REPORT

St. John's Unitarian Universalist

Façade Study

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EXECUTIVE SUMMARY

The sanctuary at St John's Unitarian Universalist Church is a unique, International style addition constructed in 1960. The north, east and west walls are masonry walls, with clerestory windows above the east and west. The south wall is a custom, steel framed and stucco-clad wall with surrounding and subdividing glazing. The scope of THP's review is the west, south and east walls.

The majority of the deterioration was found in the southern steel and stucco wall system. Significant deterioration was noted at the bottom of the wall, evidenced by damaged stucco and corroded steel. Additional deterioration of stucco was seen where the exterior and interior steel columns connect, and at the steel elements of the glazing system. The wall is suffering from a combination of water intrusion via leaks at deteriorated sealant joints and condensation caused by thermal bridging (where the interior and exterior steel connect). THP recommends a full restoration of the wall. These recommendations include repair of the window systems, replacement of the lower steel shelf (under the stucco), replacement of the stucco flashing cap, and repairs of the stucco finishes. All sealants around windows and stucco should be replaced. The repair of the windows will be a labor-intensive process, and will require careful removal of the existing glazing, repair and repainting of the steel elements, and resetting of the salvaged glazing with new steel window stops.

The masonry walls are in relatively good condition. Some deterioration was noted at the top of the exterior buttress walls – the worst conditions were seen at the top of the east end of the north wall, which will need to be partially rebuilt. Due to the condition and flat profile, the metal caps at both the east and west ends of this wall should be replaced. The stone caps at the east and west walls are loose and should be re-anchored or replaced with metal. The vertical joints between the north wall and the east and west walls have loose, deteriorated mortar and should receive new expansion joint sealant. Similarly, where the vertical strip windows anchor to the masonry, loose mortar joints will also require replacement.

Additional deterioration was seen at several steel column bases that have been exposed to contact with soil and plants, and will require structural repair. Outside the sanctuary doors, the concrete landings and supporting steel angles are deteriorating and need to be repaired. Doors at these landings are also deteriorated and should be replaced.

The opinion of probable cost to complete all the work is $286,000.00. The last section of the report, Opinion of Probable Cost, includes a breakdown of the proposed efforts.

INTRODUCTION

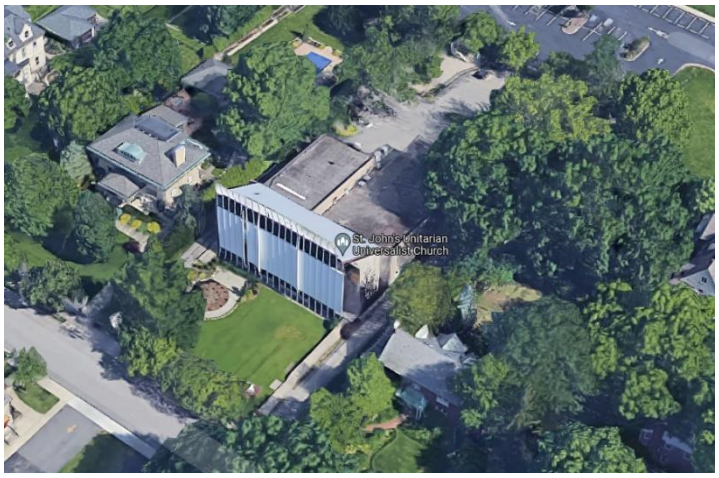
St John's Unitarian Universalist Façade Study

INTRODUCTION

In August of 2021, THP was contacted by MSA Design to review the conditions of the St John's Unitarian Universalist Church – specifically the west, south and east elevations of the main sanctuary space. In January of 2022, THP was formally contracted to complete the assessment. THP conducted the survey of the façades on January 18, 2022, with a follow-up visit on February 9th, 2022. The observations, conclusions and recommendations contained in this report are based exclusively on the following:

- Review of original architectural and structural drawings.
- Visual survey of façade components, including stucco cladding system, the exposed steel structure, custom steel glazing system, and masonry walls.

THP then developed a report summarizing the survey efforts and significant findings. Using this information, THP developed an outline of recommended repair options, including an opinion of probable costs for the façade repair.



Aerial and ground view of the site.
Aerial Imagery © Google Earth.

