St. Louis Union Station Headhouse Façade Restoration

St. Louis, Missouri

Submitted by Walter P Moore

Originally constructed in 1894, the St. Louis Union Station (Fig. 1) was at one time the largest passenger train station in the world. Architect Theodore C. Link designed the Union Station in the Romanesque Revival style, borrowing heavily from the motifs popularized by H. H. Richardson during the 1870s and 1880s. The monumental façade of the headhouse grandly displays its round turrets, ornamented fenestration, intricately carved stone features, and the impressive clock tower. In 1970, the station was added to the National Register of Historic Places. Today, the station is a National Historic Landmark property, the highest honor that can be bestowed on a historic property.

Following the eccentricities of Richardsonian Romanesque architecture, the main façade of the headhouse is articulated into five unique sections—including hipped and gabled pavilions—to frame the building at either end. Most striking is the turreted clock tower, rising 280 ft (85.3 m) above the sidewalks. All areas of the headhouse are roofed with red Spanish tiles to complement the creamy Indiana limestone.

The structure of the headhouse is mass masonry. Four to 8 in. (101.6 to 203.2 mm) thick blocks of limestone were used to clad the multi-wythe brick backup walls. Massive arches frame the grand entryways and windows.

Fig. 1: Market Street façade of the St. Louis Union Station Headhouse

ASSESSMENT

Although the entire facility underwent an extensive restoration in the 1980s, by early 2005, the limestone façades were in desperate need of repair. Deterioration of stone ornamentation on the clock tower and at the retaining walls along the main elevation prompted concerns about overhead hazards, and excessive soiling was defacing the stone surfaces. The engineers performed a detailed condition assessment of the building envelope and designed repair solutions for restoration of the limestone façades.

The assessment began with a comprehensive visual survey of all areas of the façade. In addition to visual assessment, nondestructive methods such as sounding were used to identify areas of deteriorated or delaminating stone.

Observations made in the field were keyed onto drawings and photographs of the headhouse. Analysis of the information gathered during the detailed assessment was critical during project phasing and coordination.

EMERGENCY INTERVENTION

During the course of the assessment, overhead hazards were indeed identified—primarily at the clock tower—and temporary stabilization had to be employed until the distress conditions could be addressed. Specialized safety netting was used to carefully wrap select locations as a containment measure for areas of potential concern. Pinning and reanchoring of stone were also used to temporarily secure certain areas until repairs could be performed.

STONE MATERIAL TESTING

It was also critical to develop a detailed understanding of the current durability and strength characteristics of the original limestone material. To accomplish this, stone samples were removed from select areas of the façade and sent to a national testing laboratory to study the geological composition and

Fig. 2: Surface deterioration of carved elements

Fig. 3: Same area of carvings after patching repairs

the behavior of the stone in adverse environmental conditions. The testing included both petrographic analysis and accelerated weathering tests. This laboratory testing indicated that the stone samples were a very high-quality limestone product and that the material remained in good overall condition.

MASONRY RESTORATION

Restoration of the exterior limestone façades was a complex, multi-year project that faced challenging staging requirements, carefully planned construction phasing, and scope and schedule creep due to unforeseen existing conditions. Even staging the building presented numerous challenges because of setbacks over low roofs and tight conditions that required scaffolding. Strict protocols had to be set in place to prevent overloading of scaffolding supported by the existing roof structure and to ensure the safety of workers and visitors to the site.

Although the Indiana limestone was typically in good condition, certain areas were experiencing significant surface exfoliation, such as vulnerable corners and carved details, as well as areas along public sidewalks where deicing salts were used. Other locations were experiencing deep deterioration that penetrated the entire depth of the stone unit. When possible, the original stone was maintained, and damage was patched to match the surrounding masonry (Fig. 2 and 3).

