

# MidAtlantic

News, Data and Analysis for the Construction Industry in D.C., Delaware, Maryland, Pennsylvania and the Virginias



SHEFALI KAPADIA/FEDERAL NEWS RADIO

## **Crack Repairs At Capitol Dome**

**REGION'S TOP DESIGN FIRMS ● JMT'S PLAN PAYS OFF**



IN FULL VIEW A 1.1-million-lb scaffold system surrounds the U.S. Capitol dome during exterior renovations.

# Capitol Architect Pushes To Restore Iconic Dome

The project team is executing a massive preservation effort while maintaining public access **BY BRUCE BUCKLEY**

**F**rom the ground level, the U.S. Capitol dome appears much like it did almost 150 years ago, but up-close inspection reveals an aging icon in desperate need of restoration. While the dome is designed to match the appearance of the stonework used on the Capitol building itself, the structure is comprised of 9 million lb of painted cast iron. With its prominent position overlooking the National Mall, the building's massive metal dome has been battered by the elements for decades, leading to significant corrosion and deterioration of hundreds of decorative elements. Even more troubling, more than 1,000 cracks have been documented during inspections in recent years—with some allowing moisture to penetrate to the interior.

After years of paint and seal work to help slow the damage, Congress appropriated three years of funding, starting in fiscal 2013, to launch the \$60-million Capitol Dome Restoration project. In September 2013,

a joint venture of Turner Construction and Smoot Construction was awarded the project, and work got under way the following month.

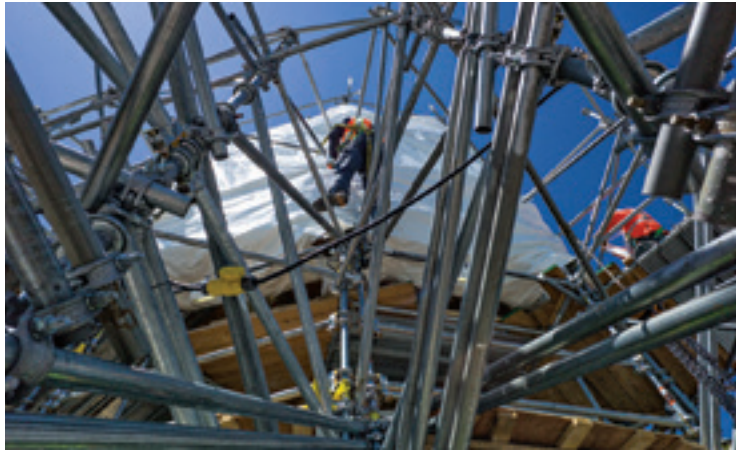
Augustine Angba, capital project administrator at the Architect of the Capitol (AOC), says the proj-



**RUST TO DUST**  
Significant portions of the cast iron dome have corroded and will need to be recast and replaced.

PHOTOS COURTESY OF ARCHITECT OF THE CAPITOL





**CARRY THAT WEIGHT** The scaffold places the vertical loads at the lower portions of the dome. The top of the system is designed to only stabilize horizontal movement.

ect's main challenges were respecting and preserving the historic elements of the dome while keeping the building operational for government employees, guests and visitors.

"Everything about this job is tough," he says. "There is a high level of collaboration between the [Capitol building] superintendent's office, the [AOC] project management team and the general contractor."

Although the current project will complete the needed dome repairs, previous restoration efforts helped guide the AOC team's design for the new work. During a 2012 restoration of the skirt at the base of the dome, crews tested the use of brazing to repair cracks. "We discovered that trying to control the expansion and contraction of the metal in the field [during brazing] was impractical," says Joe Abriatis, a construction manager on the project with the AOC.

Instead, the team employed a "lock-and-stitch" method to eliminate heat-related issues caused by brazing. Crews "stitch" the cracks by inserting a series of metal pins perpendicularly into each crack, filling all of the gaps. Then a series of "locks" are added to pull either side of a crack together and secure the repair. The exposed ends of the pins and locks can then be ground down to make them flush with the dome surface. Approximately 12,800 in. of cracks will be repaired.

### SCAFFOLD SOLUTION

Other portions of the original AOC design were modified as well. The plans put out for bid called for a fabricated steel scaffold system. In its winning bid, Turner-Smoot recommended a more cost-effective modular scaffold system. Working under a separate design-build contract with scaffold firm Safway, the team devised a lighter-duty option that was no less secure than the original design.

Based on the AOC designs, the team identified where the scaffold system could place load on the structure. The entire scaffold system, weighing more than 1.1 million lb, places its loads on the structural ribs of the dome rather than its surface. The vertical load is entirely supported on 36 points at the "peristyle" level, near the skirt at the base, and the "boilerplate" level, at roughly one-third of the way up the dome. On the "tholos" level, located at the top of the dome, the system is only supported to prevent horizontal movement of the scaffold.

To help stage the scaffolding, the team was provided limited laydown area on the roof of the building, adjacent to the dome. Starting in April 2014, pieces were delivered to the site at night, and lifted to the roof via a 60-ton crane positioned on the northeast plaza. The staging platform on the roof could sup-

### ON THE WEB

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## Replicating the Dome's Damaged Components



Damaged ornamental elements and other components from the U.S. Capitol dome are sent to a foundry in Utah operated by Historical Arts and Casting and molds are created from existing pieces and fragments. Replacement components are then cast from those molds. In some cases, one mold can be used to create multiple replacement pieces. In other cases, unique molds need to be used for pieces that have to fit perfectly into existing spaces.

PHOTOS COURTESY OF ARCHITECT OF THE CAPITOL



port up to 20,000 lb, which crews maximized during peak activity.

The completed system featured more than 75,000 pieces of equipment, 52 miles of scaffold pipe and two miles of decking.

While AOC intends to preserve as much of the existing dome as possible, hundreds of new ornamental pieces will need to be cast to replace those that are beyond repair. Crews are carefully removing and cataloging damaged pieces before shipping them to specialty contractor Historical Arts and Casting's Utah foundry. In some cases, a single mold is cast for identically designed pieces, such as the multiple 80-lb ornamental acorns that are attached to the outside of the dome. In other cases, each piece needs its own mold to ensure it will fit properly when installed. Crews found significant damage to the boilerplate balustrade, with up to 3 in. of corroded material found in some spots. All of the 288 balusters will be removed and many will be recast with unique molds.

Throughout the process, significant paint abatement is also required. An estimated 1,215 gallons of

paint will be used to repaint the dome.

As the exterior work pushes toward completion later this year, work will ramp up on interior restoration of the rotunda. Crews have already installed a white catenary system in the shape of a doughnut, which protects the public spaces below while allowing the "Apotheosis" painting at the top of the dome to be seen during restoration. A total of five layers of safety netting will be used for the rotunda work.

This phase of the project will focus on paint analysis, abatement and restoration of areas stained by moisture that leaked through the dome. None of the murals in the rotunda have suffered moisture damage and they will not require restoration.

Just as the skirt project helped inform the current restoration efforts, Angba says aspects of the current project will resonate in future work.

"There are a lot of lessons learned both from a tech perspective and in terms of the work performed," he says. "What we'll carry on to future projects are the management aspects, particularly the use of collaboration." ■

**INSPECT AND IMPROVE** Crews survey the extent of damage to cast iron elements (left). Throughout the project, existing paint (right) will be abated and replaced with 1,215 gallons of new paint.

**RECAST AND REPLACE** All of the 288 balusters will be removed (left). Several will be sent to a foundry to be molded and recast.



PHOTOS COURTESY OF ARCHITECT OF THE CAPITOL