Philadelphia City Hall

Exterior Envelope Renovation

City Hall from Love Park

By Nan R. Gutterman, AIA and Carl A. Baumert, Jr., P.E.

Philadelphia City Hall is located on William Penn's Centre Square at the intersection of Broad and Market Streets. Designed by John McArthur, Jr., it was constructed over a thirty year period from 1871 to 1901. This National Historic Landmark is an outstanding example of the French Second Empire Architecture. It has seven floors in the classical three stories, an additional two floors in the mansards of the four center pavilions, a full basement, and a partial sub-basement. With an area of over 1,000,000 square feet and about 700 rooms, it is the largest masonry bearing wall building and largest municipal building in the world. Intended to be the tallest building, it was eclipsed by the Washington Monument and the Eiffel Tower before completion.

Plan dimensions are 484 feet north-south by 470 feet east-west, with an interior courtyard 200- by 220-feet, and two light wells 49- by 66-feet over the original boiler rooms. The masonry part of the tower rises to 337 feet above grade, with wrought iron framing and cast iron cladding to 511 feet, all topped with a 37 foot tall, 27 ton bronze statue of William Penn. The top of the hat at 548 feet above the street was for many years the unofficial cap for buildings in the downtown area.

Northern Part of West Elevation

Exterior masonry is East Blue Hill and Concord granite in the areaways and up to the Second Floor. From that level to the top of the masonry part of the tower at +337, the stone is Lee Massachusetts marble, except for granite brackets that support the Twelfth Floor balconies of the tower. Berea sandstone and polished granites were used in the four corner stair towers and three of the four portals. Lightwells are glazed brick and hummelstone. The facades, portals, and tower are richly embellished with a remarkable array of monumental marble and bronze sculptures, and ornamental motifs designed and executed under the direction of the renowned sculptor Alexander Milne Calder.

Mansards throughout are faced with slate and ornamented cast iron cresting, cornices, entablature, and hip covers, Dormers are variously marble, cast iron, or copper clad, depending on location. Gutters are cast iron troughs, lined and faced with lead coated copper.

Window sash and frames are mahogany. Etched glass is found in the corner stair towers. Flat roofs were covered with a built-up membrane and slag topping. Suspended cast iron ceilings remain in the four portals, "apse" shape behind the tower in the courtyard, and in the Council Caucus Room.

Granite stairs cantilevered from the octagon walls rise from the basement to the Sixth Floor in each of the four corner pavilions. There is an opening at every floor landing to a metal trash chute, and full height iron ladders in two opposite corners behind the finished walls.

Original passenger and freight elevators, as well as one in the tower, were hydraulic with pumps in the boiler rooms and in a pump room in the courtyard. All were changed to electric and later upgraded.

The original illumination was gas, and many gas pipes and wall escutcheons remain. With the advent of electric power, a change was made to direct current generated on site in a dynamo room and its boiler room under the Courtyard. Five years were required to chase the

brick walls for conduits of the distribution system. Brass plates for gas stops and electrical are still seen in floors and walls.

When built in 1907, the Market Street subway and subway-surface trolleys went around City Hall. Many sections of the tunnels remain in use as a trolley tunnel and pedestrian concourses, others are vacant. The east and west center pavilions were underpinned in 1929-1934 to realign the subway directly through the courtyard.

Underpinning of the southwest quadrant of City Hall in 1915-20 was a major engineering feat quite well reported in the Engineering News and the Engineering Record (then separate publications). Four tracks and platforms of the Broad Street subway were constructed around and through the underpinning under the building and are in use today. Planning for upgrading this station is underway.

City Hall was very well constructed with high quality materials, whose care and quality are still evident over 100 years later.

Structure

Exterior walls of the building and tower are stone and brick backup of varying thicknesses. Each quadrant of the tower at street level is 22 feet thick from the outside to the inner space, where four polished granite columns support Conversation Hall above.

Interior bearing walls between rooms are usually 17-inch brick finished with plaster and a glazed tile wainscot. Corridor bearing walls are 20-inches or more, with built-in flues serving every room from the basement. Pavilion bearing walls may be as much as 64-inch brick with flues.

Records indicate that 88,000,000 red bricks and 300,000 pressed or glazed bricks were used in the construction of the building.

