

POST-9/11 RESTORATION OF THE EXTERIOR OF 90 WEST STREET, NYC

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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 (FMD) 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.

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 on 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 that permitted the project to move aggressively 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 were used and new technology implemented wherever appropriate. A novel, steel-framed panel system was used to repair the heavily damaged granite base with new and original materials.

HISTORIC OVERVIEW

The building (*Figure 1*), commonly called the “Little Woolworth,” was designed by famed architect Cass Gilbert between 1905 and 1907 as a precursor to the Woolworth Building. Originally known as the “West Street Building,” 90 West Street was highly regarded as a fine example of turn-of-the-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 consists of terra cotta with polychrome terra cotta as it gets closer to the top, and then it is topped off with a copper mansard roof. The back (eastern façade and courtyard) is of brick with terra cotta ornamentation.

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

Landmark Status

The building was designated as a New York City landmark in 1998 and was listed on the National Register of Historic Places while in a state of disrepair following the attacks of 9/11.



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

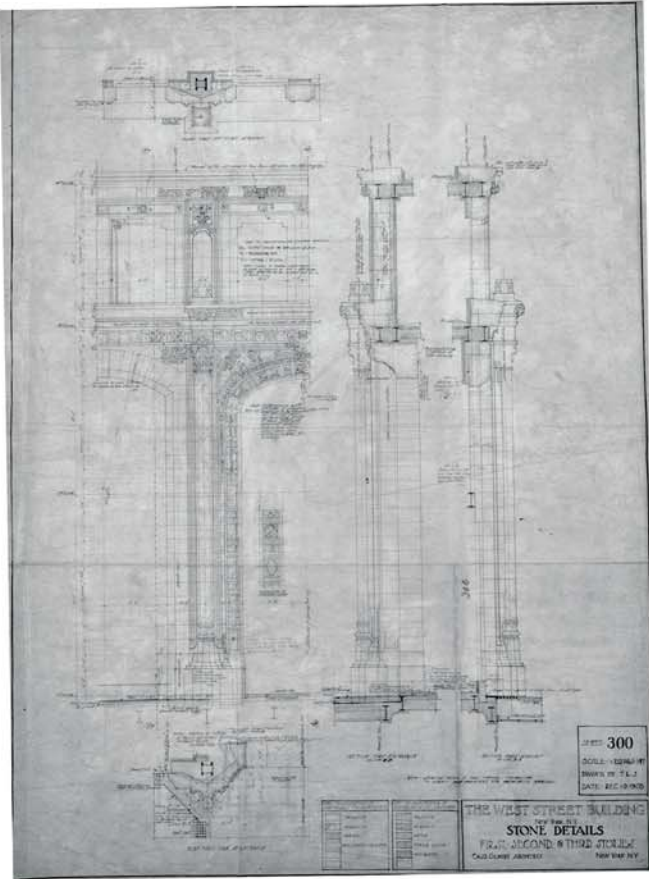


Figure 2 – North base façade – original drawing from NYHS.

