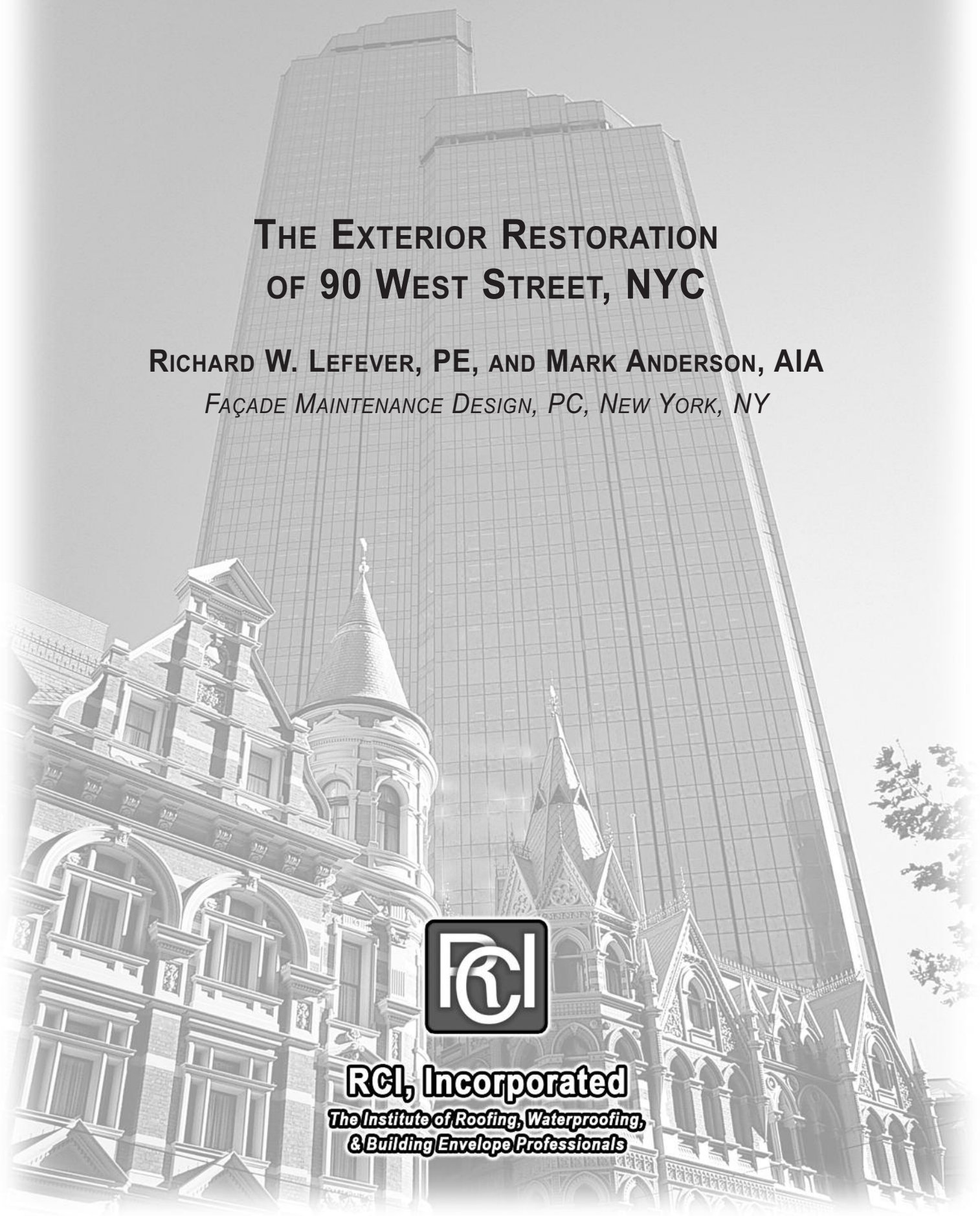
THE EXTERIOR RESTORATION OF 90 WEST STREET, NYC

RICHARD W. LEFEVER, PE, AND MARK ANDERSON, AIA

FAÇADE MAINTENANCE DESIGN, PC, NEW YORK, NY



RCI, Incorporated
The Institute of Roofing, Waterproofing, & Building Envelope Professionals

ABSTRACT

90 West Street is a New York City landmark whose very survival was in doubt after heavy damage from the terrorist attack of September 11, 2001. Located at the south end of the World Trade Center site, this early skyscraper, designed in 1907 by Cass Gilbert, lay vacant for two years until a restoration effort described as "heroic" in size was undertaken by new owners who transformed the building into residential rental apartments.

Façade Maintenance Design was the Professional of Record for the exterior restoration, which included the restoration of the copper-clad mansard roof, terra cotta façade, granite base, and windows. FMD's work began in the winter of 2003 and was completed in the fall of 2005. The project scope was reviewed by the National Park Service, the New York State Historic Preservation Office, and the New York City Landmarks Preservation Commission.

SPEAKERS

Richard W. Lefever, PE, and Mark Anderson, AIA
Façade Maintenance Design, PC – New York, NY

Rick Lefever and Mark Anderson together have over 35 years of experience in the design of exterior restoration projects. As founders of Façade Maintenance Design, an award-winning architectural and engineering firm based in New York City, they have performed design services throughout the eastern half of the U.S.