Floors and roof decks are typically brick vaults and integral wrought iron beams. Fill above the brick arch varies from sand-lime to cinder or stone concrete, and finish below is painted plaster with beads along the beam flange. Floor beams usually span across the corridor, and parallel to the corridor in the rooms. At the roof deck, the beams span across the corridor and then to the outside walls, with a rolled wrought iron beam parallel to the corridor underneath at midspan.

Spacing of the floor beams is usually 3 feet-9 inch to 4 feet-5 inch centers; roof beams may be up to 5 feet-6 inch centers. Depths of I-beams shown on reproduced framing plans may be 7-, 8-, 9- 10½- or 12-inches; we have found many roof beams to be 9 inches. Flange widths vary with weight, as would be expected, but also with the rolling mill.

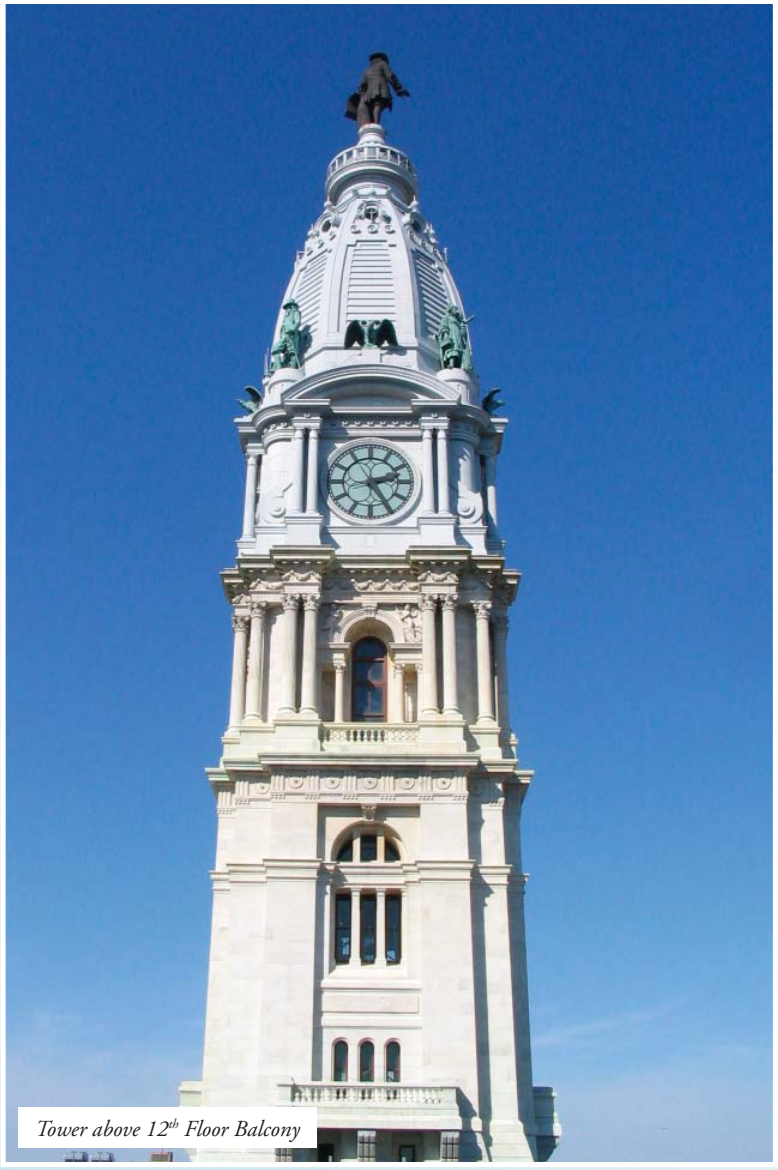
All beams were taken to be wrought iron, although roll marks on many of them show Phoenix or Trenton, both of which were in the forefront of the transition from iron to steel. Alterations over the years indicate that the metal could be welded successfully.

Larger spaces, such as courtrooms and council chambers, were spanned by built-up plate girders or trussed girders, mostly 48 inches deep, with cover plates and web stiffeners. In other places, eye-bar trusses were used, with the floor systems supported on the top and bottom chords. The deepest trusses are 21 feet-6 inches in the wings of the center pavilions. Eye bar trusses in the center pavilions support the roof system and the tall mansards.

There are 106 round or square cast iron columns in the First Floor, supporting double or triple 15-inch I-beams with bearing walls above. A few more cast iron columns were found in other places in the building.