BACKGROUND

St John's Unitarian Universalist Façade Study

BUILDING HISTORY

St John's Unitarian Universalist Church was founded in Cincinnati in 1814. In 1952, the church built a new 2-story facility at 320 Resor Street, replacing a small residential structure that previously occupied the site. The new building was only partially constructed, leaving the sanctuary that was designed for the southwest corner of the site for a future phase of construction. (A portion of the basement for this sanctuary was constructed, and was capped with a sloping concrete slab). The design of this planned sanctuary was to match the modest, traditional style of the rest of the facility. The angled entry door of the 1952 construction would remain, and the sanctuary would be built to the southwest of it (Figure 01 & 02).

However, in the following years the sanctuary was redesigned in the International Style. The revised layout extended the full width of the lot, covering the original angled entrance and requiring some intricate structural and foundation modifications. The new design for the sanctuary was iconic – featuring a modern façade with exposed built-up steel columns, exposed concrete floors, a gently curving stucco façade, exposed masonry walls, and glazed clerestory, vertical strip windows and knee wall windows (Figures 03 & 04).

Construction of the sanctuary addition began in 1959 and was completed in 1960. THP's review includes the west, south, and east façades of this addition.

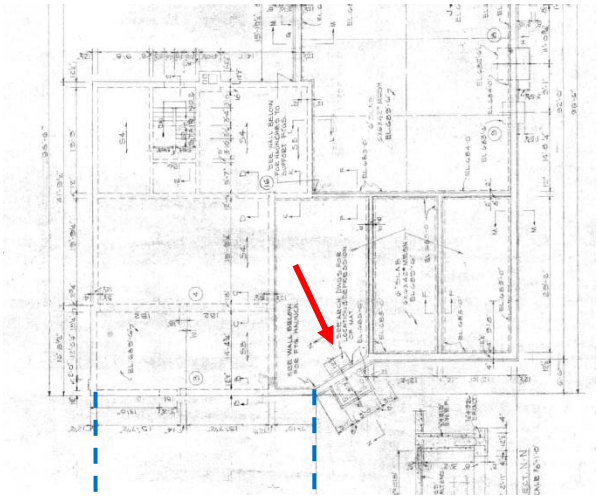


Figure 01
First floor plan of the 1952 building. Note the angled entry (red arrow). The planned sanctuary outline is shown in blue.

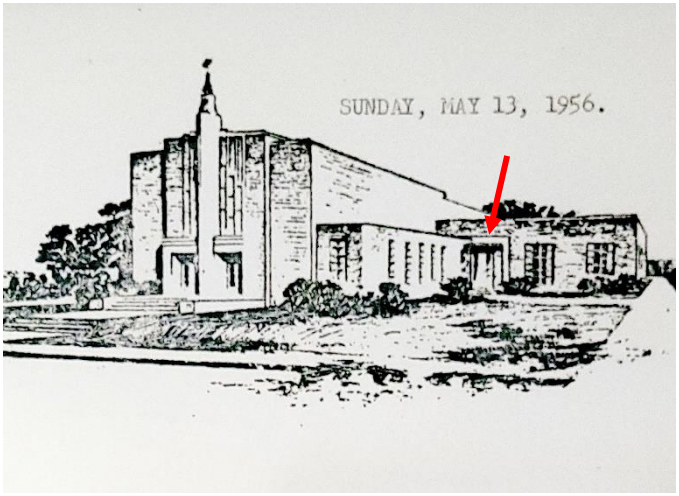


Figure 02
Original rendering of the 1952 building, including the original sanctuary design. Note the angled entry (red arrow).

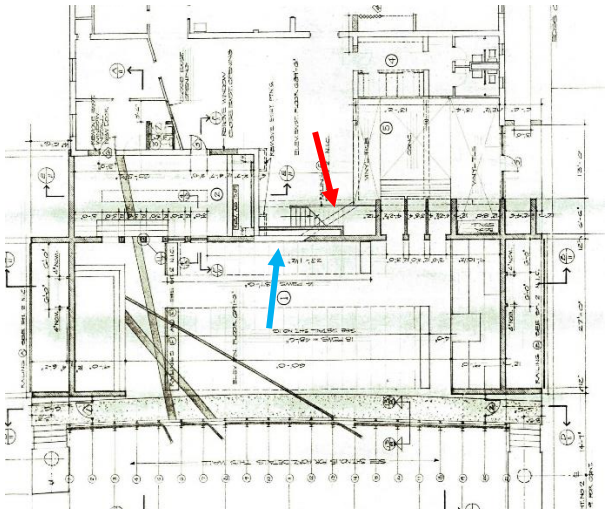


Figure 03
Redesigned sanctuary floorplan. Note the demolished angled entry wall (red arrow). A remnant section of wall (blue arrow) was incorporated into the new design.

