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Supporting a
**NATIONAL
TREASURE**

Supporting a National Treasure

A one-of-a-kind scaffold system provides access for workers, materials, and other equipment to repair the earthquake-damaged Washington Monument
by Lindsay Minard



The Washington Monument, with its obelisk silhouette, is perhaps the closest representation the United States has to an ancient-looking sight to see. Made of marble and granite, the national icon is the world's tallest free-standing stone structure and one of America's most recognized symbols.

With the additional title of world's tallest obelisk, the 555-ft. monument, completed in 1884, has been the subject of renovation and repair work four times in its history. Three of those projects have been in recent history, including an extensive restoration from 1998 to 2001; a necessary renovation between 2004 and 2005 to implement additional security measures post 9/11; and today's current repair project, the result of an unusual and unexpected 5.8-magnitude earthquake that rocked the Metro Washington region on Aug. 23, 2011.

The earthquake created cracks near the top, or Pyramidion, of the structure, which resulted in loose pieces of stone and mortar falling onto the interior stairs and observation deck. As a result, the monument has been closed to the public since the day following the natural event.

In November 2012, Massachusetts-based construction management firm Perini Management Services was awarded the latest repair project by the National Park Service (NPS). Perini subcontracted a major portion of the repairs to Metro Washington-based general construction firm Grunley Construction—the general contractor on the 1998 restoration project—to tackle the landmark once again. Grunley in turn awarded the scaffolding contract to its 1998 teammate, Universal Builders Supply (UBS).

"The success that Grunley, UBS, and a handful of other specialty contractors had on the 1998 restoration project is one of the primary reasons Perini decided to reassemble that team," says

Photographs by Colin Winterbottom for The Trust for the National Mall.

Robert Collie, project manager with Perini. “It’s an honor to be a part of this project. The Washington Monument has to be one of the most photographed icons in the U.S. I am proud to be part of the restoration team. I’m reminded of the importance and significance of this project every time I go to the top of the scaffolding and see the other memorials, prominent buildings, and sites in the D.C. area. It’s a once in a lifetime opportunity, and the kind of project that everyone in the construction industry wants to be part of.”

Echoing Collie’s sentiment, Kenneth Terry, project executive with Grunley says: “We were elated to be selected to perform the restoration work on this iconic landmark a second time around. We take great pride in our work on and around the mall, and this was a great opportunity to put our past experience to good use.”

Specializing in commercial, institutional, and government projects, Grunley Construction has a lengthy history restoring and preserving historic projects in D.C. and chose to work with UBS a second time around because of the company’s similar expertise. “UBS is well known for designing and erecting sophisticated scaffolding systems to be installed on and around some of this nation’s most iconic structures,” explains Terry. “This unique experience coupled with Grunley’s past working relationship with them, made UBS the best choice for the scaffolding work at the Washington Monument.”

In February 2013, shortly after the presidential inauguration, UBS began erecting the scaffolding system necessary for the various trades, primarily the stone contractor, Lorton Stone, to access and repair the structure.

By May 2013, the UBS team completed the scaffolding by crowning the Pyramidion—an engineering feat that was highlighted July 9, 2013, when the landmark, wrapped in decorative scrim and lights, lit up the night—making the monument, even under repair, certainly still a sight to see.

The current Washington Monument repair and restoration project, funded by the government and private investor David Rubenstein, has an estimated \$15 million price tag with a spring 2014 completion date.

Second Time’s the Charm

“This project is more complex than the 1998 project,” explains Kenneth Grunley, CEO and CFO of Grunley, who was actually on the 1998 team. “The first time around, we cleaned and tuck-pointed the stone with minor crack and Dutchman repair. However, because of the earthquake, more damage was done to the stone, which requires more extensive repairs. We chose UBS because they’d been there, done that, and did a great job the last time around—we haven’t been disappointed this time around.”

Not their first time at the rodeo, UBS knew that the scaffolding system that would provide safe access and not compromise the integrity or aesthetic of the landmark, would need to be one-of-a-kind in nearly every way, just like the system they designed for the 1998 restoration.