Rafters at the curved mansards were rolled to conform to the shape, supporting horizontal tees for the slate on the outside and metal lath for plaster at the upper part inside. Cast iron brackets bolted to rafters and roof beams carry the cast iron enclosing plates of the cornice, entablature, and hip covers.

Tall mansard rafters at the center and corner pavilions are straight along the slope, bent to vertical at the top. Trussing and diagonals



Tower above 12th Floor Balcony

in the sides provide bracing, and trusses diagonally across brace the upper part and support the roof and flagpole. In addition, there are diagonal members within the center pavilions from the base to the upper truss level.

In the tower, brick bearing walls, with vertical shafts and flues, diminish in thickness as they rise to 337 feet above the courtyard. There are four Gray columns (eight angles and bent plates) from the Seventh Floor to the top of framing around the elevator and stair at 484 feet above the Courtyard. In the masonry part, the columns support built-up plate girders, alternately north-south and east-west, and the brick vault floors.

The upper part has eight principal columns rising from box girders at the corners anchored deep into the masonry. Additional framing forms the shape of the tower and supports the cladding. The 1894 ASCE Transactions describes the design and framing in great detail.

Conversation Hall originally was full height from the Second Floor to the underside of the Seventh Floor. However, alarming cracks appeared in the walls of the tower in 1894, leading to complete infill of some Second Floor rooms with brick masonry and the introduction of a floor system at the Fourth Floor, extending into the North Center Pavilion.

The foundation of the tower is poured concrete, 100 feet square by 9 feet thick, with its bottom about 24 feet below the courtyard.

Other foundations, where seen, are rubble stone, with brick walls beginning about 2 feet-8 inches below the basement floor.

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The subbasement under the basement corridors was originally the return air system from flues in the walls from all rooms to the four chimneys flanking the east and west portals in the courtyard.

Previous Work

Interior work and upgrading of elevators was done in the 1950's and exterior work into the 1960's. Slate was replaced on all mansards, flashings and gutter liners replaced, and roofing installed. At least some cleaning of the façade occurred at that time. A remnant of an orange colored epoxy, smeared across cracks, is thought to date from that time.

Concrete encased steel beams were added under broken architraves at the East Center Pavilion, South Center Pavilion, and west curtain of the north elevation (date unknown). Concrete replacements of marble have been found at the west curtain of the south elevation.

Owner
City of Philadelphia
Capital Program Office
Owner's Representative
CB Development Services Inc., Phila, PA
Design Team
Architect of Record
VITETTA in Association with Kelly/Maiello, Inc., Phila, PA
Masonry Restoration
VITETTA, Phila, PA
Cast Iron Restoration
Marianna Thomas Architects, Phila. PA
Window & Roof Restoration
Kelly/Maiello, Inc. Phila, PA
Sculpture Conservator
Norton Art Conservation, Lafayette Hill, PA
Structural Engineer
Keast & Hood Co., Phila, PA
MEP Engineer
Vinokur Pace Engineering Services, Inc., Jenkintown, PA
Construction Manager
Daniel J. Keating, Co., Narberth, PA
Masonry Contractor
Lepore - Mark, Conshohocken, PA
Cast Iron Contractor
Crescent Iron Works, Phila, PA
Mech/Plumbing
JJ Bee, Phila, PA (Phases 1 and 3)
Devine Bros., Inc., Havertown, PA (Phase 2)
Roofing Contractor
Hamada Roofing, Inc., Phila, PA
Painting Contractor
Avalotis Painting, Collingdale, PA
Scaffolding Contractor
Eastern Scaffolding & Shoring, Inc., Phila, PA

Conversation Hall was restored in 1982 for the 300th Anniversary of the founding of Philadelphia by William Penn.

Repairs to the exterior were done in 1984-85. Cross pins were installed across cracks in architraves and soffits, mostly on the north and west elevations. Patched injection ports were noted at some cracks. Beams were installed above the Fourth and Sixth Floors of the West Center Pavilion, with hanger rods in drilled holes to plates recessed into the soffit of the broken architraves.

Rehabilitation of the upper tower and cladding (+337 to + 511) was done 1985-90. A structural condition assessment and stability analysis of the William Penn statue was done in 1987, conservation of the outside in 1987-88, and retreated in 1997.

Historic Structure Report

Work by the present design team began in 1992 with a comprehensive survey of the interior and exterior of the building, resulting in a multi-volume Historic Structure Report. This was utilized by the City as a planning tool and triggered further studies and reports.