Fig. 4: Installation of new limestone finials to match the originals

During the project, repair masons developed a fondness for the artistic side of stone patching and successfully produced repairs that closely matched the adjacent existing stone. In locations where stone deterioration was too severe to salvage the original units, replacement units were hand-carved to match the intricate surface tooling and ornament created by the nineteenth-century artisans. Lifting the new stone units (each weighing several hundred pounds or more) into locations like pedestals above the roof line and ornamental balconies high on the clock tower required intense coordination between the repair masons and the crane operator (Fig. 4). In addition to patching and replacement of damaged and deteriorated limestone units, mortar joints across all limestone façades of the headhouse were repointed.

MISCELLANEOUS EXTERIOR REPAIRS

Although restoration of the exterior masonry was the primary focus of this project, other façade elements, including gutters, downspouts, and windows, were also addressed. The original copper gutters and downspouts were still functional. Older membrane repairs were removed, and new copper was fabricated to match the dimensions and profile of the historic gutters. Sections of missing downspout were also replicated and installed at their original locations, using the unique stone-wrapped detailing of the original building.

CLEANING

To the knowledge of the project team, the exterior elevations had never been cleaned. Years of atmospheric and biological soiling created widely varied patterns of light and dark across the façades,

Fig. 5: Heavy gypsum crusts resistant to water spray and chemical cleaning

obscuring the intricate carvings and ornamental detail carved into the limestone with heavy black crusts in many places. Gentle water mist spray was successfully used to remove soiling in most locations, although the heaviest of the encrustations, especially at protected areas such as window arches and under projecting elements, resisted removal by water spray (Fig. 5). These heavy crusts proved resistant to chemical cleaning methods as well. After careful consideration of a number of abrasive cleaning methods, dry soda blasting at low pressure, a cleaning method that uses sodium bicarbonate as the abrasive media, was selected. Petrographic analysis was performed on both cleaned and uncleaned samples of limestone taken from the building, and no adverse effects from the soda abrasive were found. Concerns about residual salts and staining from the soda abrasive were mitigated by providing thorough rinsing with potable water after the cleaning was complete.

SEAL OF MISSOURI

Equally impressive, in terms of the restoration of the building as a whole, was the restoration of the large crest of the Seal of Missouri on the clock tower. From the start of the project, it was the intent of the design team to maintain the original crest and perform patching repairs only as needed. Unfortunately, hands-on examination of the crest revealed extensive deterioration of the limestone, and inappropriate former repairs made with an unknown patching mortar had exacerbated the limestone's deterioration. Cores taken through the thickness of the existing crest revealed stone that was unsound and heavily fractured through its entire depth.

Using photographs to recreate lost detail and to artistically recreate the life-sized bears that flank a massive escutcheon, the new crest was carved from blocks of solid limestone. Design quirks of the original crest, such as the slight projection of the crest over its pediment base, were replicated in the new crest to maintain as much historical authenticity as possible (Fig. 6).

Fig. 6: Installation of the replacement crest is nearly complete

Installation of the new crest was in itself very challenging. Positioned at nearly half the height of the clock tower and above a steeply hipped roof, the crest was well over 100 ft (30.4 m) in the air. Scaffolding had to be cantilevered to access the crest pedestal, and the new stone blocks were slowly lifted into position just a few units at a time to prevent overloading of the scaffold.

CONCLUSION

Restoration of the exterior limestone masonry at the St. Louis Union Station Headhouse was a complicated but successful endeavor. Not only were safety and waterproofing issues addressed, but also the team was able to restore much of the original splendor to this centenarian beauty. The St. Louis Union Station is now ready to face the challenges of another 100 years of service to the country as one of our key architectural treasures from the past.

St. Louis Union Station Headhouse

OWNER
FBOP Corporation
Oak Park, Illinois

PROJECT ENGINEER/DESIGNER
Walter P Moore
Houston, Texas

REPAIR CONTRACTOR
Superior Waterproofing & Restoration Company
St. Louis, Missouri

MATERIAL SUPPLIERS/MANUFACTURERS
Architectural Stone, Inc.
St. Louis, Missouri

Edison Coatings, Inc.
Plainville, Connecticut