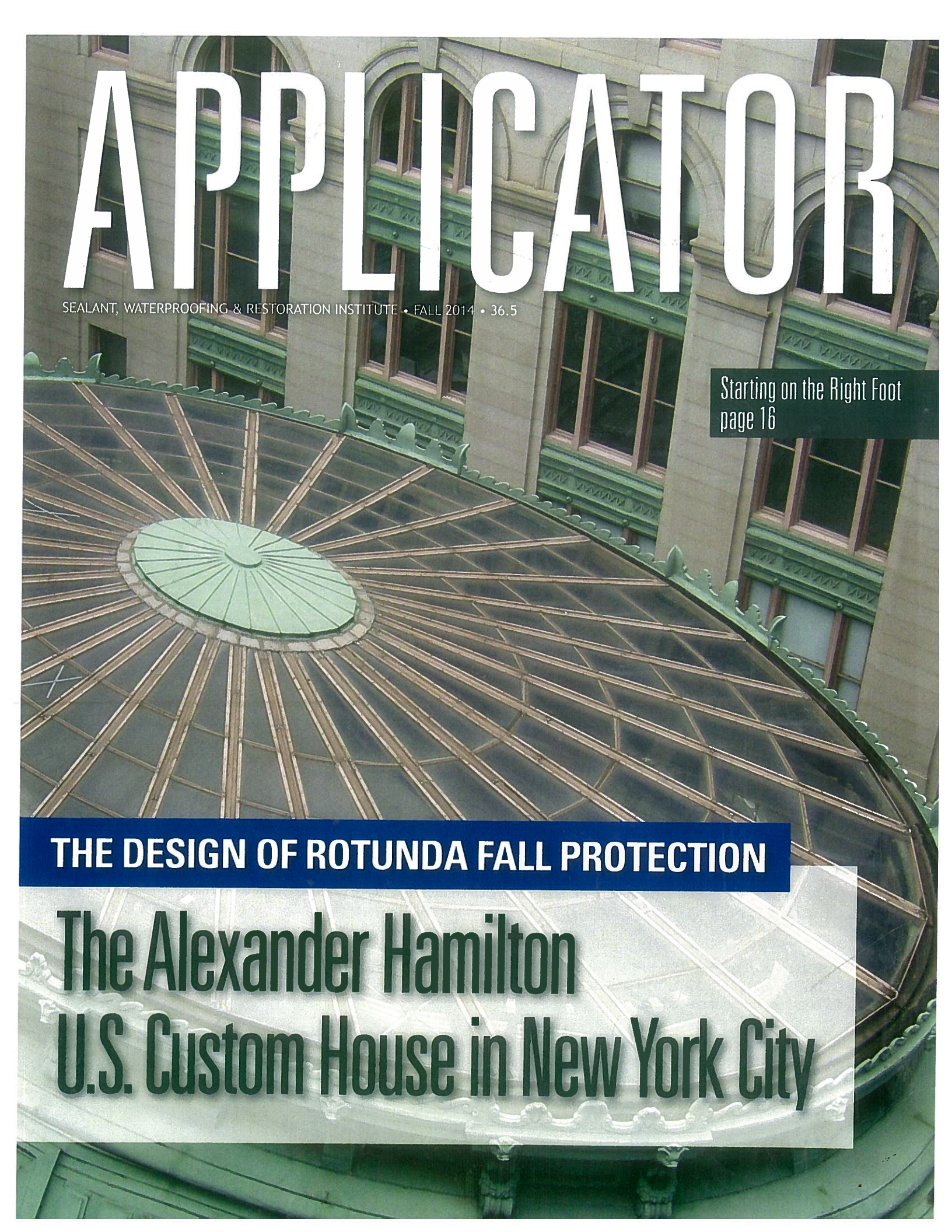


# APPLICATOR



SEALANT, WATERPROOFING & RESTORATION INSTITUTE • FALL 2014 • 36.5

Starting on the Right Foot  
page 16

**THE DESIGN OF ROTUNDA FALL PROTECTION**

**The Alexander Hamilton  
U.S. Custom House in New York City**





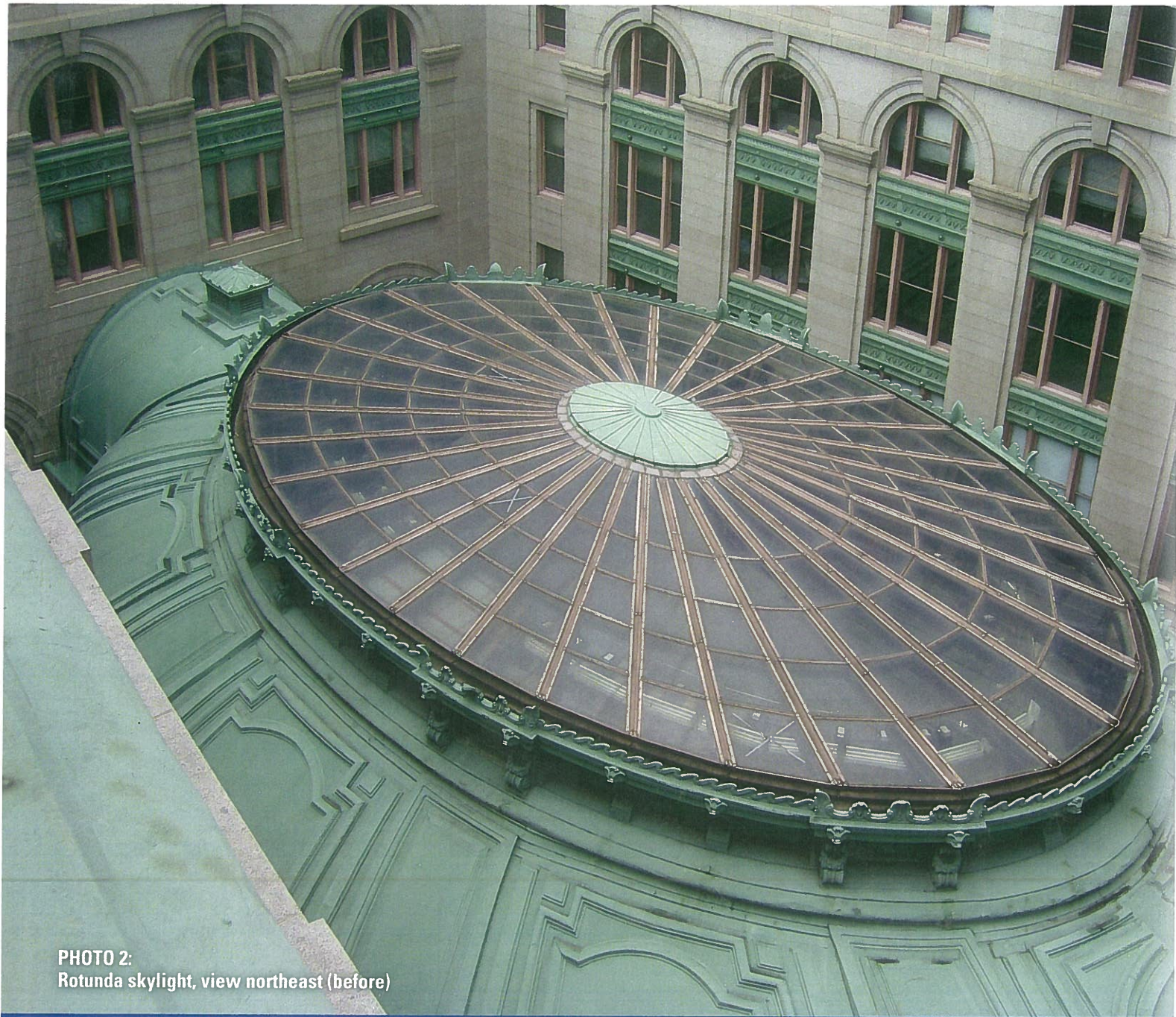
## THE DESIGN OF ROTUNDA FALL PROTECTION

# The Alexander Hamilton U.S. Custom House in New York City

BY DOUGLAS EMILIO

The Alexander Hamilton U.S. Custom House was designed by the prolific architect, Cass Gilbert, and constructed between 1900 and 1907. It is a monumental public building located at the southern tip of Manhattan, directly adjacent to the New York Harbor. It was designed in the Beaux-Arts style with façades clad in gray granite and limestone, a red slate roof, and embellishments, including a sculpture series entitled the “Four Continents” by Daniel Chester French (photo 1).