- Categorization of marble and granite.
- Tests and cleaning methods for marble and granite.
- Tests of methods for removal of paint and rust from ornamental cast iron pieces.
- Exploration of flat roofing and substrates.
- Study of window sash and frames and related air conditioner installations.
- Evaluation of cast iron columns.
- Exploration of subbasement spaces and tunnels.
- Evaluation of roof framing of the pump room under the courtyard at the South Portal.
- Evaluation of corroded beams in "apse" basement.
- Study of cracks in bearing walls below the North Center Pavilion.

Demonstration Projects

Demonstration projects were conducted in 1994-95 to establish techniques and standards for the rehabilitation of the various components of the major projects to follow.

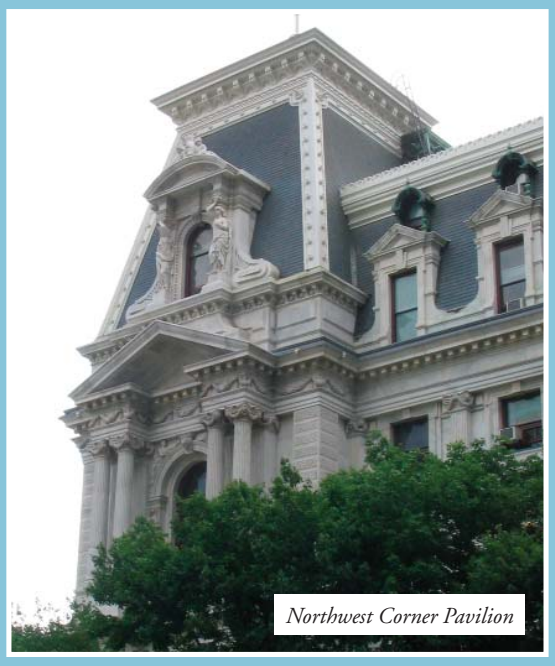
- Northeast Corner Pavilion- Restoration and conservation of the cantilevered granite stair; polished granite wainscot, sandstone walls, bronze handrails, light fixtures, and plaster ceiling.
- East Center Pavilion- Cleaning and repair of marble on the street side; cleaning, repair, and painting of ornamental cast iron; restoration of windows; replacement of flat and tall mansard roofs; repair and relining of gutters.
- Restoration of Caucus Room chandelier.
- Sixth Floor gutters around the outside of the building.
- Beginning sprinkler piping installation.

Exterior Envelope Renovation

This project was authorized in 1998. It was to include rehabilitation of exterior masonry, stone sculptures and carvings, ornamental cast iron, windows and air conditioners, roofing and flashings.

Surveys were performed by team members from inside, with binoculars from the ground and roofs, and from high reach machines up to 170 feet above grade.

Documentation of existing conditions and remedial work was executed on reproduced plans and elevations obtained from the City Archives and plan files at the Department of Public Property. Key plans and elevations and site utilization plans were followed by drawings in sections dealing with masonry, cast iron, roofing, windows,



Northwest Corner Pavilion

mechanical/electrical, and air conditioners. The scope of work was established by the design team and representatives of the City. Specifications were prepared in the Masterspec format.

The initial phase included sequentially the north side of the courtyard, street side of the northeast quadrant, associated areaways, the tower and apse from the ground to the top of masonry, and the North Center Pavilion. The Extended Scope continued to the north face of the Northwest Corner Pavilion.

Phase 2 included the west face of the Northwest Corner Pavilion, north curtain, north wing, and the West Center Pavilion, with an accepted alternate for the south wing and south curtain. Phases 3, 4 and 5 from the Southwest Corner Pavilion around to the East Center Pavilion have been documented as one Phase 3, separated as parts A, B and C. Phase 6 will cover the south side of the courtyard and, possibly, the two light wells.

West Center Pavilion, Tower Beyond

Phases 1 and 2 have been completed and work is underway on Phase 3, beginning at the Southwest Corner Pavilion. The goal of the rehabilitation is to add 50 years of serviceability with ordinary maintenance.

Construction

Basic methods and details for rehabilitation of the components were developed with testing in the demonstration projects, and were further developed and refined in the current projects.

