculations had to be completed to ensure that the shoring design would safely and effectively provide the needed support.

Between the combined efforts of PCI Scaffold and D.H. Charles Engineering, completing a certified design took roughly a month to produce. Originally, PCI Scaffold was brought onto the project to design and engineer the plan and nothing else. This changed in a very short period as GLY Construction requested that PCI Scaffold supply and perform the shoring construction as well.

Initially, a re-shore system was put in place and surrounded the perimeter of the shear wall area. This consisted of cuplock scaffold/shoring platforms placed on every floor level up to the roof. The next step was cutting the holes in the shear wall itself

for placing the beams around and through the structure to support and hold the shear wall in place.

Once holes in the wall were cut, the W40x431 beams were rolled into place on Level 1 and passed through the wall. Then the W27x281 beams were set atop the W40x431 beams to support the perpendicular wall. The 1,500,000-pound design loading and the distance of the beam spans caused too much deflection. As a result, staying within the 0.16-inch measurement was not possible. To solve this problem, PCI Scaffold provided cuplock shoring platforms spanning from the basement to the roof, giving support to the shear wall tributary slab loading. With these in place, the W40x431 beams would only need to support the 12-to-18-inch-thick shear wall.

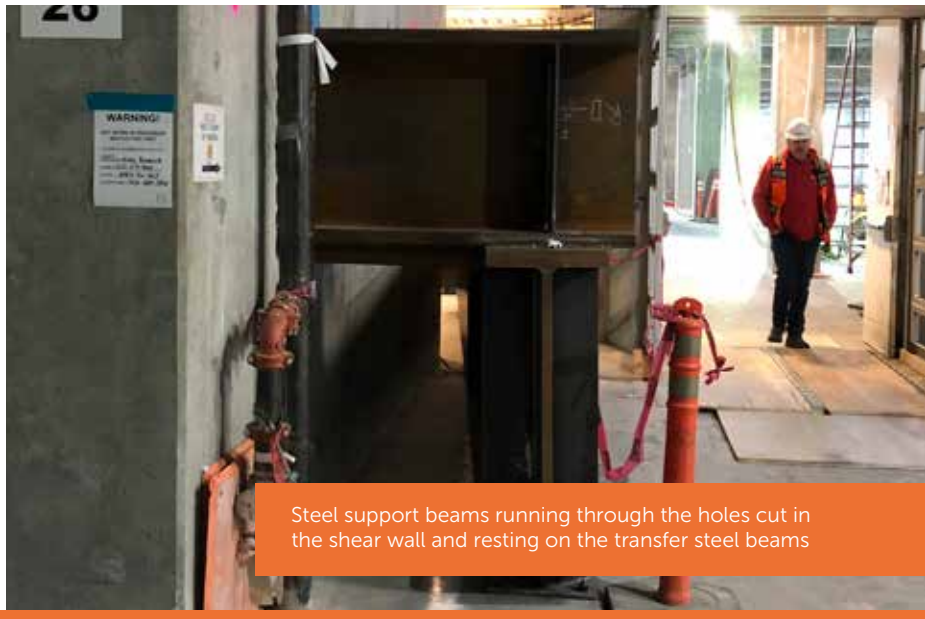
Hydraulic Jacks Controlled Deflection

Hydraulic jacks were placed to preload the wall prior to being cut from the foundation. This occurred in ten jacking phases at three different jacking location. During each jacking phase, the target jacking load differed at each location. This process ensured that the shear wall was equally loaded and that no single location would collect too high of a load. Once all of this was in place, the shear wall was able to be cut away from the foundation below. Of the 0.16-inch design deflection, the hydraulic jacks were used to preload the beams to 0.14-inch deflection. By doing this, PCI Scaffold allowed the beams to deflect .02-inch, far below the .0625-inch requirement.

The design phase began in November 2017. Installation of the shoring system began in February 2018 and was completed in May 2018. The shoring system stayed in place until December 2018. Throughout the entire process, PCI Scaffold was able to stay ahead of schedule despite the magnitude of the project.

About the Author

Darrell King is Senior Project Manager / Estimator at the PCI Scaffold Seattle Branch and can be contacted at Darrell.King@pcg.com.



Steel support beams running through the holes cut in the shear wall and resting on the transfer steel beams