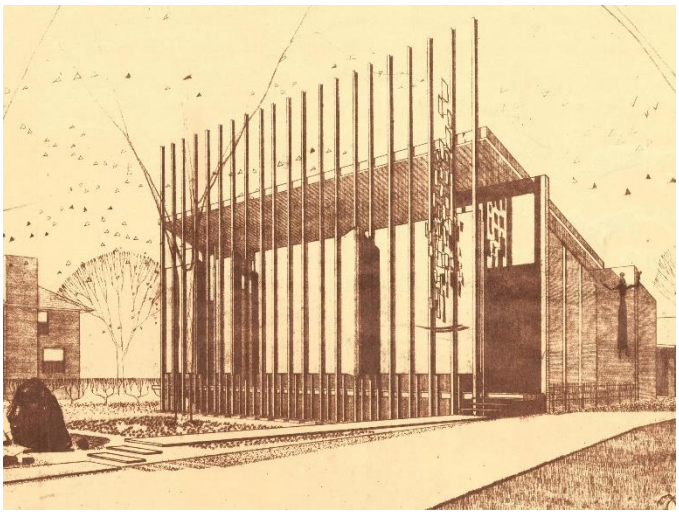


Figure 04
Redesigned sanctuary rendering from the 1959 construction drawings.

LOCAL CLIMATE

Cincinnati's climate is a transition between the south end of the humid continental climate zone and the north end of the humid subtropical climate. These two zones meeting in Cincinnati results in a region of the country that is temperate and wet. However, Cincinnati does see extreme cold and snow during the winter months and extreme heat and humidity during the summer months. Weather patterns typically bring wind and precipitation from the south and west.

During the winter, fluctuations in temperatures allows for freeze-thaw cycles to typically occur from December through February. A freeze-thaw cycle is a constant process of water changing between a liquid and solid state. This occurs daily or over several days with average Fahrenheit daytime temperatures in the 40s and nighttime temperatures in the 20s. In the liquid state, water has the ability to infiltrate small areas and cavities. When water freezes it expands by roughly 9%, and has enough force to crack and shatter stone and deform steel elements.

BUILDING SYSTEMS

Stucco cladding system

The south façade of the sanctuary is an iconic feature wall, with a stucco cladding system that spans the entire width of the façade.

- The stucco system is hung between the paired wide flange columns, supported from the back flange of the outer column. Per the 1959 design drawings, the cladding was designed to be sheet metal, supported by a series of internal steel angles and partial wide flange beams (Figure 05). It is not clear if this metal cladding was ever installed, or if the design changed to stucco prior to construction. The current cladding system features stucco on metal lath at both the interior and exterior of the wall. The internal steel structure and metal panels were not observed.
- At three locations, the stucco system is interrupted by full height vertical glazing (Photo 01). At each of these locations, a section of cantilevered stucco cladding 'peels' away from the wall. The curve of these cantilevers varies from window to window. The three curved walls are angled to align with the different solar equinox events.
- The stucco system is bounded at the top by a steel 'shelf' (see steel system section below). The 1959 design drawings do not call for any additional flashing or covering – however, the system is currently capped with a bent sheet metal flashing piece, pitched to drain towards the south (Photos 02 & 03). The flashing cap is anchored to a double 2x blocking with gasketed screws. The blocking is in turn anchored to the steel shelf. The back of the flashing cap turns up to receive a sealant along the clerestory glazing. At the exposed ends of the stucco system, the flashing turns down to cover the back side of the blocking.
- The bottom of the stucco system is also bounded by a steel 'shelf' (Photo 01 & 05).
- An additional small section of stucco exists below the main wall, enclosing the ends of the floor joists. This area is hung from the inside wide flange columns, and wraps below the floor framing to form a soffit area.

Steel system

The south façade is framed with numerous, welded, hot-rolled steel shapes, supported by a series of paired structural columns.