**PHOTO 2:**  
Rotunda skylight, view northeast (before)

The architectural and artistic accomplishments merited the building being listed on the National Register of Historic Places in 1972 and it became a National Historic Landmark in 1976. In 1979, New York City's Landmarks Preservation Commission designated the exterior and interior public spaces a city landmark. The building is managed by the U.S. General Services Administration (GSA) and houses many diverse tenants, including the Smithsonian's National Museum of the American Indian, the U.S. National Archives and Records Administration's

New York branch containing research rooms and archives, and the U.S. Bankruptcy Court for the Southern District of New York.

The plan of the building is trapezoidal with the east and west elevations tapering to the streets of Lower Manhattan and Bowling Green Park to the north. In the center of the trapezoid is a central, oval rotunda with corridors that connect the main building block (photos 2 and 3). The interior of the rotunda is 135 feet by 85 feet by 40 feet in height and is constructed using

Guastavino tile. The curved interior rotunda ceiling, adjacent to its laylight, is decorated with murals depicting ships entering New York harbor by the Works Progress Administration-sponsored artist, Reginald Marsh. The murals are executed in the Social Realism style and are an interesting juxtaposition to the building's Beaux-Arts style. Above the laylight is an interstitial space for an access walkway, mechanical equipment (including a smoke-purge system), and a sloped aluminum-framed skylight above. The interstitial space includes steel





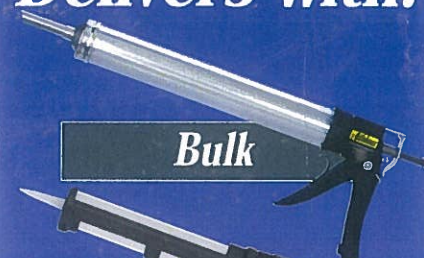
**PHOTO 3:**  
Rotunda skylight, roof, and sidewalls (before)

rafters supporting the skylight and a perimeter tension ring. The exterior sidewalls of the rotunda are clad in copper with decorative brackets, a projecting cornice, and fish-shaped spouts for the removal of precipitation from the built-in gutter. This beautiful roof assembly is not visible from the public streets, only from the interior-facing windows and adjacent high-rise buildings. Before this project, if access was required to the rotunda-skylight roof, an extension ladder was placed on the barrel roof and against the dome sidewall. This approach forced

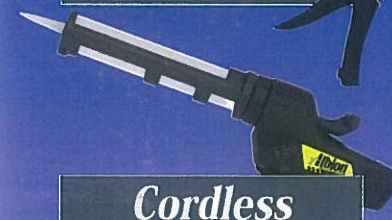
a person to transition from the ladder into a narrow built-in gutter. The skylight and adjacent sloped roofs had suffered from deferred maintenance due to a lack of safe access. As such, there were several persistent leaks that had reached the decorative interiors below.

The New York architectural and engineering firm of Wank Adams Slavin Associates LLP (WASA/ Studio A) was issued a task order under their term contract to design a comprehensive rotunda-skylight

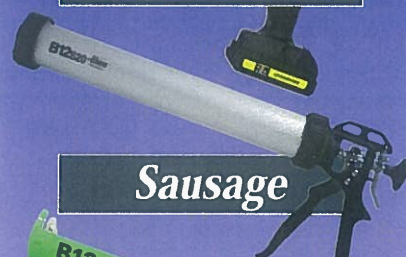
**Professionals Demand  
the Very Best Tools—  
Albion  
Delivers with:**



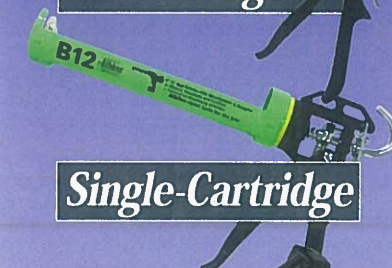
**Bulk**



**Cordless**



**Sausage**



**Single-Cartridge**



**Multi-Component**



**Accessories**

**Expect the Best.**  
Ask your distributor for Albion.  
Professional dispensing tools  
since 1929.

Request  
our new 88 page  
Handbook #333!

