Water Intrusion Mitigation at Historic Center for Puppetry Arts Facility

By Mickey S. Leso, PE, LEED GA and Mark Girton

Figure 2 – Overall view of west elevation.

OVERVIEW

The Center for Puppetry Arts (CFPA) facility is a three-story building located at 1404 Spring Street, NW in Atlanta, Georgia (*Figures 1* and *2*). This historic structure has been home to many organizations since it was built in 1918. Originally designed for and occupied by the Spring Street Elementary School, the building is currently home to the United States' largest organization dedicated to the art form of puppetry. In recent decades, many historical elements and items have been discovered within this structure. The interior spaces include a puppetry theater hall and training center, offices and meeting spaces, and archives for many priceless artifacts—most notably, an extensive Jim Henson collection and intact unerased chalkboards covered with drawings, notes, and daily items dating to 1933. Leaks—both past and current—were reported throughout the structure. The water intrusion caused staining, blistered paint, and extensive damage of the drywall, paint, and interior plaster finishes (*Figure 3*). In the worst-case areas, significant moisture resulted in deterioration of the masonry façade and undermined

Figure 1 – Overall view of east elevation of the original Spring Street School, currently the Center for Puppetry Arts building, prior to the 2016 addition.

Figure 3 – Water damage on interior basement walls of east elevation, as a result of masonry, parapet wall, and roof scupper flashing defects.

features such as roof access ladders, parapets, and cornices attached to the walls (*Figure 4*).

CONSULTANT'S ROLE

NOVA Engineering and Environmental's (NOVA's) role was to evaluate the ongoing water intrusion. Our involvement began as an investigation of numerous problematic leaks that were occurring, and our services grew to include a review of the deteriorating exterior façade of the historic structure. This included select removal of some exterior bricks to observe concealed conditions within the wall cavities. Additionally, select mortar and materials testing was conducted due to the historical nature of the structure in order to ensure appropriate repairs were developed. We produced a summary report and recommendations for repair. Along with CFPA (owner) and Heery International (program manager), we discussed priorities and options for repair within the limited available budget. These repairs were illustrated in a set of repair drawings and specifications, which were put out to bid for several specialty restoration contractors. After contractor selection, the repairs were completed without complications, despite an uncharacteristically rainy late summer season, which included the passing of Hurricane Irma.

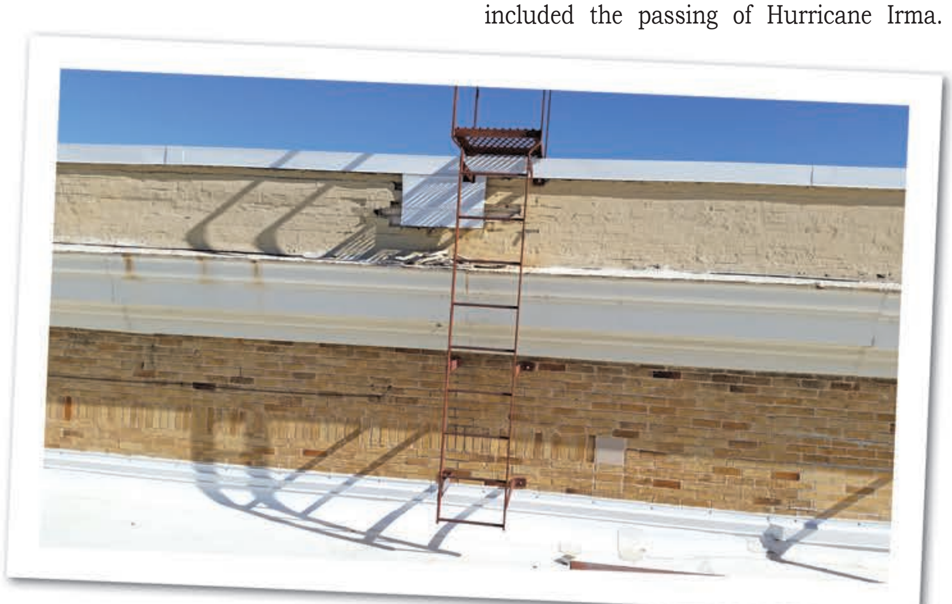


Figure 4 – South elevation parapet wall and access ladder conditions. Sheet metal hides displaced masonry.

Figure 5 – Hidden arched window openings from the original façade design behind the adjoining terra cotta veneer.

Figure 6 – Enlarged view of wall cavity between terra cotta lintel and original brick arch showing large voids in backup masonry wall and exposed wood framing for interior finishes.

BRIEF DESCRIPTION

The original structure consists of exterior multi-wythe load-bearing mass masonry walls with window openings, stamped and sheet metal copings and cornices, and cast-stone elements. The roof consists of a steep-slope, single-ply roof assembly with through-wall parapet scuppers at the building perimeter. Additions were later added to the south end façade in 1949 and—most recently, in 2016—across the courtyard from the east elevation. After completing the east elevation addition, CFPA elected to focus their funds on repairs to the original structure.

