

Restoration of Historic Temple Emanu-El

By Tara Ikenouye, AIA, CPHC

This paper was presented at the 2024 IIBEC International Convention and Trade Show.

TEMPLE EMANU-EL is a synagogue that is a prominent landmark in the East Side neighborhood of Providence, Rhode Island. The Temple complex consists of the original domed sanctuary built in 1927 designed by the then Boston-based firm Krokyn & Brown, an education building built in 1953, and a meeting house built in 1959 (**Fig. 1** and **2**). Wiss, Janney, Elstner Inc. (WJE) started working with the congregation at Temple Emanu-El in 2015 to investigate coating and repair failures at the cast stone facades of the sanctuary. In 2019, WJE was contacted again by the Executive Director and President of the Temple in 2019. Frustrated with the ongoing deterioration of the cast stone facades that clad the section of the sanctuary that greeted neighbors walking by and welcomed congregants inside, Temple administrators enlisted WJE to design a full facade restoration of the sanctuary. This project would require significant effort to remove existing cast stone units from the building facades and replace them with more than 400 new cast stone units. WJE, Temple administrators, congregation members, and Joseph P. Gnazzo Company (Gnazzo), an experienced historic masonry contractor, collaborated to successfully resolve the many challenges encountered

during construction, and the restoration was completed three years later.

In the era when Temple Emanu-El was designed and built, architects were experimenting with ways to use manufactured materials such as concrete and terra-cotta to mimic natural stone. At that time, cast stone cladding was a more economical material than natural stone and could be cast to mimic the visual appearance of traditional masonry materials. The Temple sanctuary is designed in the stripped classical (modern classical) style that was developing in Europe and the United States in the early 20th century. This is a streamlined architectural style that retains foundational elements of classical architecture, such as porticos, colonnades, and domed roofs, but eliminates more decorative aspects of traditional classical styles. Many public and institutional buildings in the United States and Europe were designed in this style during this time as a physical manifestation of classical government ideals. The Temple sanctuary consists of a central square mass with a domed roof, and a longer and narrower rectangular mass oriented diagonally along the northeast to southwest axis. There are three sets of hand-carved wood double-doors, a four-column cast stone colonnade forming a shallow portico, and a cast stone cornice above the columns with an entablature carved and gilded with the inscription "Seek Ye The Lord And Live."

The main entrance and return facades of the sanctuary are clad with 4- and 8-in.-thick (102 and 203-mm-thick) cast stone units placed in a running bond pattern with multi-wythe structural clay tile backup walls. The typical cast stone unit at these facades is approximately 24 in. (610 mm) tall and 36 in. (914 mm) wide. Each unit weighs between 300 and 600 lb (136 and 272 kg), depending on the depth of the unit. The other facades of the sanctuary building are primarily constructed of multi-wythe brick masonry with cast stone coping units along the parapet, a cast stone belt-course that wraps around the building at the top of the facade, and other decorative cast stone elements such as plaques with gilded inscriptions or designs, and two cast stone units depicting the Ten Commandments with gilded lettering at the center of the parapet above the main entrance.



SOURCE: TEMPLE EMANU-EL ARCHIVES.

Figure 1. Temple Emanu-El. This photo was taken some time between 1930 and the 1950s.

Historical photographs from the time of original construction show that the cast stone elements of the sanctuary were not coated. However, by 2015 when WJE was first engaged by the Temple, coatings that had been applied on the cast stone starting in the early 1990s exhibited pinholes, splits, and blistering, and were delaminating at many locations. Where the coating was distressed or damaged, the underlying cast stone also exhibited craze cracking, uneven surface texture, pockets of efflorescence, and incipient spalls. Multiple cast stone units at sanctuary facades had damage from cycles of freezing and thawing (Fig. 3 and 4). As part of the initial condition assessment, core samples from three cast stone units were removed for petrographic analysis. Samples of the various coatings were also removed to study the many layers and types of coatings applied to the cast stone.