**Albion**  
DISPENSING SOLUTIONS  
www.albioneng.com

ALBION Engineering Co.  
1250 N. Church Street  
Moorestown, NJ 08057-1102  
856-235-6688 FAX: 800-841-7132  
E-MAIL: service@albioneng.com





**PHOTO 4:**  
Rotunda barrel roof, view west (before)

**PHOTO 5:**  
Rotunda barrel roof, view south (before)

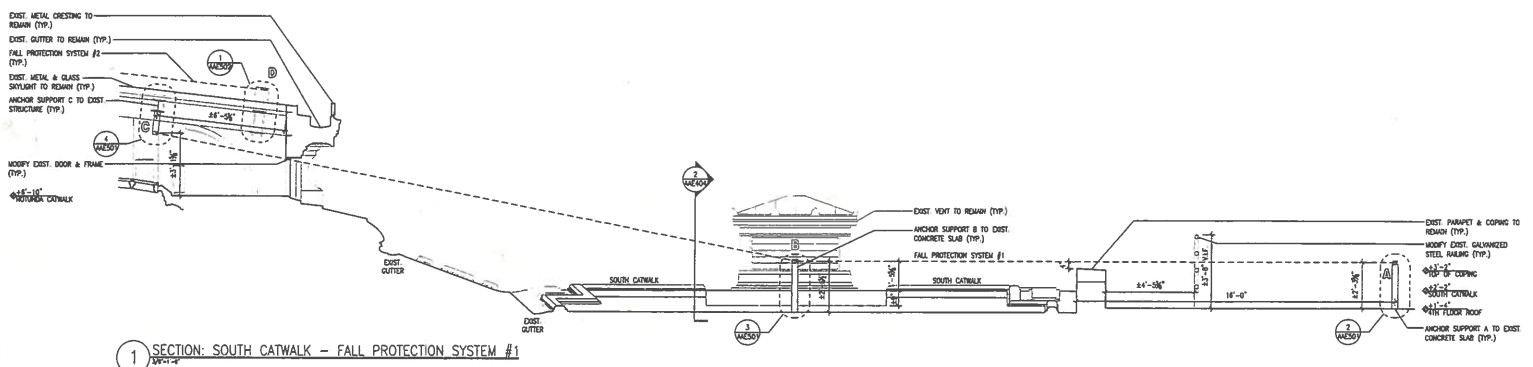
fall-protection system. The GSA's program for the project called for a permanently installed personal fall-protection system to allow periodic inspection, repairs, and maintenance, including repairs/waterproofing to the cladding of the dome; cleaning of roof drains and gutters; caulking, painting, glass cleaning and replacement; changing of lamps at light fixtures, and replacement of filters for mechanical equipment. The program also required two workers being in the work area simultaneously.

WASA/Studio A's Architecture and Preservation Groups, working in

conjunction with the fall-protection consultant/manufacture, Pro-Bel, commenced the project by a visual examination of the existing conditions, review of existing and archival drawings, and study of various access options. This initial step resulted in a design-development report for the GSA's review. Design considerations outlined in the report included: 1) life-safety and compliance with applicable codes, 2) how to best obtain access for daily maintenance and periodic maintenance, and 3) the visual effect of the new system against the historic building fabric. As the building is a National Historic Landmark, design

options needed to have the least visual impact possible, while in no way compromising life-safety. All of the proposed design options were reviewed and vetted with the GSA's Regional Historic Preservation Officer.

The selected scheme provides access from an adjacent third-floor low-slope roof with an existing metal guard rail, across a barrel-shaped roof and around a rectangular vent at the mid-point (photos 4 and 5), into the interstitial space, and up from the barrel roof to the top of the skylight. The design included three separate fall-protection systems (Drawing 6). The first cable