The Exterior Restoration of 90 West Street, NYC

PROJECT SUMMARY

The exterior of 90 West Street has been miraculously resurrected to its original splendor through a comprehensive restoration, which repaired the impact and fire damage inflicted to the building on September 11, 2001. The schedule weighed heavily on the success of the project. The design and construction team developed a fast-track approach to the restoration, which permitted the project to move progressively forward before the restoration plans were totally designed. The scale and unusual nature of destruction by fire and impact created a monumental task for all involved. The restoration team overcame many obstacles through focus, trust, and pride.

Replaced materials match the original: copper at the roof; terra cotta, brick, and granite at the façade. Innovative testing instruments and new technology were used whenever appropriate. An innovative, steel-framed panel system was used to repair the heavily damaged granite base with new and original materials.

HISTORIC OVERVIEW

The building, commonly called the "Little Woolworth," was designed by famed architect Cass Gilbert between 1905 and 1907 as a precursor to the Woolworth Building (*Figure 1*). Originally known as the "West Street Building," 90 West Street was highly regarded as a fine example of turn-of-century skyscraper design, as it was analogous to a classical column with its tripartite configuration of base, middle, and top, with an added romantic mansard at its apex. This tripartite arrangement of the exterior was also reflected in the use of materials. The base is of massive "Fox Island" granite, the middle of terra cotta with polychrome terra cotta as it gets closer to the top, and then topped off with a copper mansard roof. The back (eastern façade and courtyard) is of brick with terra cotta ornament.

Ownership of the building changed several times between September 11, 2001 and December of 2003.

Landmark Status

The building was designated a NYC landmark in 1998, and listed on the National Register of Historic Places while in a state of disrepair after the attacks of 9/11.

Figure 1 – West and south façades, 1907, from NYHS.

Post September 11, 2001 Restoration

Façade Maintenance Design PC, Architects and Engineers, began the monumental task of preparing base drawings, documenting, analyzing deterioration, designing repairs, and performing construction administration of the exterior restoration, which included the mansard roof, terra cotta façade, windows, and granite base, at the beginning of 2003. Concurrent with the exterior restoration, the interior was being converted into residential units, which were designed by H. Thomas O'Hara Architects.

The project needed to be expedited on a fast-track basis as dictated by the financing for the project. Designs and construction sequences met the required three-year completion date through the use of flexible design, good planning, and implementation. Seaboard Weatherproofing served as the exterior restoration construction manager, as well as the masonry contractor.

Base Drawings

As the professional firm for the exterior restoration, it was our responsibility to analyze the deterioration and damage and to indicate how and where repairs were to be performed. We needed to produce accurate drawings of the façade and roofs to communicate and quantify the repairs to the other team members.

Historic drawing sources were identified and evaluated for their accuracy, which included façade drawings from recent projects to the original drawings and blueprints, which are locat-

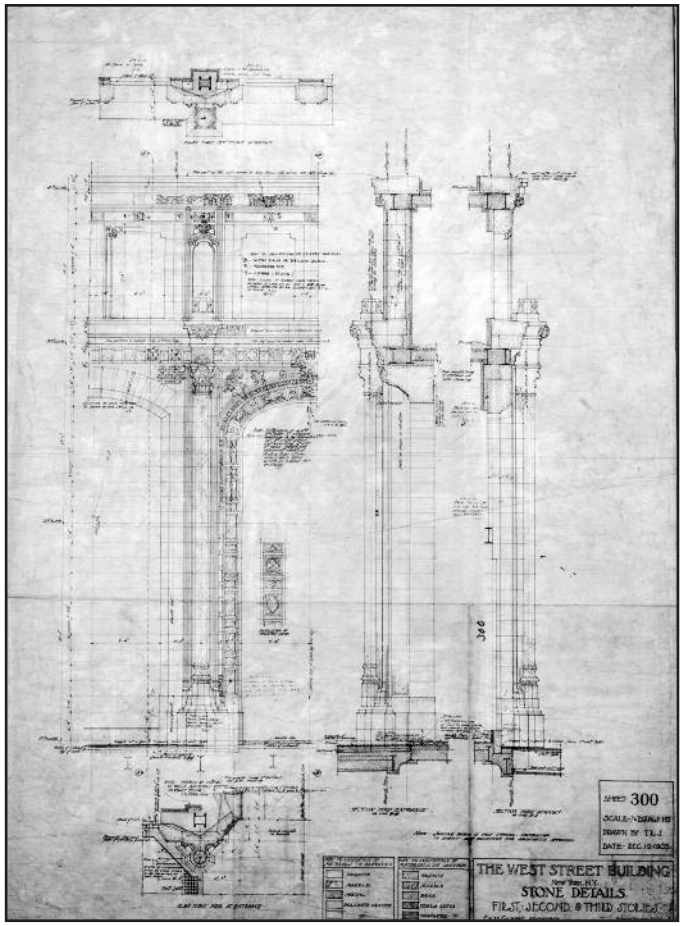


Figure 2 – North base façade – original drawing from NYHS.

ed in the Cass Gilbert Archive at the New York Historical Society (*Figure 2*). This archive, which consists of several boxes of original drawings, blueprints, photographs, and office correspondence, is very interesting and was viewed on multiple visits. The photographs, taken soon after the building's completion, proved to be the most useful items from the collection, as the drawings were often folded and needed to be conserved before we they could even be opened up to view. Photographs of the original drawings were not permitted.