INVESTIGATION AND FINDINGS

NOVA began its investigation by visiting with tenants of the building to survey past interior leaks and damage to the finishes. After our interior survey, we traced the locations of interior damage to the exterior and observed the exterior wall conditions to locate deficiencies and to determine possible sources of water intrusion. In addition to improperly flashed openings, numerous areas containing previous improperly repaired conditions were observed and deemed to be contributing to the deterioration of the structure.

We supplemented our visual survey

by performing several inspection openings within the exterior wall assembly to observe the existing concealed masonry and flashing conditions. Our openings revealed many issues, the most concerning being defects in the exterior surface and voids in the backup masonry walls. This issue was further exacerbated because, as was typical in that era and type of construction, no continuous weather barrier/waterproofing membrane was installed between the terra cotta and the brick masonry and around various penetrations, such as windows. As part of our envelope condition assessment, we sampled and tested various materials to ensure future repairs would be compatible with the historic structural components.

The original drawings provided very little information about the existing construction. Therefore, the exterior wall construction was determined through a series of inspection openings. These openings revealed that the exterior is not a typical fired brick as it appeared, but instead consisted of terra cotta block with an exterior face that is formed to resemble brick. The exterior surface dimensions of the units were cast similar to a standard brick; however, the depth was approximately 8.5 in. A backup wall exists behind the terra cotta and consists of a multi-wythe solid red brick masonry wall measuring approximately 12 in. thick, making the total thickness of the composite masonry wall approximately 20.5 in.

The ground floor extends approximately four feet below grade. The terra cotta masonry extends from the ground-floor sublevel to the third-floor roofline, where it forms a 10-in.-wide parapet of terra cotta masonry. A metal cornice band set below the top of the parapet exists on the north, east, and south elevations. A cast-stone water table is 13 in. above the first-floor windows, and surrounds the building perimeter.

The current window systems (not original to the structure) are mostly rectangular-shaped frames set in punched openings. It was discovered that these rectangular window openings were not the original rough openings in the masonry walls. Similar to other "lost" historical elements within this structure, arched window openings were discovered hidden in the backup wall along the east elevation. It appears as though the building façade was originally constructed with arched window openings (*Figure 5*). The arches in the windows were visible in the brick structure; however, the exterior terra cotta openings were rectangular. The new window heads are lined with terra cotta masonry in a standing "soldier" course pattern. These units are supported by steel lintels that span approximately 6 in. beyond each side of the window opening. The original windows have brick in an arched pattern without a steel lintel over the window heads. The backup wall area below the arches, but

Figure 7 – View of east elevation parapet wall deterioration at time of evaluation.

Figure 8 – Example of cracks and bulging masonry causing discontinuity of parapet wall coating.

Figure 9 – Example of spalled terra cotta masonry at parapet walls.

above the elevation of the newer veneer lintels, was not filled in (*Figure 6*). Once sample bricks were removed from the lintel, a clear path to the building interior was observed. No flashing was provided along the window head lintels. This allows air/moisture to readily flow in/out of the building behind the veneer bricks.

At the parapet walls above, an elastomeric coating covers the terra cotta block above the cornice over the third-floor windows (*Figure 7*). The parapet wall above the upper roofline seemed to consist of only terra cotta masonry; there did not appear to be a backup wall structure. The coated wall surfaces exhibited cracks, and areas of bulging masonry were also present, suggesting some disintegration of the coated terra cotta (*Figure 8*). In isolated areas, deterioration of the terra cotta behind the coating resulted in spalling and significant loss of terra cotta masonry (*Figure 9*).

This terra cotta, if properly constructed, should be a breathable system. The terra cotta surfacing typically repels bulk moisture entry, and water that does enter the wall typically escapes during drying periods through voids in the surrounding lime putty-based mortar joints. The observed coating defeated this function, and intruding water at failures or gaps in the coating became trapped within the wall. Terra cotta is typically fired at lower temperatures than face brick and is, therefore, more susceptible to water-related swelling and deterioration if it remains in a wet environment. This condition appeared to be occurring throughout the parapet walls.

Isolated areas of mortar repointing were observed to have been conducted with a cement-based mortar, which resulted in further damage to the joints. Cement-based mortars transfer water out of the wall system at a slower rate than lime putty, which is what the original construction included. Therefore, the existing lime, behind the cement mortar, stayed wet for longer periods than desirable. Once the lime becomes saturated, it begins to revert to its original state, or otherwise break down and wash away, leaving cavities.

There were isolated locations where piping, conduit, or other wall penetrations were not watertight. It seems as though either the perimeters were never sealed or the sealant had eroded away, leaving the penetration susceptible to water intrusion. Additionally, some window perimeters and joints had begun to show signs of age, with some surface cracking and cohesive failure along the edges.