The petrographic analysis was used to microscopically assess failure mechanisms, mixture proportions, and air entrainment in the concrete. It demonstrated that the sampled cast stone was a wet cast mixture versus dry tamp cast mixture, which are the two methods to manufacture cast stone units. The mixture was not air entrained and exhibited properties consistent with a mixture that had a high water-to-cement ratio. The non-air-entrained concrete made the cast stone units more susceptible to freeze thaw damage, which was consistent with findings from the petrographic study. The parallel microcracks present at the outer end (the exterior face of the cast stone unit) and inner end (the face of the unit next to backup masonry) of two sample cores were a result of cyclic freeze-thaw deterioration (Fig. 5). Without air voids to accommodate expansion within the units from the pressure of ice formation during freezing-and-thawing cycles, the concrete cracked. The finding that the inner end of the core samples showed deterioration from freezing and thawing indicated that the unit embedded within the mass-masonry wall was experiencing saturated conditions. This finding aligned with overall conditions of the sanctuary facades.

Water had a pathway into to the cast stone facades from troublesome conditions present at the sanctuary. Sealant installed at mortar joints had blocked water from migrating out of the wall through these joints. The layers of coatings that were intended to protect the cast stone from moisture actually trapped water within the concrete when moisture bypassed the coating through splits, voids, and peeling coatings. Through-wall flashings with short drip edges were also sealed without weeps. As composite mass-masonry walls, the facades of the sanctuary

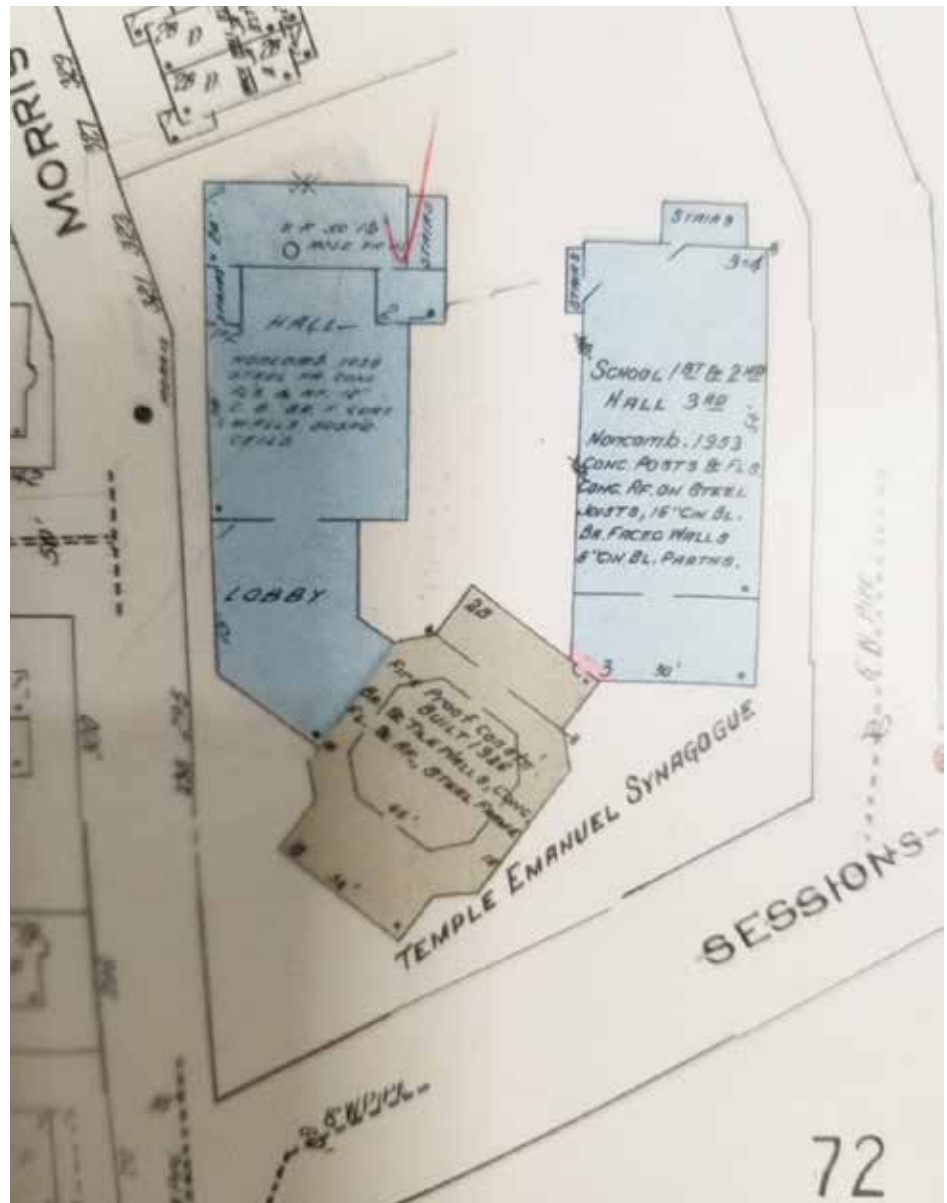


Figure 2. Temple Emanu-El site plan from Sanborn Insurance Map.