- The façade is composed of (21) columns pairs, arranged in a slight curve in plan. Each column pair consists of two wide flange steel pieces bearing on a single below-grade steel plate, anchored to a concrete foundation 'wing wall' (Photo 01 & 04). The bearing plate is covered with a concrete cap.
- The outer wide flange columns extend from the foundation to approximately 10' past the top of the roof (Photo 01). The outer columns directly support the stucco cladding, as well as the outer edge of the various steel 'shelves'. At the roof, these outer columns also support a built-up steel beam, which in turn supports the metal roof decking.
- The inner wide flange columns extend approximately 2/3^{rds} of the sanctuary's height. These columns directly support the sanctuary floor framing, as well as the inner edge of the lower steel shelf (Photo 05).
- The outer and inner wide flange columns are connected at several points (Photos 05, 06, 07). They are connected by a ¼" thick steel plate that forms a shelf (at the bottom of the stucco wall, approximately 2'-6" above the sanctuary floor); by trapezoidal shaped ties (at the mid height of the stucco cladding); and by a combination of vertical steel channels with ties (located near the top of the inner wide flange). The channels extend to the underside of the roof decking. They support the upper steel shelf, and form the vertical mullions of the clerestory and vertical strip windows.

Roof assembly

Per the 1959 design drawings, the sanctuary roof is framed with 7 ½" deep metal deck that spans the width of the sanctuary (Figure 06). At the south façade, the decking bears on a custom built-up steel beam, which is in turn supported by the previously mentioned steel columns (Photos 08 & 09). At the north masonry wall, the decking sits on a custom bent steel plate which is anchored to the wall. The drawings show the original roof ventilation strategy, which consisted of louvered vents on the south face of the roof curb. During subsequent roof modifications, these vents were covered, and new vent strips installed on the back side of the curb (Photos 08, 10 & 11). The roof curb is covered with a bent metal cap that is flashed and sealed to the vertical wide flange columns (Photo 11). Though not in the scope of this review, THP did attempt to observe the condition of the roofing material; however, at the time of the site visit most of the roof was covered with snow.

Window System

The sanctuary windows are custom clerestories, full height strip windows, and lower knew wall windows made from built-up steel shapes and insulated glass panels (Figure 07). Design drawings call for beads of "non-hardening caulking" between the steel and insulated glass. The system is relatively simple, relying on small, welded angles to form the glass stops (Photo 12). There are no thermal breaks, as all the primary steel support pieces are continuous from interior to exterior. Doors in the full height strip windows were called out as 1 ¾" Kalamein (metal clad wood) doors. Where the window meets the masonry buttresses, the design drawings call for the system to be anchored into the masonry wall, with an embedded 4"x3" angle.

Masonry walls

The west, north, and east walls of the 1959 addition are solid, multi-wythe brick bearing walls.

- The north wall is an approximately 22' tall masonry wall. It features (5) 14' tall brick arch openings, and (3) 6'-8" arched openings with partial recessed infill (Photo 13). It also incorporates an approximately 9' x 11' section of the original 1952 exterior masonry wall (Photo 13, Figure 08). At both ends, the wall extends beyond the outside of the building approximately 6'-6" to form exterior buttress walls. These

extended portions of wall also form the north walls of the sunken light wells that flank the sanctuary. The entire north wall bears on a mixture of previously existing basement walls, as well as new concrete-brick walls with poured footings (Figure 08).

- The east and west sanctuary walls are mirrored versions of one another. Where they meet the north wall, these side walls are approximately 20'-4" tall, and are capped with a 1'-8" tall clerestory window (Photo 14). As the wall moves south, the top of wall rises, parallel with the sloped roof, increasing in height to approximately 34'-1". On the outside of the building, these walls form the sides of the sunken light wells (Photo 15). Per the 1959 design drawings, these walls are reinforced brick masonry. At the south end of each wall, the wall intersects a 16'-6" long buttress wall (Photo 14), also partially capped with clerestory. Where these buttresses extend outside the building, they form the south walls of the sunken lightwells. Where the buttresses extend into the building, they form alcoves for the organ and altar area, respectively. The buttresses are separated from the south façade by custom full height strip windows.