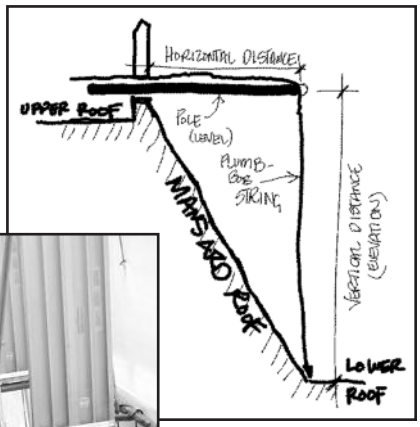
Another source of early photographs was the New York Public Library's *Historic Views of New York City*. The New York City Landmarks Commission Individual Landmark Designation Report was also a useful resource, as it clearly defined the significance of the building.

The unusual nature of the cause of the damage needed to be identified and understood, and unique logistical problems needed to be overcome. Prior to the arrival of the construction team, FMD set up a computer network using electricity extended from construction lighting in the bulkhead of the gutted, one-elevator, one-toilet building to minimize the usual disconnect between the gathering of information (at the site) and input and assembly of the information into a scalable drawing format (usually in our office in Midtown).

The building was measured around its base in plan and compared with Sanborn Maps and other official descriptions of the building. Elevations and individual stones were measured wherever access could be obtained from scaffolding or from the exterior platforms (*Figure 3*). Existing exterior elevator landing platforms were used at each floor to measure each course of stones from the base up to the 23rd floor.

A digital camera mounted on a swivel head on a telescoping pole of 10 to 20 feet long was used in the self-timer mode to take photographs of difficult-to-reach locations to assist in the production of drawings. Photographs of details, taken perpendicular to the façade, were inserted into CAD and traced into the drawing. Information was input in the office and on laptop computers in the field.

The purpose of the base drawings was to accurately indicate each building unit, such as each stone, within the façade. Stones were not drawn so accurately that they could be manufactured from our drawings, though, as fabrication shop drawings would be produced by the terra cotta manufacturer, stone contractor, and manufacturer after the scope of work was known. Each stone joint was drawn with a dominant pen thickness and details were indicated on stones in a thin line thickness to help clarify different stones where appropriate.



Above: Figure 4 – Roof measurements obtained with use of a pole and plumb-bob.

Figure 3 – Accurate façade elevation drawings were created that depicted every stone.

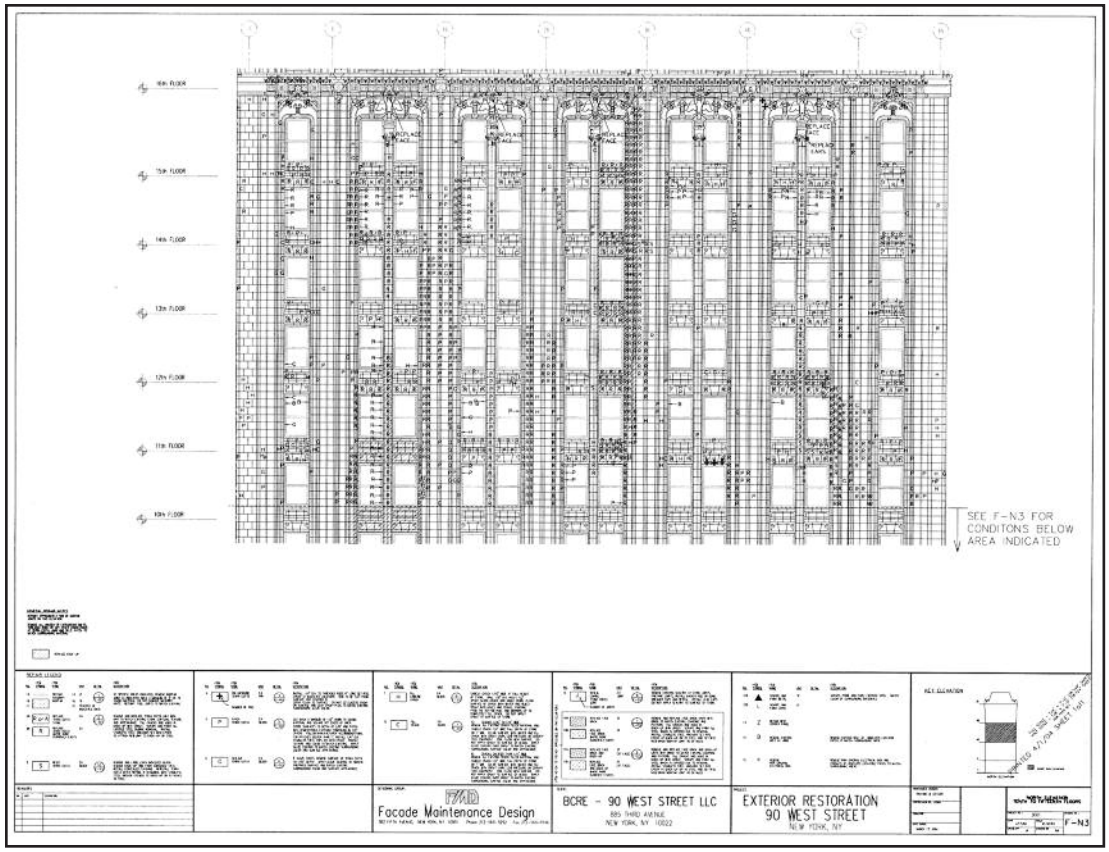


Figure 5 – Typical elevations with noted repairs.