Figure 3. Cast stone units at the parapet with freeze-thaw damage and coating failure.



Figure 4. Cast stone units at the belt course with blistered and peeling coatings and efflorescence. The top and bottom photos are from 2015 and 2019, respectively.

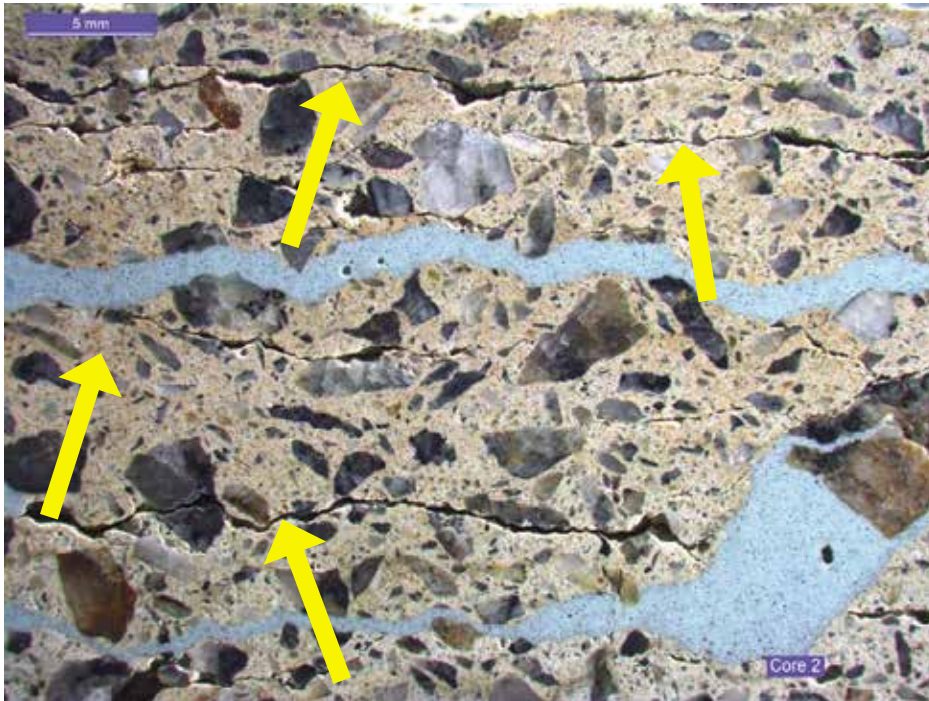


Figure 5. This is a cross-section sample from one of the cast stone core samples. Parallel microcracks in a cast stone sample are indicative of damage from cycles of freeze-thaw damage.

were designed to manage water from rain and snow with a cycle of absorption and release through the cast stone and brick masonry. However, the many added layers of coatings effectively became a vapor barrier, and with the sealed mortar joints, this moisture management system was disrupted. These modifications were causing significant damage to the facades.

After the investigation and laboratory analysis, WJE presented Temple administrators and congregants with three options to address the conditions at the cast stone facades. These included baseline repairs to address aesthetic concerns and repair conditions at the facades to prevent further water intrusion and protect the concrete; facade overcladding; or facade recladding with new cast stone units. The baseline repairs would include repointing, new flashings, removing the existing coatings,

completing crack and concrete repairs, replacing some cast stone units, and installation of a new elastomeric coating. This scope of work would become the first of many cycles of repairs to maintain and continue to repair the original cast stone units where damage from prolonged saturation and freeze-thaw cycles could not be undone but only managed.

The overcladding option envisioned a new mechanically fastened cladding anchored to the backup masonry, bypassing the existing cast stone units but leaving them in place. A thorough structural analysis of the existing backup walls would be required for this option. The overcladding option also meant a major alteration to the appearance of the historic building.