In the spirit of not reinventing the wheel, they returned to the original design with a proven track record, tweaking it to meet current code requirements says Mark Tsigigos, vice president of UBS, and 1998 project team veteran. “The 1998



Looking upward through the scaffold at the Pyramidion shows how the crown’s structure differs from the lower structure.



A UBS team of as little as 12 and as many as 30 met the challenge of erecting the scaffold system.



From 500 to 555 ft. a 70-ft.tall, fabricated aluminum structure crowns the structure’s Pyramidion.



The 2013 scaffold system has the hoist, which is anchored to the scaffold, outboard of the system. In 1998 the hoist was inside the scaffold, making it difficult to access the south face.

award-winning design was proven successful, and we felt that the NPS would feel confident and comfortable knowing that this system was being used again,” he contemplates. “However, while UBS maintained the engineering documentation from the 1998 design, revisions to calculations had to be performed with new criteria.”

The aluminum scaffold system is designed to withstand a million pounds of ice.



The tweaked design accommodates increased criteria for the code-mandated wind speed and ice loading capacity.

Not Your Typical Scaffold

The unconventional, custom-designed and engineered structure is designed to not only accommodate the trades working on the project, but also to withstand the elements that become particularly unfathomable on a 555-ft. obelisk.

“What drove the design of the system in 1998 and today, from an engineering standpoint, was wind and extreme weather conditions,” says Tsigos. “Ice accumulation on this engineered structure has the same potential effect as it does on power lines or trees. The UBS structure has a design load in excess of a million pounds to accommodate the potential accumulation of ice on the structure.”

This scaffold system capable of taking on a million pounds of ice is constructed of “extra” heavy-duty aluminum, and has an extraordinary high load carrying capacity while maintaining the inherent lightness of the material. Additionally, the aluminum does not rust and stain a building as other more conventional systems might—a definite no-no in this situation.

“UBS’s high-capacity aluminum system has been in our inventory for over 40 years now and has been used on many high profile projects over the

years with great success, including the renovation of the Statue of Liberty,” says Tsigos. “It has a heavy-duty leg and is commonly used on structures varying in height reaching up to 1,000 ft. high.”

Point-Perfect Erection

Tapered

A UBS team of as little as 12 and as many as 30 on a given day met the challenge of erecting the scaffold system that Tsigos says was clearly atypical from an application on a square/symmetrical building. “Every level had a different girth, which meant a different girth and brace to follow the profile,” he says. “Each one was custom fabricated because one may be 14’7” and the next 14’5.25” and so on. It wasn’t standardized in any way.”

The system did employ some standard parts and pieces; however, the girths and braces of the main scaffold system were specially designed to allow the structure to follow the 1° taper of the monument from zero to 500 ft.—with no mechanical anchors, which are strictly prohibited by the NPS.

In order to make the 1° taper possible, the scaffold was tilted inward towards the monument, and its end tower panels towards the center, creating a true 1° tapered corner. To achieve the tilt, girths and braces of varying lengths were used on the corner tower panels.

“Because these corner tower panels were tilted to create the corner, they also required special shim stacks to allow the panels to maintain the same elevation as the adjacent tower panels during installation,” continues Tsirigos.

Stabilized

With mechanical anchoring not an option, UBS designed special brackets to use at the corners and mid-span of the predetermined tie-elevations, every 26 ft., eliminating any potential for inward thrust by the scaffold into the monument.

“To satisfy the opposing forces, we employed cable systems also positioned at the tie-elevations that were routed through the scaffold and engaged the corner brackets,” explains Tsirigos. “Once in place, the cables were tensioned in a manner not to overload any one side of the monument or scaffold system components, but to ensure that even pressure from the cables was being engaged into the system.”

Crowned

Once the scaffold reached the 500-ft. elevation, or the base of the Pyramidion, UBS took on topping off the monument—a feat accomplished with an additional 70-ft. tall, fabricated aluminum structure that truly is free-standing.

“The top of this scaffold structure is crowned with a single fabricated piece that collects the truss-like members that span the 70 ft.” says Tsirigos. “The crowning structure does not rely on the monument for any lateral bracing or support and follows a 17° taper to the top of the structure.”