Innovation was needed to measure the mansard roof, as the roofs are trapezoidal in elevation and access was difficult because of obstruction and tight angles. After measuring the top and bottom and length along the angled roof, we needed to determine the horizontal distance from the top edge to the bottom edge to draw the roof in plan. To do this, we used a telescoping pole with attached level (*Figure 4*). A plumb-bob was hung through a hook at the end of the pole, which was held horizontally through the balustrade at the top of the mansard. A person located at the bottom of the mansard guided the pole and plumb-bob to the intersection of the flat roof at the bottom of the mansard. A mark was placed on the pole and the string of the plumb-bob at the top edge of the mansard and the pole was brought back to the upper roof, where the pole was measured (horizontal distance of the mansard in plan) and the length of string from the pole to the plumb bob was also measured (vertical distance in elevation).

The accurate drawings proved especially useful to document areas of the façade that were completely missing (*Figure 5*).

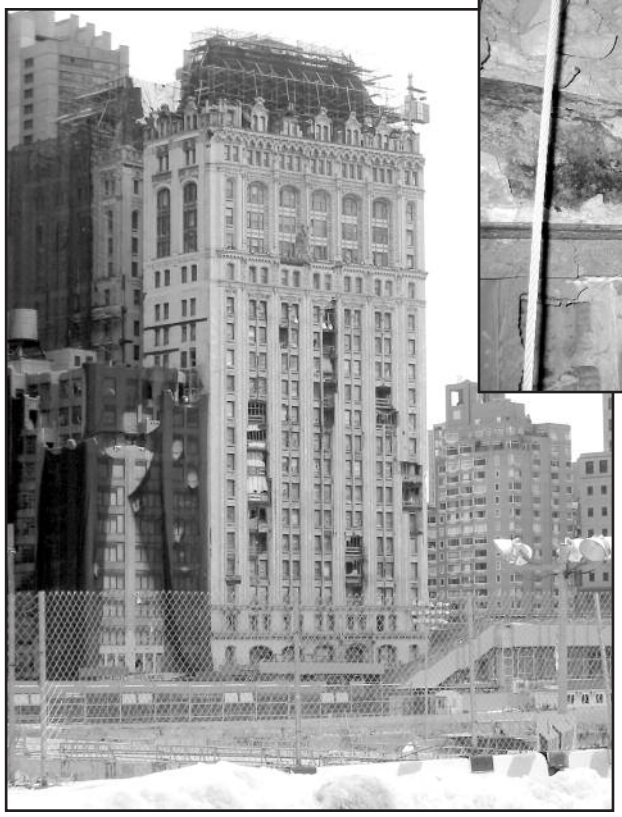


Figure 6 – North façade – as the building looked after initial cleaning, removal of loose materials, and before the mast-climbing scaffold was installed.

Façade Cleaning and Access

The brick was cleaned with "Light Duty" restoration cleaner (Prosoco) and the terra cotta was cleaned with Lemon Joy dishwashing liquid and warm water. Loose and unsafe areas of the façade needed to be removed and shored up before work could begin (*Figures 6* and *7*). Access to the façade was gained through an elaborate assortment of pipe scaffolding, swing scaffolding, and mast climbers.

Façade

The majority of the façade is of ornamental, hand-pressed terra cotta with brick back-up. The north elevations sustained the most severe deterioration from impact and from fire. The façade was completely missing at several locations, due mostly to impact (*Figure 7*).

Figure 7 – North façade – impact damage crushes terra cotta, bends, and nearly shears through a steel spandrel beam.

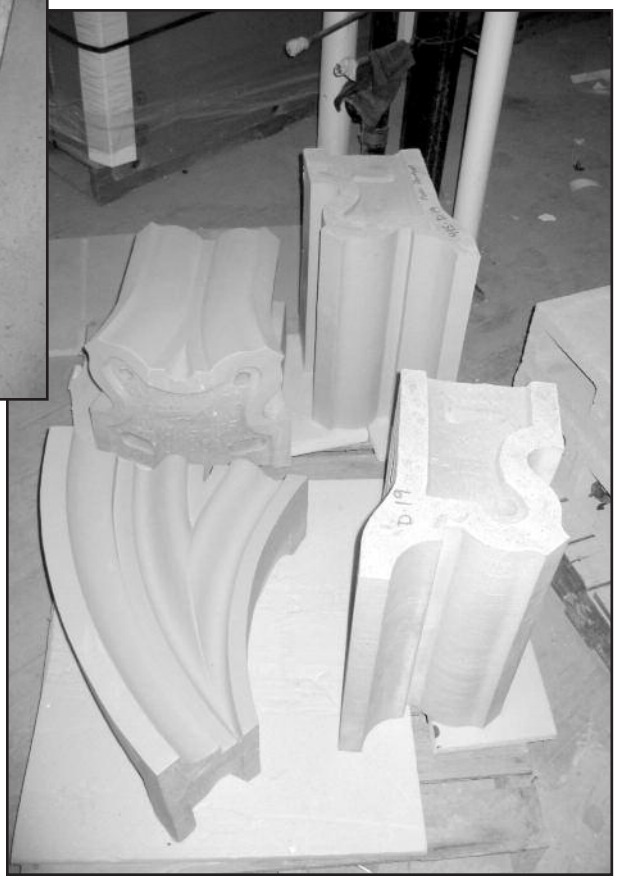
Figure 8 – North elevation – sounding of terra cotta with "sounding ball."