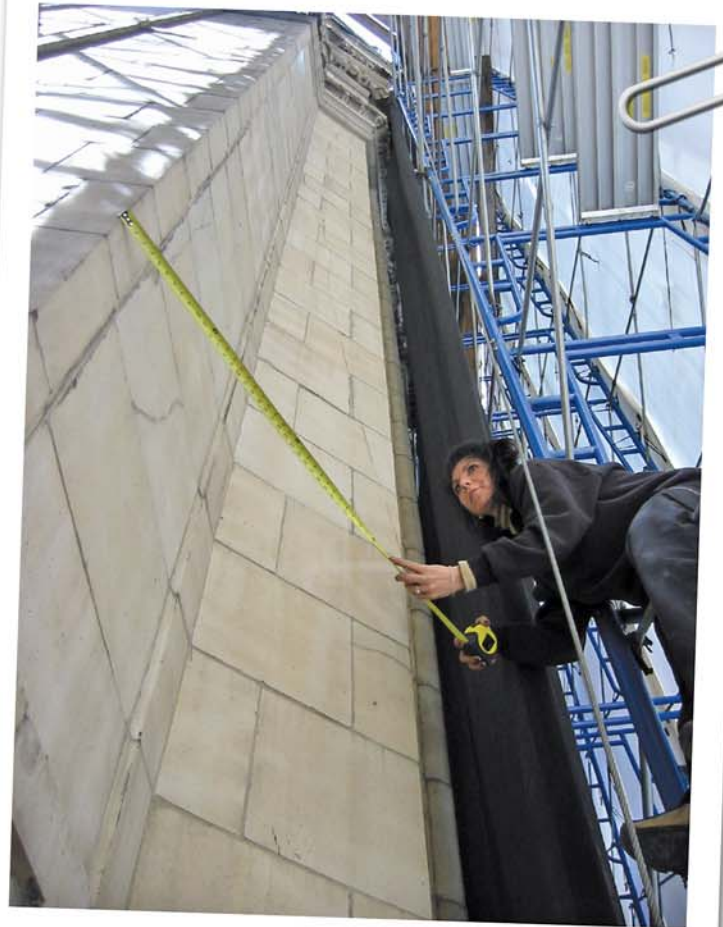


Figure 3 – Accurate façade elevation drawings depicting every stone were created.

Post-September 11, 2001, Restoration

At the beginning of 2003, FMD 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. Concurrent with 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 FMD's responsibility to analyze the deterioration and damage and to indicate how and where repairs were to be performed. Accurate drawings of the

façade and roofs had to be produced to communicate and quantify the repairs to the other team members.

Historic drawing sources were identified and evaluated for their accuracy. These included façade drawings from recent projects to the original drawings and blueprints (Figure 2), which are located in the Cass Gilbert Archive at the New York Historical Society (NYHS). This archive, consisting 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 they could even be opened 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 damage needed to be identified and understood, and unique logistical problems needed to be overcome. Prior to 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 FMD's office in midtown Manhattan).

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

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

Figure 5 – Typical elevations with noted repairs.

