Safway's SafRise Climber® Clinches Historic Renovation

A custom-engineered solution provides safe access to the front, top and back of a historic downtown landmark.

Many of the unique qualities of older buildings, cherished across generations, can also cause major headaches when it's time for renovation. This was the case when JP Cullen was asked to renovate the exterior of Milwaukee's City Hall.

The 120-year-old landmark presented numerous access challenges, requiring the best engineers to forge novel methods for safe, productive work. From its inconsistent vaulted spaces below ground, all the way up to its steep copper roof in the sky, this access challenge was as tough as they get. It only got tougher with freezing weather, a dense urban work environment (sidewalks alongside the building had to stay open) and 19th century engineering specifications (or, more precisely, the lack of).

In describing the job, Safway Branch Manager Andy Virnich commented, "This project was one difficult challenge after another. Fortunately, this is the kind of challenge we thrive on."

As the tallest office building in the world when it was completed in 1895 at 353 feet, Milwaukee City Hall was declared a national historic landmark in 2005. JP Cullen was charged with the replacement of heavy terra-cotta cap pieces along the top edges of all gables, dormers and finials in various locations. This meant Cullen needed access to the front, top and back sides of the gables and dormers at the same time. With building steps inward as much as 13 feet, a traditional mast climber wouldn't work. Cullen met with Safway to discuss the project requirements.

SafRise Climber® meets the challenge

Ultimately, Safway was awarded the contract to provide a modified version of the motorized SafRise mast climber for the job, on the basis of Safway's reputation as a leader in engineered solutions for complex access situations with a steadfast focus on safety. "It was great working with Safway," said Chris Hastings, JP Cullen's project manager on the job. "The project flowed very well for us."

SafRise offers an unprecedented level of safety with a platform that descends in a controlled manner, if the system detects excessively rapid descent, or in the event of a power failure. Other mast climbers simply leave workers stranded. SafRise also offers the highest speed-to-capacity ratio on the market. The standard configuration can move up to 8,000 pounds on a 50-foot-wide platform at 30 feet per minute.

Employing the unique features of the SafRise system, Safway collaborated with Hydro-Mobile, the designer and manufacturer of the equipment, to develop a

The Milwaukee City Hall rennovation required 17 SafRise Mast Climber installations, erected in two phases, including 11 in use simultaneously during the first phase of the project – although not all the MCWPs had custom extensions.

multi-faceted solution with iron-clad safety and unprecedented worker productivity.

The custom-engineered solution: A forward extension creating walkways with guardrails that cantilevered toward the building from the mast climbing work platform (MCWP). The extension locked onto a rail system bolted to the MCWP in such a way that it could be winched up, drawbridge-style. While the extension was up, the MCWP could be raised or lowered. At the appropriate height, the extension could be rolled sideways along the length of the platform to the needed position. Once in position, the extension was then lowered to horizontal with a manual winch. To complete the system, two additional hook-on platforms were attached, one at the end of the extension extending behind the gable and one extending in front. This allowed one worker to stand safely on each side of the cap unit to lift and replace the heavy pieces of terra-cotta. There was also an extension added to the back of the MCWP to allow for a portable toilet and a full-size job box.

“The modified mast climbers were specifically adapted for the City Hall project,” said Hastings, “and they provided exactly what we needed to get access to those difficult areas.”

Shoring design proves critical

Some of the SafRise machines imposed downward forces exceeding 38,000 pounds. So long before the fancy extensions were built, Safway engineers had to consider what the equipment was resting on. It wasn’t pretty. There was a basement area under much of the sidewalk on which the climbers rested. Because the vaulted areas under each mast climber involved different spatial and structural configurations, a unique shoring design was required for each mast climber.

It was critical that the basement shoring be placed precisely under the canopy legs above the sidewalk in order to ensure the loads were transferred properly. To locate the positions in the basement, the building exterior was digitally scanned. A surveyor then used the scan data and expert trigonometry to transfer key points into the building, down the stairs and into the basement areas.

Even the soil below the basement floor was a challenge: Milwaukee City Hall was built on a swamp so the soil’s load-bearing capacity varies widely. Due to this, worst-case conditions of 500 psf had to be assumed.