Scaffolding

- The building structure and surrounding pavement were evaluated by the design team and permissible imposed loadings shown on the contract documents. Reinforcement of roof framing at the apse and North Center Pavilion was designed and installed to support the tower scaffolding. Criteria for the scaffolding were established by the design team. The engineering and design was done by the scaffold contractor's engineer.
- Push-pull ties were to be anchored to ashlar masonry; ties to sculptures and carved elements were prohibited. Joints were too thin for drop-in anchors, so recessed threaded inserts in the body of the stones were noted. The contractor proposed the use of self-threading double helix bolts which were successfully installed, removed, and the holes patched. Bearing on projecting elements was also prohibited, and the contractor framed around them. The contractor devised a support system for scaffolding above the Twelfth Floor balconies, since they could not sustain the load.
- Heavy duty laminated scaffold plank was specified for the potential load of large stones and large panels of cast iron. Pipe frame scaffolding was used on the elevations and around center and corner pavilions up to 200 feet above the ground. Walking planks were on most levels of the pipe frame scaffolding.
- Systems scaffolding was used at the tower, from the courtyard and roofs to the top of masonry at 337 feet above grade. Integral stair towers and material hoists provided access and service to all levels. Ten levels of systems scaffolding were planked at any given time and moved as the work progressed.

Masonry

- Existing conditions recorded during the initial survey and remedial work was shown on the contract drawings. The scope was verified after cleaning and additional work was shown on field sketches by the architect and the engineer, and then reviewed again for the punch list.
- Workmen who will apply the proprietary patching mortar must have received training and a certificate from the manufacturer of the product. All workmen must demonstrate proficiency in methods to be used for a given task (cutting joints, pointing, tooling, cleaning) to the satisfaction of the Architect before being accepted for work on the building.
- Cleaning was accomplished by misting in areas of heavy carbon or gypsum build-up, and a low-pressure micro-abrasive using crushed dolomite on the marble and crushed glass on the granite.
- Stone facing below the Second Floor is East Blue Hill and Concord granite. Runoff from the marble above and some wicking and splash from the pavement below resulted in scaling (delamination) of the surface. Stones were sounded and then tooled with pneumatic chisels to achieve a sound surface and to replicate the original tooling of the stone.

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Courtyard, South Portal, Lightwells

- All joints and some cracks in the stone masonry were carefully cut out and repaired with proprietary patching mortar. Because of lack of accessibility to maintain sealant, wash joints in cornices, pediments, and balustrades were pointed flush. Some joints at reentrant corners of cornices and balustrades were left open to permit thermal movement. Where lead joint covers were found on arched and gabled pediments, the joints were cleaned, pointed, sealant installed and the existing or new joint cover installed. Around sculpture bases on the pediments and in joints between masonry and metal flashing, lead wool was caulked into place to allow some movement but to exclude water.
- Brick masonry at the service elevator penthouses was repointed and corroded lintels replaced.
- Ferrous inserts were cored out and the holes filled with patching mortar, as were the holes from the scaffold tie-backs.
- Defunct high voltage bird wires and ceramic posts were removed. If the threaded stud was loose it was removed, but if it was tight it was cut flush with the surface of the masonry. A dab of sealant was applied to the remaining part of the stud on horizontal surfaces.
- Loose pieces of stone were removed or secured with threaded stainless steel pins set in epoxy in drilled holes. Pins were recessed a minimum of ½-inch. The surface hole was filled with patching mortar.
- Some cracks were filled with injection mortar; some were cross-pinned for integrity.
- Small spalls and open veins were tooled to drain. Larger spalls were filled with patching mortar or cut back and a dutchman installed. A few existing dutchmen were reset.
- Large fluted dutchmen were carved in the shop and installed at engaged pilasters on the west side.
- At the Twelfth Floor balconies, a new baluster was modeled from one adjacent and installed on the north side. A broken slab on the east side required removal of the balustrade, raising and securing the stone slab, patching, and replacement of the balustrade.
- A broken and rotated raking cornice stone on the West Center Pavilion was raised and secured in place. A broken pediment at the North Center Pavilion was reinforced with the construction of a brick pier recessed so that it is hidden from below. Other broken pediment stones will be addressed in Phase 3.
- All plant growth was removed from the building in Phases 1 and 2 and an attempt made to treat the roots.