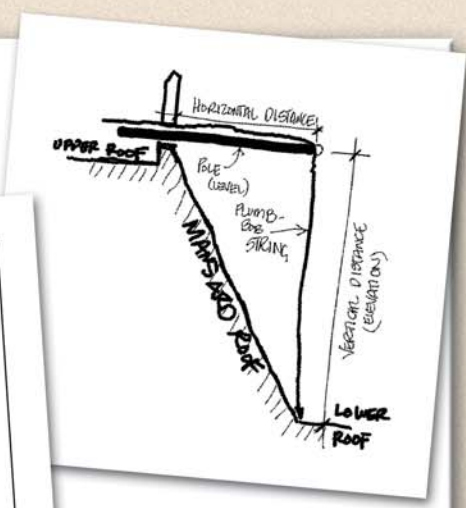
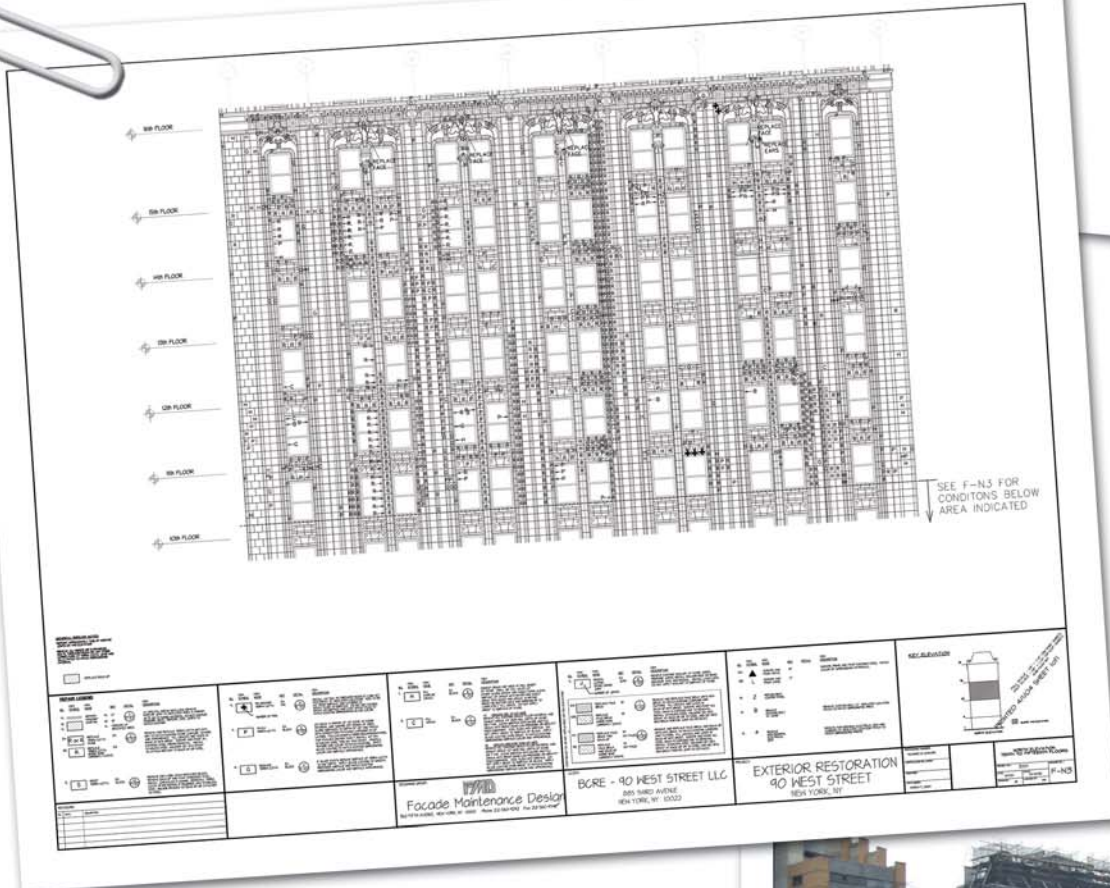


Figure 6 – North façade as the building looked after initial cleaning, after removal of loose materials, and before the mast-climbing scaffold was installed.

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 within the façade, such as each stone. Stones were not drawn so accurately that they could be manufactured from FMD's drawings, though, because 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.

Innovation was required 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, FMD needed to determine the horizontal distance from the top edge to the bottom edge to draw the roof in plan. To do this, a telescoping pole with attached level was used (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



Figure 7 – North façade. Impact damage crushed terra cotta and bent and nearly sheared through a steel spandrel beam.



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. There the pole was measured (horizontal distance of the mansard in the 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).

Façade Cleaning and Access

The brick was cleaned with Light Duty Restoration Cleaner (Prosoco), and the terra cotta was cleaned with Lemon Joy dish-washing 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 and swing scaffolding and mast climbers.

Façade

The majority of the façade is of ornamental, hand-pressed terra cotta with brick backup. The north elevations sustained the most severe deterioration from impact and fire. The façade was completely missing at several locations, due mostly to impact (Figure 7). Fire damage originated from both the interior and exterior at all elevations.

The existing pipe scaffold kept workers more than an arm's length from the façade, which was not close enough to perform a thorough evaluation of the terra cotta. A

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Figure 8 – Mark Anderson sounds terra cotta with a “sounding ball” at the north elevation.

- 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 hand-pressed or hand-sculpted by Boston Valley Terra Cotta. In all, 7,853 pieces were replaced.
- A simply designed CMU backup 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-in length and unique buff color (Figure 9A and 9B).

“sounding ball” attached to a telescoping pole was designed and used by FMD to evaluate each stone (Figure 8).



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



Figure 9C – Courtyard after cleaning, November 2003.



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



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-in deep, 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 of an entire unit only if over 75% of its area had been damaged.

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





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

Color Matching

The terra cotta façades are of several shades, creating 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 took a template swatch of the pre-



Figure 12 – Completed restoration at north and west elevations.