A major contributor to the observed interior damage at one location along the east elevation was related to improper roof membrane flashing at a parapet through-wall scupper sleeve. Also, the sleeve was not flashed or sealed properly to the conductor head and downspout on the outside face of the wall. It was also discovered that the scupper sleeve was smaller than the roof area requires. Therefore, water was overwhelming the scupper opening and draining into the brick masonry, which led to years of subtle moisture intrusion within the wall cavities (*Figure 10*). Over time, this began to appear as stains on the outside face of the brick masonry or efflorescence on the inside face of the walls.

NOVA also observed concealed waterproofing systems below grade via a small excavation test pit. The excavation revealed the solid red masonry brick wall provided the below-grade wall structure. A cementitious parge coat—ranging in thickness from feathered-edge thickness to 1-in. thickness—was observed to cover most of the below-grade brick. While the parge coat is more resistant to water intrusion than the brick masonry, it was not waterproof.

Another below-grade excavation revealed a bentonite waterproofing membrane at one location. This membrane appeared to be in good condition; however, the termination height of the membrane was approximately 12 inches below the finished grade elevation. A large tree was removed from this courtyard, and the area has been regraded several times. With the grade level higher than the top of the waterproofing membrane termination, the several courses of buried terra cotta and lime mortar joints are subject to abundant moisture absorption.

RECOMMENDED REPAIRS

Upon conclusion of our investigations, we provided our opinion of the existing conditions and developed a recommended scope of repairs to help preserve and protect the existing historical façade. Our involvement continued and included the development

Figure 10 – Exterior view of roof scupper/downspout and stained masonry (second and third floors) above Figure 4 *basement location.*

Figures 11 and 12 – View of south and east elevation parapet wall and original Spring Street School entablature after repairs and new breathable coating to protect original masonry.

of a full set of construction documents, construction administration services, and on-site observations of the installed repairs. Due to the historic nature of the structure, development of compatible repair methods and materials was of high importance.

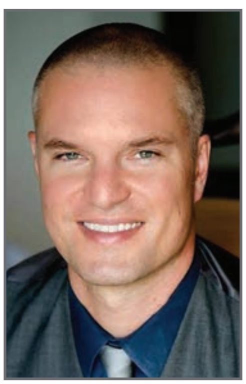
It was determined that the wobbly access ladder, defective through-wall scupper, dysfunctional cornice metal, and deteriorating masonry parapet walls were the primary causes of concern and the most important steps to minimize further decline of the structure within the available budget. The final repair scope of work included the following:

1. Remove existing coatings and loose or delaminated surfaces of terra cotta and mortar in the parapet walls above the cornice. Patch voids and tuckpoint mortar joints with specialty historical mortar and patching materials. Apply a parge coat and breathable elastomeric coating with a similar aesthetic color and finish to the existing coating.
2. Clean, prime, and paint (with rust inhibitor) the existing steel ladder and install retrofit bolts and threaded rods with adhesive into the repaired terra cotta masonry parapet wall.
3. Enlarge existing through-wall scuppers and add new overflow scuppers at the parapet wall. Apply new TPO-coated metal scupper sleeve and flashings, and connect/seal to new conductor heads and faceplates secured to the outside face of the parapet walls.
4. Remove existing cornice metal and repair/replace deteriorated plywood and wood framing at existing cornice. Install new cornice cap and counterflashing, primed and painted to match existing color.

SUMMARY

The repair work was performed by Western Specialty Contractors for a total construction cost of approximately $250,000, which is roughly equal to CFPA's initial budget. NOVA performed services within the budgeted cost of $30,000. The scheduled date of completion was October 1, 2017; the actual date of completion was September 28, 2017.

NOVA, the program manager Heery International, and the owner, the Center for Puppetry Arts, are extremely satisfied with the conclusion of the repairs. The facility was able to stay open and fully operational throughout the course of repairs, which was of great importance to the facility. The historic nature of the building was preserved, and previous improper repairs were removed and restored properly this time. This repair project will extend the life of the structure 50 or more years and preserve a historic structure for the Center for Puppetry Arts for years to come (*Figures 11* and *12*).



Mickey Leso, PE, LEED Green Asssociate

Mickey Leso, PE, LEED Green Associate, is a registered architectural engineer and senior technical professional, and provides departmental management and client support for the facilities services group at NOVA Engineering and Environmental. Mickey has 15 years of work experience and a master's degree in architectural engineering with a minor in architecture, and studied abroad in Italy and England, graduating from Pennsylvania State University. He participates in RCI, NRCA, USGBS, ICRI, BEC-Atlanta, CEFPI, GASFA, BOMA, and other groups.

Mark Girton

Mark Girton has 35 years of experience in the architectural engineering field, focusing on roofing and waterproofing systems. He excels at water leakage investigations and at producing repair designs. Also, he is an expert with electronic leak detection and infrared thermography. He was trained in architectural and advanced structural design at Phoenix Institute of Technology, uniform building code determination and enforcement at New Mexico Polytechnic Institute, and computer-aided drafting and design at New Mexico Junior College.