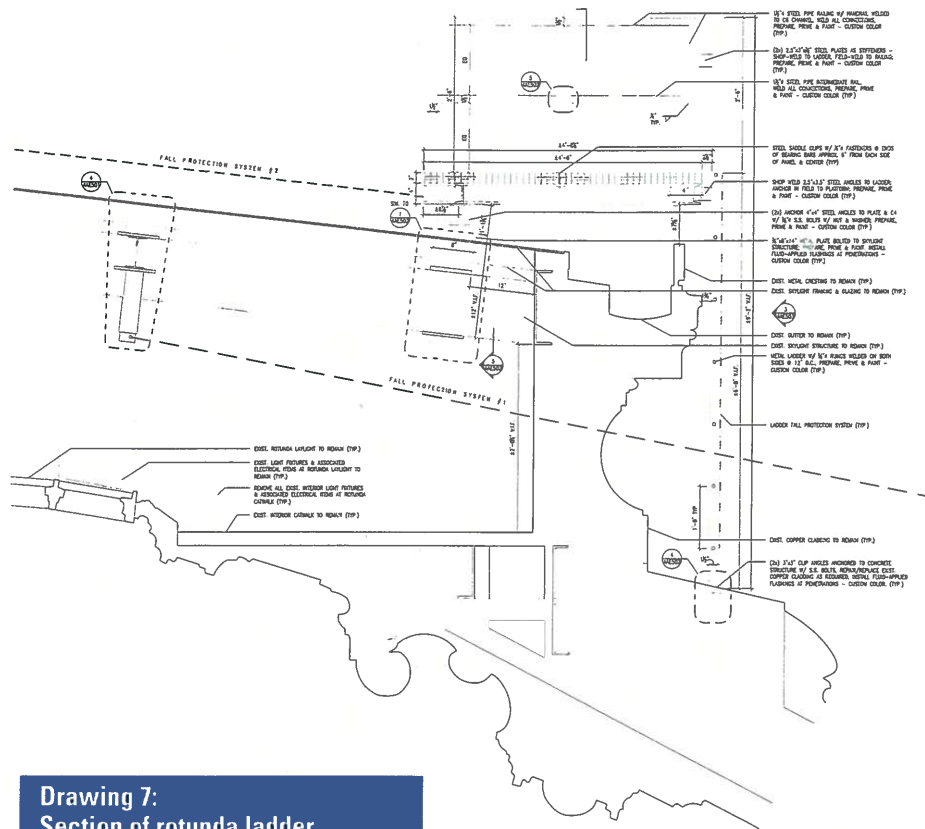


**Drawing 6:**  
Section at south catwalk

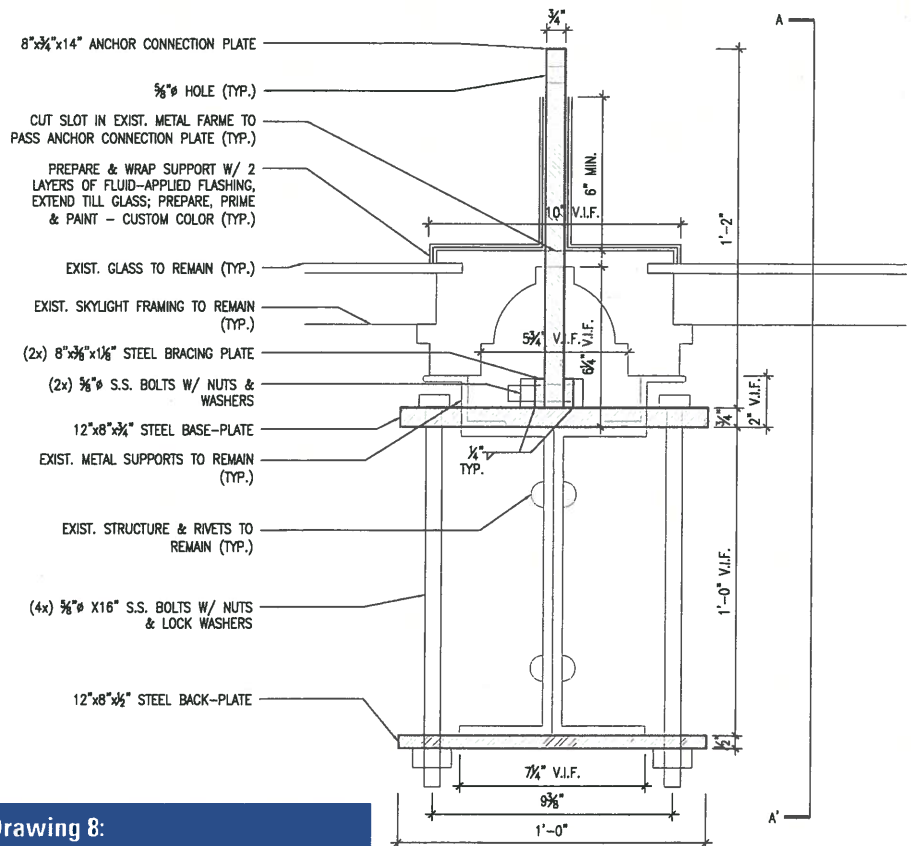
allows a person to transverse from the flat roof across the barrel roof and either enter the interstitial space or transition up a ladder to the top of the skylight (drawing 8 and photo 9). The second line is vertical and parallel with the ladder and the third is along the skylight in a diamond shape. Fall-protection cables were anchored by means of a post connected to the building's substructure (photo 10) or to fins welded to the steel frame. Pull tests were performed during the construction phase to ensure code-compliant anchorage to the substructure below the flat roof and copper dome. All users of the fall-protection system wear a full-body harness with two lanyards allowing positive connections at transitions between cables.