"Every single shoring location was different," noted Eileen McEnroe Hankes of Graef, the engineer of record for the attachments to building. “Safway worked with us to use their shoring systems and readily available materials to create a unique solution for each case."

Innovative tying technique required

Anchoring the masts was yet another huge challenge. The exterior of Milwaukee’s City Hall is a hard kiln-fired brick material. The inner wythes, however, were relatively soft cream city brick. Pull testing with a custom designed tool showed standard wedge-type anchors did meet installation load requirements, but could not meet the operational load requisite for the mast. The solution required ¾-inch diameter stainless steel threaded rods embedded 13 inches into the wall and held in place with a two-part epoxy.

“Working with Safway was a great experience, and I look forward to working with them again. Their whole team was extremely talented.”

This would have been fairly straightforward if the air temperatures at the time hadn’t been well below zero. Even the epoxy manufacturer had no set strength values for temperatures that cold. So Safway, with the support of the field engineer for the epoxy manufacturer, Hilti, determined that sufficient anchor strength developed after a four-hour cure time. After the designated cure time, the epoxy anchors were tightened and the system was again pull-tested to ensure it met the operational load requirements.

Beyond that, the building configuration itself presented another mast-tie challenge. Holes could not be drilled through decorative terra-cotta façade panels located at the floor levels. This required the ties to be attached either above or below the floors. However, there were windows in these areas. So, to create attachment points, custom lightweight beams – some 20 feet long – were fabricated and spanned across the windows, then bolted to the wall surfaces on the sides of the windows.

Complication at the top

Finally, tying the mast to the building at its very top presented the most extreme challenge. Cullen needed to replace finials atop the peaks of the gables of the building’s clock tower. This required the MCWP to travel to this elevation; however no ties could be installed to support the mast as the front face of the entire gable was covered with decorative terra-cotta panels. The steeple roof over the clock tower rose behind the gable. Clad in copper, it could not be drilled. The only possible way to tie the top end of the mast back to the building was through a 19-inch by 32-inch hatch opening above and slightly off-center of each gable ridge. However, no welding or bolting to the clock tower internal structure was allowed.

The solution, created with the help of Graef, was to clamp and cable an elaborate steel support system inside the tower so that a 12-inch by 6-inch steel receiver tube was aligned with the hatch opening. A 10-foot-long aluminum tie structure was designed and fabricated to fit into the hatch from the outside. These structures were hoisted by crane and then slid over, and bolted onto, the steel receiver mounted in the hatch opening. The cantilevered portion of the tie structure extended out of the building and encircled the top of the finial without touching the exterior of the building. It included a horizontal member in front of the gable face, to which the mast could then be tied.

The wedge anchors allowed the erectors to continue building upward while the epoxy anchors cured.

The project began in January 2014 and was completed in November of the same year, with no safety incidents.

All this was complicated enough. But on installation day, with the part suspended 300 feet in the air by a crane that was blocking traffic, the crew discovered a fabrication error. The part could not be mated with the receiver as planned.

"At this point it was 7 p.m. and there was no turning back," Virnich recalled. "I was in the clock tower discussing possible solutions with the team. I called Graef and was impressed at how quickly they developed a field modification and verified it with a structural analysis. The crew was then able to make the mod and proceed with the installation. We wrapped up in about an hour. Graef was a key partner throughout the project."

Hastings summed up his impression of Safway. "We worked great with Safway's field and management staff," he said. "Their system really worked out well for us."

Added Hankes, "Working with Safway was a great experience, and I look forward to working with them again. Their whole team was extremely talented."

Safway's Virnich offered his final thoughs on the project: "Just as the Milwaukee City Hall building stands as a testament to cutting edge architecture for its time, this project stands as an example of Safway's unique ability to solve the most difficult access challenges while keeping safety as the top priority. We're extremely proud to contribute to preserving part of Milwaukee's architectural heritage."

With more than 110 locations in the U.S. and Canada and a growing system of distributors worldwide, Safway Group companies deliver efficient, high-performance multiservice solutions – *The Smart Way®*

SAFWAY® Group

Safway Group Holding LLC
N19 W24200 Riverwood Drive
Waukesha, WI 53188
Toll free: (800) 558-4772
Telephone: (262) 523-6500
www.safwaygroup.com