Sculpture

- There are over 250 sculptures and carvings on the exterior of the building and tower. All were designed by Alexander Milne Calder and modeled in plaster before carving or casting. Photographs of the plaster models were available at the Philadelphia Historical Commission.
- The missing knee of a figure on the north side of the tower was modeled from a photograph of the plaster cast using expanded metal lath and patching mortar. A marble dutchman was carved in the shop and installed on the tower.
- Sculptures and carvings were carefully cleaned by misting and low pressure micro-abrasive.
- Stainless steel pins were installed across veins and cracks where deemed necessary for long term integrity. Figures were patched and repaired. Missing small parts, such as fingers and toes, were not replaced.

Cast Iron

- Highly ornamented cast iron panels on the various mansards top the building. Bells, bows, garlands, buttons, and moldings are fastened to the panels with ferrous bolts, many in poor condition. Cresting, cornices, entablatures, and hip covers are made up of panels, often eight feet long, weighing about 500 pounds. The panels are supported on cast iron brackets fastened to the wrought iron mansard rafters. Roof decks and rising walls on the center pavilion mansards, and gutters and cornices on the corner pavilions are cast iron, as are the dormers on the sides of the center pavilions and turrets at the South Center Pavilion.
- Existing conditions observed during the initial survey and anticipated repair were shown in the contract documents. However, many problems were obscured by layers of paint and rust, so the scope of work was verified after cleaning and additional work was shown on field sketches prepared by the contractor and confirmed by the architect.
- Every piece of cast iron was thoroughly cleaned to sound metal with needle guns to remove old lead paint and rust. This was done within enclosures by properly protected workmen. The residue was collected, put in metal drums, and treated as hazardous waste. Surfaces were immediately primed to prevent rust bloom.
- Sound pieces of cast iron could remain in place, renewing fasteners with stainless steel. Fasteners of ornamental pieces applied to enclosing plates were also replaced with stainless steel.
- Minor repairs and reinforcement with stainless steel bars and plates was done at the site. Small holes were filled with epoxy and a stainless steel screen.
- Inspection and repair/replacement of the iron supporting brackets and structure was accomplished when enclosing plates were removed. Corroded or broken cast iron brackets were cleaned and primed, and reinforced with stainless steel. Some replacement brackets were fabricated in the shop of stainless steel. Miscellaneous auxiliary supports were fashioned with stainless steel angles and plates.
- Major repairs were accomplished by removing the piece from the building, reinforcement and repair in the shop, and reinstallation on the building. Badly damaged pieces were removed and used as a pattern for oversized models. New molds were then prepared and replacement pieces cast. Fit of the new pieces on the building was very good.

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- Record drawings were prepared by the Contractor for each piece and reviewed by the Architect.
- Joints were caulked and a three coat aliphatic acrylic polyurethane enamel, custom colored coating system was applied to all pieces.

Gutters

- Cast iron trough gutters encircle the building and parts of the courtyard at the Sixth Floor cornice. At the corner pavilions the gutters are on the two exterior faces at the Eighth Floor and around the pyramidal roof at the mansard cornice, while at the center pavilions they are at the Eighth Floor in the courtyard (east and west) and at the Ninth Floor on the street side. There is another gutter around the tower at the top of the masonry, and others in the two light wells.
- The existing lead coated copper lining and fascias were removed. It was found that concrete had been placed in the bottom of the trough in some places, possibly in 1963, to improve the slope to the drains.
- Cast iron sections were cleaned to sound metal, repaired where necessary, and primed. A new lead coated copper lining and fascias were installed with end dams and expansion joints.

Windows

- Large to huge original mahogany windows and frames were still in relatively good condition, so that very few pieces had to be replaced. Wood components were consolidated with epoxies where required, and the members restored.
- Full window sash sizes were retained. Sash and frames were stripped of lead based paint, which was treated as hazardous waste. Frames and sash were painted with a color selected to match a natural finished mahogany. New window washer's lugs were installed.

West Elevation

Air Conditioners

- Old window air conditioners had been installed over the years in the upper or lower parts of the windows, moving the sash to suit and stuffing insulation between the upper and lower sash. Various methods of support were employed, ranging from blocking or posts on the sill to hangers from inserts in the stone soffit above. Condensate damaged wood sills and the marble below. All of these units were removed and turned over to the Owner.
- New support frames were designed and installed, with proper closures at the sides and above or below. Frames were anchored to the window frames, not to the masonry. The new window units with upgraded electrical service were then installed.
- Chilled water mains have been installed in the northeast corner of the building and distribution piping is underway in some areas. It is the intent that the entire building will be on a central system and the window units and support frames will be removed, allowing the window sash to regain its proper position.