One of the design challenges was how to connect the fall-protection system to the steel frame below the skylight and have it pass through the skylight. The ultimate design called for cutting a slot for a  $\frac{3}{4}$ "-metal fin in the skylight frame at selected locations (photo 11). The fin was then bolted to an upper steel receiver located on the top of the existing steel frame and then connected to a lower welded-steel angle. The two were then connected with threaded rods (photo 12).

Another challenge was designing a ladder from the barrel roof to the top of the skylight. The new custom ladder, platform, and railing assembly had to have the smallest footprint possible, and would need to transition over the existing built-in gutter. In addition, the inner edge of the platform was located over the skylight, limiting mounting/support points. For this condition, the ladder itself was designed to be structural, supporting the outer portion of the platform. The inside edge of the platform was supported by a single steel fin that passed through the skylight frame and attached to the steel frame below, a more robust version of the skylight fall-protection



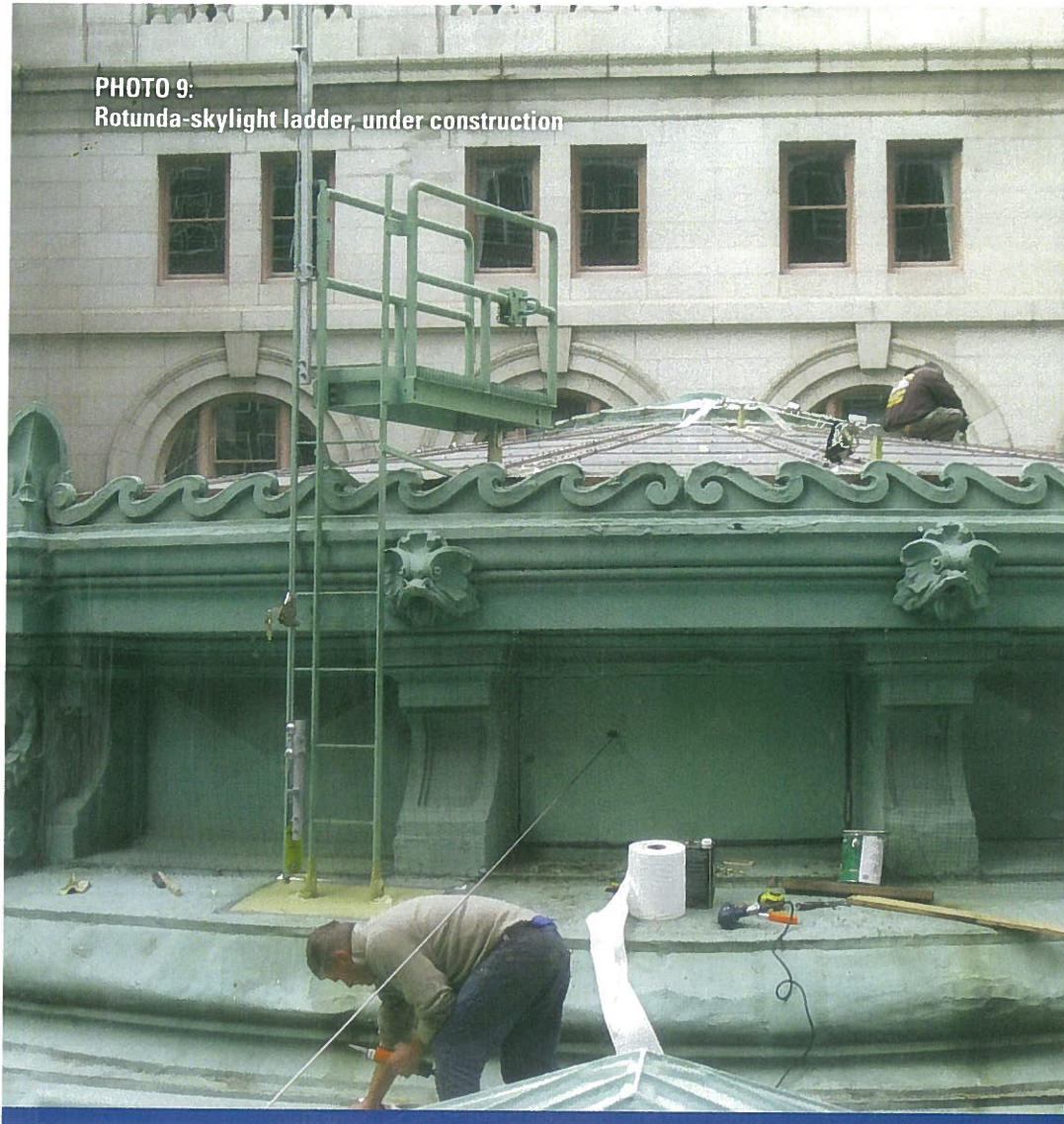
**Drawing 7:**  
Section of rotunda ladder