The third option, which was ultimately selected by the Temple, was to reclad the cast stone facades with new cast stone units. This option

offered a pathway to address the deterioration of the facades, reduce future maintenance requirements, and restore the sanctuary to retain its historic appearance. In addition to removing existing cast stone units and replacing with new cast stone units, this option involved full restoration of other facade elements, including new flashings, complete repointing of the brick masonry facades of the sanctuary, sealant replacement at building joints, restoration of historic stained glass wood windows, re-gilding decorative elements, and painting the dome. This was the scope of the project that Temple Emanu-El, WJE, and Gnazzo started in the spring of 2020, as the world was grappling with the initial effects of the COVID-19 pandemic.

The restoration project designed by WJE was based on findings from the investigation in 2015, and additional investigation in 2019. Without historical drawings, information about the as-built construction of the sanctuary had to be collected through fieldwork and inspection openings. From the inspection openings, the project team learned that the cast stone units alternated between 4 and 8 in. (102 and 203 mm) deep. The team decided to design new cast stone units to be 3½ in. (89 mm) deep to allow for a ½ in. (13 mm) joint for new adhesive anchors and grout. The expectation was that the 8-in.-deep units would remain embedded in the backup masonry with the outer 4 in. cleaved off. However, once the masonry contractor started removing cast stone units, they proposed fully removing the 8-in.-deep units and infilling with brick masonry (Fig. 6).

This approach was easier for the masons and maintained the load path of the back-up masonry wall.

The concrete mixture for the new cast stone units reflected what the construction industry has learned about extending the service life and long-term performance of concrete since the first units at the sanctuary were cast nearly 100 years prior. The new units were wet cast with a concrete mixture that had 4% to 6% air entrainment in accordance with ASTM C185, *Standard Test*

Method for Air Content of Hydraulic Cement Mortar,¹ and a maximum water-to-cement ratio of 0.35. That maximum ratio, which took into account water added to the mixture as well as moisture content from the fine and coarse aggregates, had previously demonstrated successful resistance to freeze-thaw damage. WJE required the cast stone manufacturer to test the fine and coarse aggregates, in accordance with ASTM C1260-14, *Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar Bar Method)*,² to demonstrate that the aggregates would not adversely react to the cement alkalis in the concrete mixture. This reactivity, which is referred to as alkali-silica reaction (ASR), results in a silica gel formed around the aggregate and is associated with expansion that leads to cracking of concrete.³ The process of the cast stone manufacturer sourcing and testing aggregates and cement for ASR took several months before a combination tested within acceptable alkali-silica reactivity limits.

Some of the concrete elements of the sanctuary facade would not be replaced but would receive concrete repairs and be recoated with an elastomeric coating. Therefore, the new cast stone units were cast with a pigmented concrete mixture to closely match the color of the new coating. The light-beige color selected for both the concrete and the coating so closely resembled the color of the coating of the old facades that most passersby would not have known that the extent of the restoration at the sanctuary involved more than new gilding and updating of the gold-painted dome.

The cast stone units that comprised the cornice were large and deeply embedded in the exterior wall, and the original plan for restoration and repair at the cornice above the portico was primarily localized concrete repair. However, when demolition was underway, it became apparent that freeze-thaw damage was widespread in the projecting sections of the cornice and would require extensive concrete repair. The Temple, WJE, and Gnazzo agreed that retaining the embedded sections of the cornice, removing the deteriorated concrete, and replacing the cornice with a new glass-fiber-reinforced polymer (GFRP) shell was an appropriate option. Aesthetically, the GFRP was a smart choice because the shell could match the profile of the existing cornice as well as the color of the new cast stone units and new coating. The GFRP shell also replaced concrete, which would have continued to deteriorate and require regular repair.

While the ongoing deterioration of the cast stone at the sanctuary was the main reason for the restoration project, many other elements



Figure 6. The removal of cast stone units from the sanctuary facade exposed structural clay tile back-up masonry. Note the void where 8-in.-deep (203-mm-deep) units were removed (arrow).



Figure 7. Historic door pull handle found in storage room. A mold based on this handle was used to cast new bronze pull handles for the restored front doors.

of the facades were in as much need of repair. The project budget allowed for restoration of some of the smaller stained and colored glass windows that were set in the cast stone sections of the facade. The frames of these windows had to be modified because of the placement of the new cast stone units. Additionally, restoration of these windows involved wood repair, repainting, reglazing, and installation of new exterior storm windows.

The large, double-height-stained glass windows that provide light into the main sanctuary space already had protective exterior storm windows. These were repaired and repainted as part of this project. The Temple planned to apply for historic preservation grant funding so that these stained glass windows could be restored at a future time.

