Hotel Monaco Historic Cornice Repair Project

Washington, DC

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The Hotel Monaco is located in Washington, DC, and is a National Historic Landmark that was formerly the U.S. General Post Office. It was built in two phases between 1839 and 1866. The original building was commissioned by President Andrew Jackson and designed by Robert Mills, the same architect who later designed the Washington Monument. Mills selected an all-marble-clad exterior and the building became the first of its kind in the capital.

The second phase is referred to as the General Post Office extension and the same architect who designed the Capitol Dome, Thomas Ustick Walter, oversaw its construction. A number of government agencies have occupied the building since the U.S. General Post Office relocated in 1897, including the General Land Office, the Tariff Commission, and the U.S. International Trade Commission. The building was converted into a hotel in 2002.

Elements of the marble façade are largely reflective of Neoclassical and Palladian architecture and are comprised of a Roman classical entablature with a plain frieze and dentil molded cornice supported by elevated Corinthian columns and pilasters. It is presumed that the marble exterior cladding is supported by interior solid masonry walls.

Two horizontal slabs form the cornice; the upper part of the cornice is 8 in. (203 mm) thick and features a decorative profile, while the lower part of the cornice is 10 in. (254 mm) thick and features dentils and rosette medallions attached to the underside of the cornice between dentils. A large capstone, which forms the parapet wall, sits atop the cornice, acting as a counterweight. The cornice projects approximately 2 ft (0.6 m) from the face of the parapet capstone.

INITIAL INVESTIGATION AND CAUSE OF FAILURE

On July 15, 2010, a nearly 7 ft (2.1 m) long section of the lower cornice containing five dentils suddenly fell. The marble failed approximately 11 in. (279 mm) back from the face and the remaining surrounding marble was determined to be in sound condition. Initial investigations revealed that the failure was due to water infiltration through cracked and open mortar joints in the parapet capstone and cornice that expanded during multiple freezing-and-thawing cycles.

Atmospheric staining was present along 80% of the length of the break, suggesting that the crack had been there for some time prior to the failure. As the crack expanded and separated, the unaffected adjacent marble could no longer support the weight of cantilevered marble that had separated; eventually, the piece broke off. The capstone was found

Condition of cornice prior to restoration

Repaired cornice area

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to be secure, plumb, and level after the failure and there was no evidence that it had settled or otherwise moved as a result of the cornice failure below.

The initial investigation revealed other nearby elements of the cornice in need of repair. The upper cornice slab directly above the failed cornice was observed to have a significant crack that extended through its full thickness and a re-entrant corner piece of the lower cornice had a large crack. Both exhibited evidence of a similar delaminated condition due to moisture infiltration. There were also a number of rosette medallions found missing and 50% of those remaining were severely weathered and loose.

Larger section being fabricated from smaller marble pieces

Setting new cornice section

Exterior view of Hotel Monaco

SPECIALIZED TESTING AND RESULTS

Samples of marble and mortar were collected and transferred to a specialized historic testing agency to aid in the selection of replacement marble and repair design decisions. During the sample collection, boroscopic inspections were performed to determine the depth of embedment of the marble and overall thickness of the cornice/parapet wall assembly.

The goal of the specialized testing of the existing marble was to understand its physical and performance-related properties as a preliminary basis of comparison against published data of the potential replacement marble. Tests performed included compressive strength and absorption and the results revealed high compressive strength and low absorptivity. The results determined that there were no inherent flaws or weaknesses in the original stone, suggesting localized failure.

Petrographic analysis of the existing mortar was performed to determine the type, composition, quantity, and mixture ratio of the binder and aggregates. The results led to the recommendation of a mortar recipe with some portland cement because the low compressive strength of straight lime mortar would not be appropriate for the structural needs of the project and exposed locations of the repairs.

ACQUISITION AND TESTING OF REPLACEMENT MARBLE

Historic research revealed that the most likely source of the original marble was from the Beaver Dam quarry in Cockeysville, MD. Upon award of a contract in November 2010, the contractor indicated he had access to large pieces of marble from the original source that had been salvaged from a dismantled building in the area.

The sample presented was visually the best match and tests performed found that the compressive strength, density, and flexural strength were comparable to the original marble and the engineer determined the Beaver Dam marble to be an acceptable match. This readily available salvaged source resulted in a contract savings of over $30,000 and reduced the construction schedule by 40% by eliminating the lead time needed to supply newly quarried marble.

REPAIR DESIGN AND EXECUTION

Project specifications following historic treatment procedures and repair drawings were issued in October 2010 and mobilization took place in November 2010. Cold-weather protection was installed over the entire scaffolding and heaters within the tented scaffolding were used to maintain appropriate temperatures for work to proceed through the cold winter months.