Roofing

- Slag and deteriorated built-up roof membrane on low slope roofs were removed in sections coupled to the façade work and a temporary roof installed.
- Roof drains were rehabilitated or replaced, and new overflow drains installed. Piping was cleared as necessary.
- Redundant HVAC equipment and ductwork have been removed from the roof. Closure of roof openings no longer in use was achieved by installing a steel frame and concrete fill between the integral beams in the brick vault roof deck.
- Following completion of an exterior section and repair of the substrate, insulation was placed on the deck and covered with a light weight concrete fill. New copper flashings and the final Siplast roofing membrane were then installed.
- Limited repairs to the slate roofs on the mansards were performed by section. Copper cladding on Seventh Floor dormers was repaired where needed.
- Work proceeded sequentially counter clockwise from the East Center Pavilion to the Southwest Corner Pavilion.

Guano

- Pigeons and some other birds have seriously fouled the building, especially on the west side. Tons of guano have been removed and handled as hazardous waste. Affected masonry was cleaned with water and a detergent before any work could be done, and often had to be repeated because of continued roosting.
- Bird netting has been installed as areas are finished to minimize a recurrence.

Communications

- A separate project was the moving of City Communications to the northeast quadrant of the Seventh Floor. A new opening in the south wall of the Northeast Corner Pavilion required transfer of load from one mansard rafter to the two adjacent, and removal of a portion of the channel sill and bottom of the rafter without damage to the mansard roof and flashing to the main roof.
- New mechanical units throughout the space were suspended from the existing roof framing.

Tower Sculptures

- Another separate project is the conservation of the tower sculptures. Systems scaffolding has been erected on the cast iron "eyebrows" above the tower clocks and around the corner figures and four eagles. The corner figures are about 24 feet tall; eagles have a wingspan of 12 feet. Bases of the sculptures are about 400 feet above grade.
- Scaffolding is served by a hoist at the southeast corner of the tower and a platform at the level of the sculpture bases.
- The bronze figures will be cleaned by laser and then conserved with patina and wax.
- Anchor bolts and flange bolts are to be replaced with stainless steel.

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Summary

The original building was well constructed of fine materials: two types of granite at the base; Massachusetts Lee marble for the facades and sculptures; cast iron for the cresting and ornaments on the mansards, solid mahogany windows, copper dormers, slate facing on the mansards, and built-up flat roofing systems. The quality of the original construction set the standards for the restoration work. Where any new or replacement materials were installed, they were the same materials or the same quality of materials that were used when the building was constructed over one hundred years ago, and the project has set a high standard for the level of care.

The Philadelphia City Hall Envelope Renovation is a multi-phase project. The first two phases of the project included the exterior renovation of about half of the exterior facades of the building facing both the street and the courtyard. The projects included the exterior rehabilitation of over 200,000 square feet of granite and marble masonry; the rehabilitation of the cast iron cresting and ornament; the rehabilitation of 680 of the original mahogany windows; installation of new window air conditioners and frames; repairs to slate cladding; and the installation of over 62,000 square feet of new flat roofing. The north façade and the tower were completed in the fall of 2003 and most of the west façade was completed in the fall of 2004. The building was continuously occupied throughout the construction period. Public safety and public image were always important on this very prominent City building.

The Phase 3 project began in early 2005, with the goal of the project to complete the renovation of the exterior of City Hall over a period of about eight years.

The project team included the City Capital Program Office as the Owner, C.B. Development Services as the Owner's representative, and a team of professional consultants. VITETTA was the lead designer historical architect and project manager for Phases 1 and 2, and was also responsible for documenting repairs to the masonry and copper dormers. Kelly Maiello, Inc. was responsible for documenting repairs to the windows, roof and gutter systems, and is the project manager for Phase 3. Marianna Thomas Architects documented repairs to distinctive ornamental cast iron roof components. Norton Art Conservations led the sculpture conservation work. Keast & Hood Co. was the structural engineer for the entire team, and Vinokur Pace Engineering Services for the related mechanical and electric engineering.

Daniel J. Keating Co., as the general contractor for Phases 1, 2 and 3, selected sub-contractors who could complete quality work for each of the trades required to restore the building envelope to its original condition when completed in 1901, and the original high standards of craftsmanship established by the original architect.