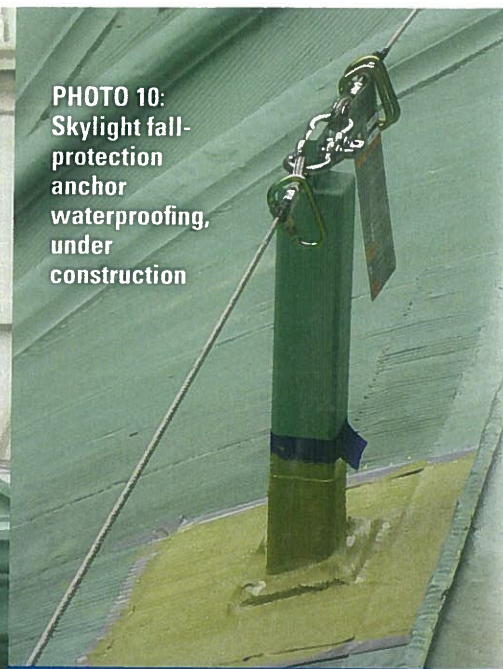
**Drawing 8:**  
Detail of fall-protection anchor  
to rotunda-skylight structure



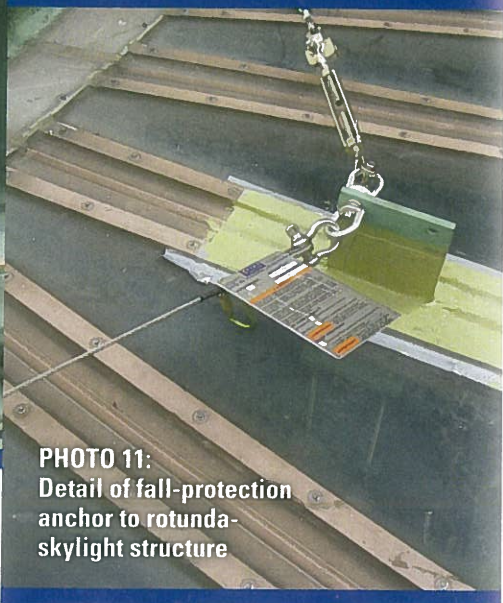
**PHOTO 9:**  
Rotunda-skylight ladder, under construction



**PHOTO 10:**  
Skylight fall-protection anchor waterproofing, under construction



**PHOTO 11:**  
Detail of fall-protection anchor to rotunda-skylight structure



anchor points. To waterproof the slotted connection through the skylight, ladder legs, and cable posts, we used a PMMA fluid-applied flashing system with a reinforcing fleece. A final color coat of the flashing membrane allowed the waterproofing to match the color of the existing aluminum skylight frame and copper-clad roofing, further minimizing the impact of the new elements.

The executed design was competitively bid to the GSA's Northeast and Caribbean Region indefinite-delivery/indefinite-quantity general contractors and executed in the summer of 2011 by Trio General Contracting of Queens, N.Y. Construction logistics needed to consider welding in an occupied building directly over public spaces. Before the building's maintenance staff could put the fall-protection system into use, the fall-protection installation

contractor provided them with training sessions and harnesses. Signage was installed at key points to ensure that only authorized building personnel used the system. The completed fall-protection system has allowed the government's facility manager, Brooks Range Contract Services, to safely and successfully perform the required maintenance to the rotunda skylight.

#### **About the Author**

Douglas Emilio is an associate partner at the architecture and engineering firm of WASA/Studio A in New York City. He has led complex adaptive-reuse and exterior-envelope projects for public and private clients. He is adept at master-plan development and large-scale conditions assessments, as well as fine-grained preservation, conservation, and exterior-envelope projects. •

**PHOTO 12:**  
Rotunda-barrel roof fall-protection post, under construction