The contractor began removing additional metal cap flashings at the parapet and over the cornice ledge to fully access the repair area and verify field dimensions of the cornice pieces to be replaced. However, behind the parapet wall, there was an 18 in. (457 mm) wide brick masonry wall beneath the flashing and on top of the back span portion of the cornice assembly. Removal and subsequent replacement of the brick wall were required to access and remove the parapet capstone.

Because there was virtually no lead time for the locally available salvaged Beaver Dam marble, fabrication of the replacement pieces began almost immediately. Slabs of the salvaged marble were not available in sizes large enough to fabricate the upper or lower cornices, so replacement cornice pieces were fabricated as two separate pieces and were doweled and epoxied together prior to site delivery. The doweled joints were embedded in the cornice assembly and were not visible to the exterior.

While fabrication of the replacement cornice pieces and rosette medallions was underway, crews in the field meticulously removed the unstable portions of the cornice. Limits of replacement were carefully selected to minimize the number of parapet capstones that would need to be removed to access and install the replacement cornice elements beneath.

Upon successful installation of the cornice pieces, the sheet metal flashings were replaced in a better configuration. Joints between the sheets were fabricated to channel water away on either side of the joint so there is redundancy and the sealant joint is not the only means of waterproofing.

In addition to the replacement of the failed pieces, a number of other proactive repairs, including repointing, Dutchman repairs, face patching, epoxy crack injection, and pinning and stabilization of loose and/or exfoliating façade elements. General cleaning of the marble façade within the repair area was also included as part of the scope of work.

PROJECT RESULTS

The Hotel Monaco historic cornice repair project was a good case study on the detrimental effects of water infiltration and exposure to freezing-and-thawing cycles over time on a marble-clad building.

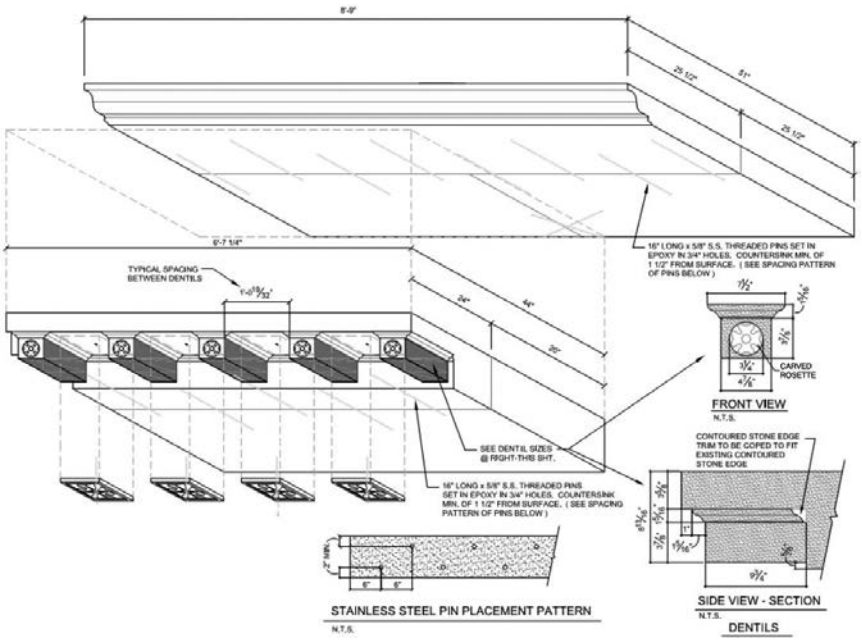

Diagram of repairs (Note: 1 ft = 0.3 m; 1 in. = 25.4 mm)

Historic façades, although typically robust, rely heavily on the maintenance of auxiliary components, such as mortar joints and flashings. It is easy for the early stages of deterioration to go unnoticed, as the crack that caused this particular failure formed from within the stone.

The procurement of the ideal replacement marble, mined from the original source and immediately available, resulted in both a time and cost savings to the owner. During the construction, the existing tight tolerances were maintained and the repairs were seamlessly integrated into the original historic marble façade.

Hotel Monaco

OWNER
Jayhawk Owner, LLC (owner at time of repair)
Bethesda, MD

PROJECT ENGINEER/DESIGNER
Smislova, Kehnemui & Associates, PA
Potomac, MD

REPAIR CONTRACTOR
Worcester Eisenbrandt, Inc.
Baltimore, MD

MATERIAL SUPPLIERS/MANUFACTURERS
Marx/Okubo Associates
(Owner's Representative)
Denver, CO

Conservation Solutions, Inc.
Santa Fe, NM