The Washington Monument’s top hat of sorts features 72 lifts, each with a quarter inch shim stack that ensured the frames were flush to one another once they reached the peak.

To visualize, take two chopsticks—one sitting vertical, the other tapered in 5°. “Even though the chopsticks are both 12 in. long, the tapered one travels a shorter distance. So every time we put another lift on we have to put a shim stack because with every lift we’re losing a fraction of an inch,” portrays Tsirigos.

Collie says that UBS’ experience led to predictable results that made scheduling seamless. “We looked forward every day to recording the daily progress

made on the scaffold erection. The highly qualified UBS erection team worked safely, efficiently, and were great to work with on a very important assignment,” he concludes.

Extraordinarily Supportive Scaffold

With the scaffolding erected and inspected, the trades began accessing the Washington Monument via UBS supplied hoists, suspended scaffolds, and ladders at the end of May 2013.

A significant difference between the 1998 scaffolding system, and today’s is the location of the hoist that was inside the scaffold system the first go round; this presented challenges for accessing the south face of the structure. “Today, the hoist is outboard of the scaffolding to allow for uncluttered access to all faces of the monument,” says Terry.

Materials and workers access five composite decks set at 100-ft. intervals from zero elevation all the way to the base of the Pyramidion (500-ft. elevation) on a 6,000-lb. rated personnel and material hoist that like the scaffold, tapers in 1° from zero to 500 ft.—again, with no mechanical anchors used.

“What is unique about the hoist are its ties that allow it to be anchored to the scaffold itself at the 100-ft. deck levels,” explains Tsirigos. “The scaffold braces are beefed up at those intervals to accommodate the special hoist ties, as the hoist relies solely on the scaffold as a support structure.”

Between each of those 100-ft. deck intervals are swing stages with varying lengths—shorter as the monument tapers in at higher elevations. The stages are suspended to the scaffold itself along with all the fall protection safety lines for operators.

Tsirigos explains: “The monument is 55 sq. ft. at the base, and 35 sq. ft. at the base of the Pyramidion. Two swing stages are provided on each side of the monument between the five deck levels. As the stages move up the monument, we reduce their lengths to fit the decreasing scaffold profile.”

When workers reach the Pyramidion level, (above 500 ft. elevation) they’re working off fixed decks and accessing them with fixed ladders.

“The repair work itself is similar in some ways and different in others from



The scaffold has a 1° taper created by tilting it inward towards the monument and its end tower panels towards the center.



At the base of the Pyramidion the angle of the scaffold tilts, going from a 1° to 17° taper all the way to the top of the structure.



The scaffold, wrapped in decorative scrim and lights, was lit July 9, 2013.

the 1998 restoration,” says Terry. “Like then, the job includes lots of joint repointing and stone patching, as well as a significant amount of Dutchman repairs. What is dissimilar today is the amount of cracks to fix and the addition of steel saddle anchors inside the Pyramidion to assist in stabilizing some of the stone panel rib tip connections that suffered cracks during the earthquake event. The saddle anchors will help to secure the stone panels during future seismic events.”

Manuel Seara, president of Lorton Stone, says that the access provided by UBS has allowed his team the ability to access every possible work location without issue thus far. “The scaffolding system could not have been designed any better, and the hoist is second to none,” he states. “We are progressing steadily on the work to be done.”

Dinner Table Tales

Everyone hopes to have days or projects they’ll remember years down the road, retired, and living the life—monumental successes in a career to

share around a dinner table. For UBS and several of the other project team members, the monumental days have been more than some considering their market niches; however, the icing on the cake is likely the distinction of being awarded not one, but two scaffolding projects on the one and only Washington Monument.

UBS President Kevin O’Callaghan says while many of the faces on the project team have changed since 1998, the job has run like a well-oiled machine, thanks to the professionalism and pride of all involved.

“When you do a job with the NPS, you know it’s going to be a well-run project. This second time around, even with new players involved, has run very smoothly,” O’Callaghan reiterates. “UBS has employees on this job, some for the second time around, who are first generation immigrants, standing shoulder-to-shoulder with patriots who truly bleed red, white, and blue—both so proud to be a part of the fabric and legacy that is this iconic project.” •