In addition to wood window restoration, the three front entrance doors with hand-carved

surfaces were removed and carefully restored off site. During construction, the property manager for the Temple found one of the historic bronze door handles in a storage room. The contractor located a nearby foundry to mold and cast new handles for all three doors (Fig. 7).

Elements of a facade that can be touched, such as the Temple's door handles, or that can be seen from afar, like the gilded carved designs and lettering, and the glistening gold-painted dome, are what most people notice when it comes to the building restoration. That is why it was important for this restoration to address those features. For the depiction of the Ten Commandments tablets at the parapet above the main entrance, new cast stones were cast and gilded. The three cast stone plaques above the front doors, the cast stone plaques at each corner of the building, and the entablature below the new

SOURCE: T. IKENOUE, WISS, JANNEY, ELSTNER ASSOCIATES INC.

SOURCE: WISS, JANNEY, ELSTNER ASSOCIATES INC.



Figure 8. The restored Temple Emanu-El with new cast stone units, a glass-fiber-reinforced polymer cornice, and gilding completed.

GFRP cornice did not have the same extent of concrete deterioration as other areas. Therefore, the team only had to remove the coatings on these elements and recoat the concrete before applying new gold-leaf gilding to the carved designs and lettering.

The dome atop the sanctuary is constructed of steel, metal lathe, and stucco and is clad with flat-seam copper roofing. Many coatings and paint had been applied to the copper over the years. The project budget did not allow for reroofing the dome with new copper, but the Temple did not want to leave the dome as is, so the team decided to repaint it. The contractor designed and erected a creative system of rope access so that painters were able to remove many of the layers of paint on the dome down to an asphaltic coating. This coating was well-adhered to the copper and could not be fully removed. Repainting the dome required a specialized paint formulated for applications on exposed architectural metal surfaces that had to be supplied from the Midwest. WJE performed field-adhesion testing on several primer and

paint mock-ups before a combination capable of adhering to the substrate was determined.

Work on the dome, which was the last major part of this project to be completed, was finished in the fall of 2022. At this point, WJE had been working with the Temple for seven years starting with the first investigation in 2015. When design for recladding with new cast stone units and restoration of the sanctuary facades was completed in early 2020, the construction team planned to start work in the spring of 2020 and initially established a 12-month to-completion schedule. Then, the COVID-19 pandemic disrupted the project timeline.

With construction work stopped by local government shutdown restrictions, supply chain delays, and a lack of skilled labor, the project had many pauses and schedule resets. However, the project was successfully completed because of the crucial combination of an engaged client, a pragmatic design team, and a skilled and resourceful historic masonry contractor. Temple Emanu-El is a place of personal importance to many in the congregation and community (Fig. 8).

Individual donors, who contributed to funding for this project; volunteers, including a member of the Temple (also an architect), who lent their time each week for project team meetings and site visits; members of Temple operations committees, and Temple staff, who had with many other responsibilities besides this project were at the heart of this successful project. 

REFERENCES

1. ASTM International. 2020. *Standard Test Method for Air Content of Hydraulic Cement Mortar*. ASTM C185-20. West Conshohocken, PA: ASTM International.
2. ASTM International. 2014. *Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar Bar Method)*. ASTM C1260-14. West Conshohocken, PA: ASTM International.
3. Marusin, S. L., and L. B. Shotwell. 2000. "Alkali-Silica Reaction in Concrete Caused by Densified Silica Fume Lumps: A Case Study." *Cement, Concrete, and Aggregates* 22 (2): 90-94.

ABOUT THE AUTHOR



TARA IKENOUE,
AIA, CPHC

Tara Ikenouye, AIA, CPHC, is an architect with master's degrees in architecture and historic preservation. She is a senior associate with Wiss, Janney, Elstner Associates Inc. at the Boston office. She has performed condition assessments and designed

repairs, restoration, and renovations for many historic buildings from the 18th, 19th, and 20th centuries. In addition to a practice in historic preservation, Ikenouye provides enclosure consulting services for new and existing building projects with technical expertise in brick and stone masonry, concrete, windows, and roofing. She can often be found asking questions at the front of a historic house tour.

Please address reader comments to chamaker@iibec.org, including "Letter to Editor" in the subject line, or IIBEC, *IIBEC Interface*, 434 Fayetteville St., Suite 2400, Raleigh, NC 27601.