Figures 9A and 9B – New terra cotta was manufactured by extrusion and hand pressing.

Fire damage originated from both the interior and exterior at all elevations.

The existing pipe scaffold provided more than an arm's-length distance from the façade, which was not close enough to perform a thorough evaluation of the terra cotta. A "sounding ball" attached to a telescoping pole was designed and used by FMD to evaluate each stone (*Figure 8*).

- The owners proactively began purchasing replacement terra cotta from Boston Valley Terra Cotta as soon as Seaboard was brought on board as the exterior CM/masonry contractor and before the scope of work was completely defined.
- The large quantity of terra cotta replacement permitted many of the new pieces to be extruded, with the remainder being either hand-pressed or hand-sculpted by Boston Valley Terra Cotta. In all, 7,853 pieces of terra cotta were replaced.
- A simply designed CMU back-up wall allowed the early closing in of the gaping holes and installation of new windows before the terra cotta was installed. Seaboard expeditiously installed as much of the window-surrounding terra cotta as possible before the windows were installed.
- A total of 80,000 bricks were custom manufactured by Belden Brick to match the existing courtyard face brick. The bricks were a special 8.25-inch length and special buff brick color (*Figure 9*).



Terra Cotta Glaze Restoration

Damaged areas of terra cotta glaze were being ground down to sound bisque. The perimeter of the affected area was feathered into the original glaze surface using a cup grinder.

Bisque Repair

Deep spalled areas, greater than 1/8-inch depth, were prepared and patched with Custom System 45 Terra Cotta Patch by Edison Coatings. Thinfill 55 by Edison Coatings was applied over prepared glaze spalls, as well as over patched areas, to make the surface uniformly smooth.

Glaze Restoration

A significant portion of the value of historic terra cotta is its glazed surface, so as much original glaze as possible was retained. Plans specified reglazing of the least portion of the stone as possible, with reglazing

Figure 9C – The courtyard during the cleaning.

Figure 9D – Brick spalls due to heat of fire in the courtyard.

of an entire unit only if over 75% of its area had been damaged.

Color Matching

The terra cotta façades are of several shades, which create the appearance of a single color. Matching the shade of a portion of glaze with a matching repair glaze was tricky; it required both a scientific approach and an artistic applicator to be most effective. Four shades, which represent the range of original glaze shades, were established for the building. Edison Coatings produced custom colors for each of these shades, along with additional colored materials so that the contractor could tweak the colors as necessary on the scaffolding. The contractor compared a template swatch of the premixed colors and compared it to the existing glaze. In most cases, one of the premixed colors was acceptably close to the existing terra cotta so as not to need additional color mixing. Most often, two premixed colors were mixed together to achieve the desired shade. Rarely was additional tinting necessary. This process provided fast (which the contractor liked) and accurate color (which the architects and engineers liked) matching.

Reglazing

Aquathane UA-210 NCL – Custom Glaze by Edison Coatings was applied to replicate glossy glaze surfaces and Elasto Wall 351 – Custom Glaze Replication was applied to

Figure 10 – New and existing terra cotta stones at screen walls.

Figure 11 – North elevation – completed restoration of devastated area at top of north elevation.

Figure 12 – Completed restoration at north and west elevations.

replicate the matte glaze surfaces. Both the Aquathane and Elasto Wall are breathable, to allow moisture present within the masonry wall to escape without disadhering the coating from the surface.

These products were applied to the surface using a brush and extended 1/4-inch over the top of the existing surrounding glaze. Brown or black coating was applied over the dried coating to replicate the iron oxide speckles present within the original glaze, by flicking the bristles or tapping a brush over a stick.