Figures 13A and 13B – Copper sheets on the mansard roof melted, and wood nailers burned from the fire on 9/11.

mixed 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 color matching (which the contractor liked) and accurate color matching (which the architects and engineers liked).



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



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

These products were applied to the surface using a brush and extended one-quarter 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, 13B, 16A, and 16B).

- 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 15A, 15B, 16A, and 16B).
- The entire balustrade was replaced with custom fiberglass panels by Seal Fiberglass (Figures 15A and 15B).
- The 23rd floor dormers were replaced with copper, while the 21st and 22nd floor dormers were repaired with copper wherever necessary.



Figure 15A – Craftsman solders new icicles.



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

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 subse-



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

quent 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, the perimeter was flashed with Thermolastic T-60 Acrylic Flashing Compound by Thermo Manufacturing, and 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 terrorist 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 flash-

ings were designed to allow a new liquid membrane to be installed after the copper, as necessitated by the work and access schedule.



Figures 17A and 17B – Fire and impact damage rendered much of the north granite base unrestorable.

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 Kemperol. 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 installation of both new and original stone, a first on such a large scale. A galvanized, welded steel tube skeleton



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

was constructed of 3-in x 4-in tubes to which new and existing veneer stones were attached by stainless steel threaded anchors. New stone was cut approximately 3 in thick in a “hooker” pattern, which repli-

cated the original stone configuration without additional joints, which are commonly seen on new panel systems (Figures 19, 21, 23, and 24).

An integral stainless steel gutter and weep system was incorporated into the pan-



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



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

Figure 21 – Existing and new granite bracket during fabrication.

els. 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 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 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 stones were removed, and the stones were 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 degree of damage inflicted on the building.



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

Figure 23 – Granite panel hoisted from flatbed truck.



Figure 24 – Completed north entrance arch, December 2005, where approximately 50% of the original granite was reinstalled after being refitted onto the new panels. Compare with Figure 17A.

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. On subsequent projects, tablet computers have been used 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 timesavers.
- Including contractor and owner representatives in the evaluation and repair methods proved to be a liber-



- ating 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 work in the required time.

- The need to complete the project on time produced a higher quality restoration than is typical. The use of replacement materials that matched the historic materials (copper, terra cotta, granite) was often made before receiving the Landmarks Commis-

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




Figure 25 – Close-up of Figure 26.



sion'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.

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. 

Rick Lefever, PE, LEED AP

Richard W. Lefever, PE, LEED AP, principal and president of Façade MD, purchased the firm from its parent firms, DeSimone Consulting Engineers PLC and SBLM Architects, PC, in 1999. Lefever had been general manager of Façade MD since 1988. Under Lefever's guidance, the company has expanded from a New York-centered firm to a regional firm. Lefever has managed façade, structural, and waterproofing restoration and rehabilitation projects for dozens of buildings throughout the eastern half of the U.S. He has provided expert testimony in New York and Florida on masonry restoration and waterproofing. He is a member of the National Trust for Historic Preservation, the Association of Preservation Technology (APT), and the Sealant Waterproofing and Restoration Institute (SWRI), and he is a frequent presenter at various industry technical events. He holds an engineering degree from Lafayette College, has studied architecture at Columbia University, is a graduate of the RESTORE masonry restoration course, and is a LEED AP. Mr. Lefever was the professional of record for the exterior restoration of 90 West Street.



Mark Anderson, AIA



Mark Anderson, AIA, vice president and director of historic preservation for Façade MD, studied architecture at City College of New York (CCNY) and historic preservation in the master's degree program at Columbia University. He has also studied architecture in Italy and historic preservation in Turkey. For nearly 20 years, Mr. Anderson has been an integral part of Façade MD, where he has designed and observed every phase of exterior restoration. He has been the leader of the design team for the restoration of façades such as the

landmarked 90 West Street, Woolworth, McGraw Hill, and Fuller Buildings, as well as the restoration of interior ceilings and stained glass of the landmarked Gould Memorial Library. Anderson is a member of AIA, SWRI, and the Association of Preservation Technology (APTNE).