The general contractor organized their subcontractors and submitted a project schedule that took into account the restoration of the cast iron, which was the one critical path item for the project that would control how quickly the project could be completed. The other critical item was temperature limitations, which affected most trades.

The client, Capital Program Office, and owner's representative, C.B. Development Services, have been well pleased with the results of Phases 1 and 2.

The current view from North Broad Street and the Benjamin Franklin Parkway shows that the City has properly reinvested in its primary governmental symbol for future generations..

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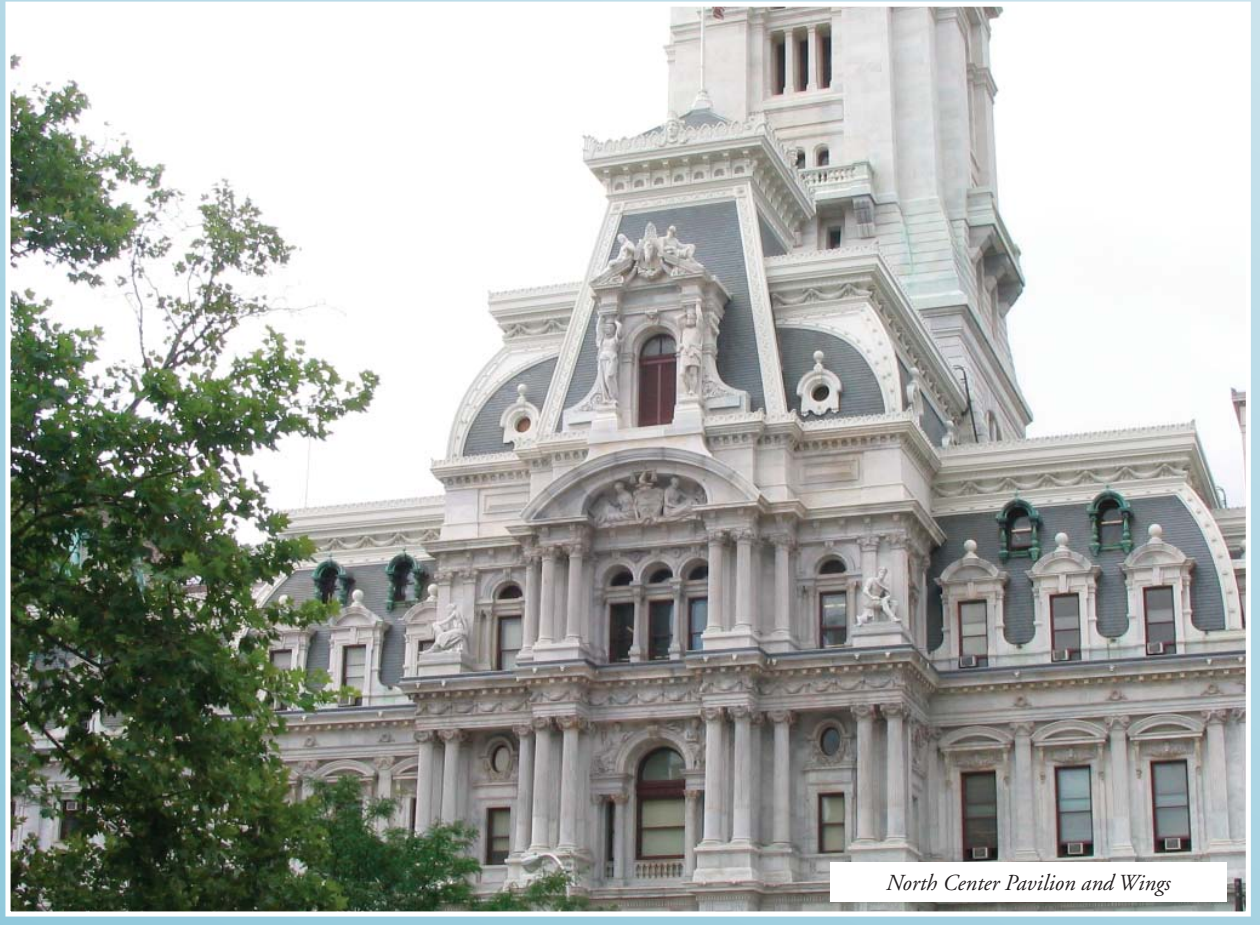

North Center Pavilion and Wings