Mansard Roof

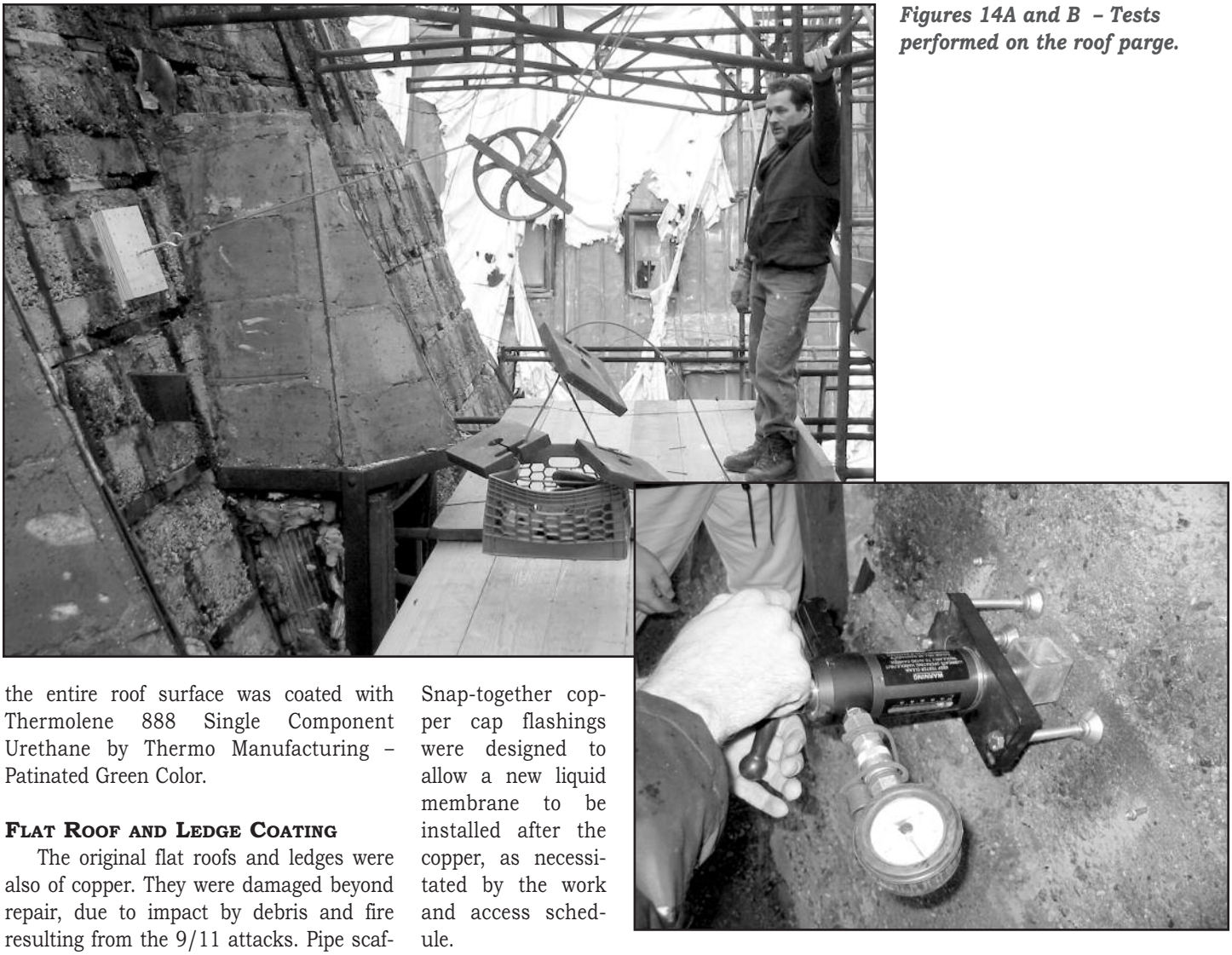
The original copper mansard roof and stamped copper balustrade had been repaired and coated with various sheet and liquid membranes numerous times prior to 9/11. Fire burned the coatings, deformed the copper, burned the underlying wood nailers, and exposed previously unseen deterioration of the roof's attachment (*Figures 13A* and *B* and *16A* and *B*).

- The copper mansard was removed down to its cinder fill substrate, and new batten-seamed copper was laboriously installed by Eagle One Roofing to match the original roof (*Figures 15* and *16*).
- The entire balustrade was replaced with custom fiberglass panels by Seal Fiberglass (*Figures 15A* and *B*).
- The 23rd floor dormers were replaced with copper, while the 21st and 22nd floor dormers were repaired with copper wherever necessary.

Roof Dormer Coating

The original mansard roof and dormers of 90 West Street were of copper and coated over for decades. Most of the coated copper roof was damaged beyond repair due to impact by debris and fire as a result of the attacks on 9/11 and subsequent damage from water. Several of the existing dormer walls were in good condition and were restored by simply recoating them. The existing coated surfaces were power-washed, perimeter flashed with Thermolastic T-60 Acrylic Flashing Compound by Thermo Manufacturing, and

Figures 13A and 13B – Mansard roof – copper sheets melted and wood nailers burned from fire.

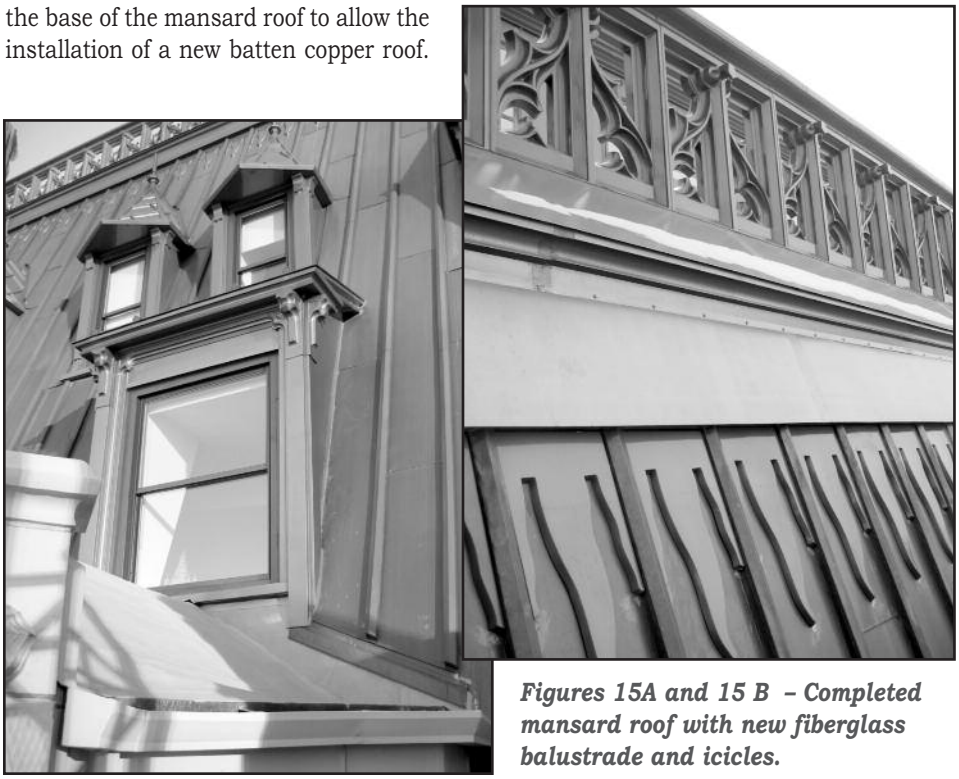


Figures 14A and B – Tests performed on the roof parge.

the entire roof surface was coated with Thermolene 888 Single Component Urethane by Thermo Manufacturing – Patinated Green Color.

Flat Roof and Ledge Coating

The original flat roofs and ledges were also of copper. They were damaged beyond repair, due to impact by debris and fire resulting from the 9/11 attacks. Pipe scaffolding was located on the flat roofs at the base of the mansard roof to allow the installation of a new batten copper roof. Snap-together copper cap flashings were designed to allow a new liquid membrane to be installed after the copper, as necessitated by the work and access schedule.



Figures 15A and 15 B – Completed mansard roof with new fiberglass balustrade and icicles.

The existing metal roof membranes were removed down to the parged concrete deck, which was patched to create a smooth, suitable substrate. Kemperol by Kemper System was applied over the substrate. The surface was primed and a polyester, fleece-reinforced, monolithic liquid membrane was applied over it. Urethane paint, which matched the color of the surrounding terra cotta, was applied over the Kemper System. A 20-year Premium NDL Warranty was obtained.

Granite Base

Eighty percent of the north elevation granite base needed to be removed due to excessive impact and fire damage (*Figures 17A, 17B, 18,* and *19*). New ornamental stone was expertly cut and carved in Canada and Italy (*Figure 20*).

An innovative, steel-framed panel system was employed to replace the heavily damaged granite base at the north elevation. This panel system met aesthetic (*Figure 22*) requirements, as it provided the

Figures 16A and B – West mansard roof before and after restoration.

installation of both new and original stone, a first on such a large scale. A galvanized, welded steel tube skeleton was constructed of 3-in x 4-in tubes that new and existing veneer stones were attached to with stainless steel threaded anchors. New stone was cut approximately 3-in thick in a "hooker" pattern, which replicated the original stone configuration without additional joints as commonly seen on new panel systems (*Figures 19, 21, 23,* and *24*).

An integral stainless steel gutter and weeping system was incorporated into the panels. Panels were typically 6-ft wide by 8-ft high, with the largest being 10-ft high by 16-ft wide. The skeleton and attached stone panels

Figures 17A and 17B – North granite base – fire and impact damage rendered much of the north base unrestoreable.

were fabricated in Utah and shipped to the site on a flatbed truck.

OTHER FACTS AND ANECDOTES

- Unusual combinations of impact and fire damage were major sources of much of the damage to the building.
- Damaged areas were viewed as opportunities to learn more about the building's construction and condition.
- The design team needed to wear respirators while on site and often walked the 25 flights of stairs several times a day.
- Materials that were removed or stored for the building's restoration prior to 9/11 needed to be located and evaluated. Though there were clues of a removed griffin, it wasn't until the end of

Figure 18 – Much of the north sidewalk, which supported the granite, was missing.

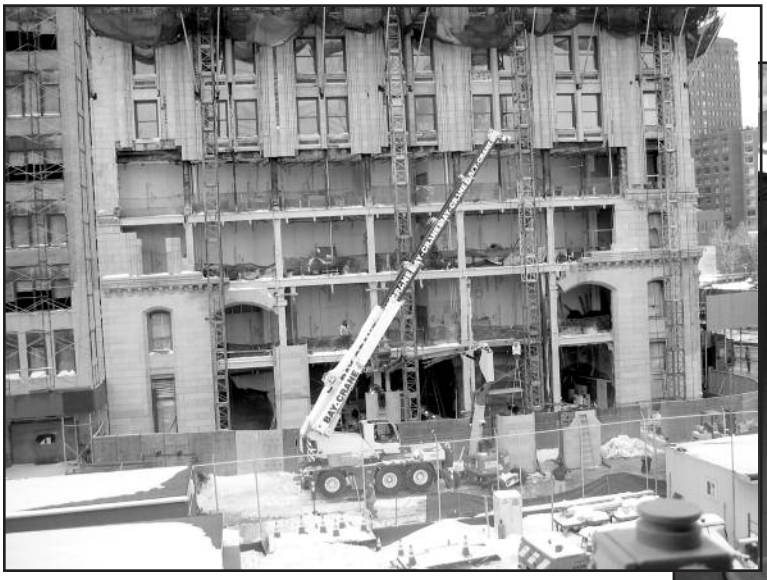


Figure 19 – North base – most of the north façade granite was completely removed.

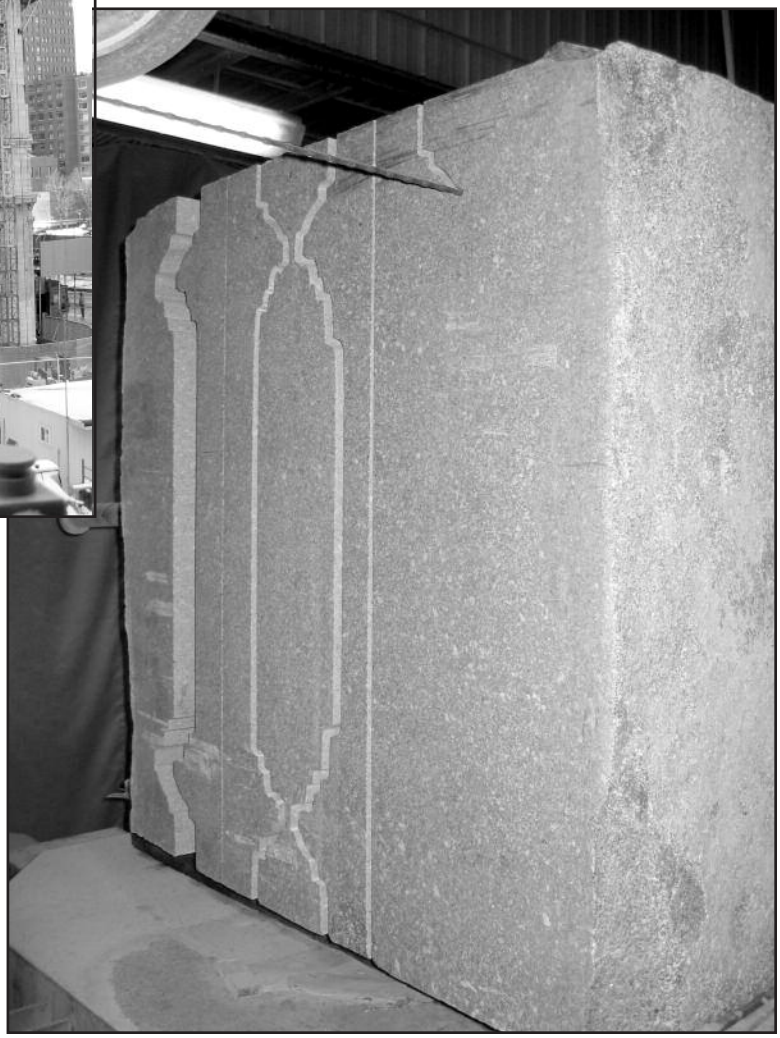


Figure 20 – New granite was custom cut in Canada by computer-guided saws.

the project that the design team learned of its location, and it is now a significant addition to the lobby.

- North scaffolding (now removed) was adorned with artwork created by comedian Yakoff Smirnoff.
- Remnants of liquor bottles were found in wall cavities and were incorporated, along with a horseshoe, in the roof parging. It is believed by some that the horseshoe provided a source of luck for the building.
- Aluminum, double-hung windows were replaced with new, aluminum, double-hung windows that matched the existing windows, which were damaged by heat, impact, and soot.
- Loose portions of the massive granite were removed and the stones left in place when the remaining stones were structurally sound. This minimized residual damage through the restoration process and serves as an indication of the historic degree of damage inflicted on the building.

Figure 21 – Existing and new granite bracket during fabrication.

Figures 22A and 22B – New steel tube panels with stone facing installation.

EXPERIENCE GAINED

- Development of a clear repair criteria and legend established before the survey began provided a straightforward, consistent, and efficient use of survey time and a tool to focus on solutions.
- The transfer of written field notes to CAD drawings was tedious and created a time lapse of several days before the evolving scope of work could be evaluated and distributed to other team members. We now use tablet computers to input repair symbols directly into CAD, eliminating the need for double entry. This method also allows the evaluation and indication of alternate repairs on the construction documents in the field.
- The development of special tools, such as the sounding ball and plumb-bob stick, proved to be great time-savers.
- Including contractors and owner's representatives in the evaluation and repair methods proved to be a liberating and effective method to

obtain materials, develop realistic repairs, and minimize the production of unnecessary documents.

- The owner's willingness to bring qualified contractors onto the project before construction documents were complete contributed greatly to producing a common goal that was necessary to achieve the needed scope of the work in the required time.
- The need to complete the project on time produced a higher quality restoration than typical. The use of replacement materials that matched the historic materials (copper, terra cotta, granite) was often made before receiving the Landmarks Commission's blessing on the scope of work and repairs, because the firm was confident it would obtain approval for the materials.
- The easy transfer of electronic drawings and photographs helped to communicate efficiently to and from the team at the site and with contractors and manufacturers around the world. The ability to have this information in hand (electronically) at all times was also helpful.

Figure 23 – Granite panel hoisted from flatbed truck.

Figure 24 – Completed project – northwest corner, December 2005. Completed north entrance arch where approximately 50% of the original granite was reinstalled after being refitted onto the new panels.

Figure 26 – Completed project as viewed across the World Trade Center site from The Woolworth Building, December 2005.

Below: Figure 25 – Close-up of Figure 26.

CONCLUSION

All involved in the restoration of 90 West Street feel an enormous sense of pride and gratitude for having had the opportunity to contribute their collective talents to answer the needs of this devastated landmark. A building rich with architectural history, and severely scarred by the events of 9/11, 90 West contributes to the quality of life downtown, and is now a building that hundreds of people call home.