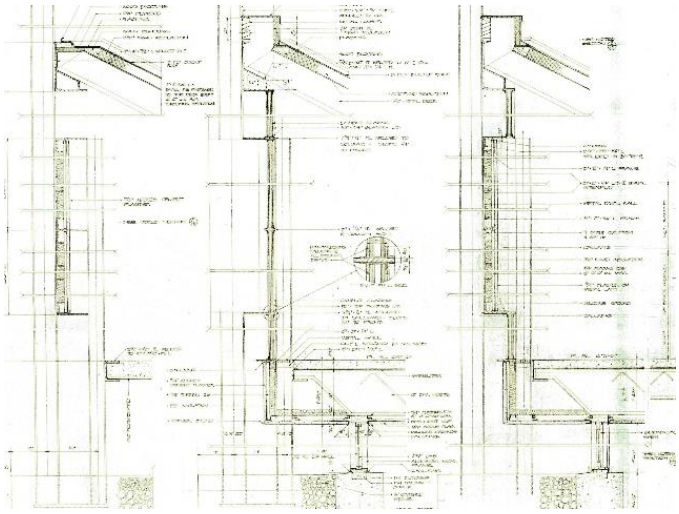


Figure 05
1959 design drawing showing wall sections through the various paired column conditions.

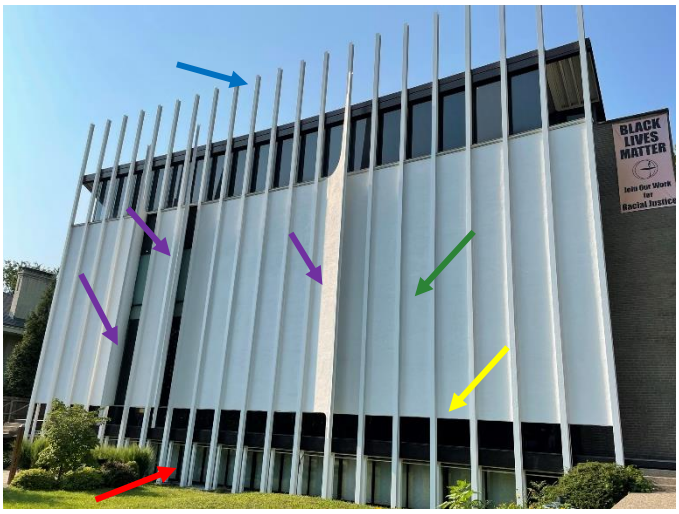


Photo 01
Photo of paired columns (red arrow), stucco cladding (green arrow), bottom steel 'shelf' (yellow arrow) and column extension (blue arrow). Note the cantilevered, curved sections of cladding at full height strip windows (purple arrows).
Photo taken 7/27/2021.

Photo 02
Photo showing bent metal flashing cap over stucco cladding.
Photo taken 1/18/2022

Photo 03
Photo showing bent metal flashing cap at corner of sanctuary.
Photo taken 1/18/2022

Photo 04
Photo showing paired column bearing location, with concealed concrete cap.
Photo taken 1/18/2022.

Photo 05
Interior photo showing the inner wide flange columns (red arrow), lower steel shelf (blue arrow), trapezoidal ties (green arrow), channels (yellow arrow) and upper shelf (purple arrow).
Photo taken 1/13/2022.

Photo 06
Photo of trapezoidal tie between outer and inner wide flange columns (taken at east end of stucco cladding).
Photo taken 1/18/2022.

Photo 07
Photo of lower steel shelf (red arrow), continuous across stucco and window areas.
Photo taken 1/13/2022.

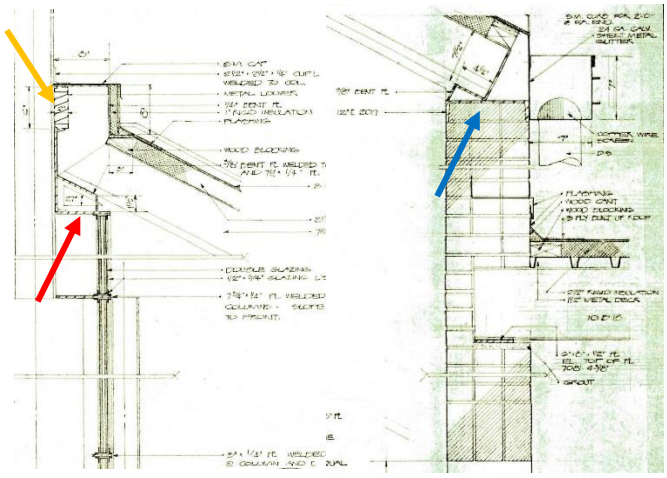


Figure 06
1959 drawings showing roof deck bearing conditions. The custom beam (red arrow) at the south façade is supported by the outer wide flange columns. At the north end, the custom bearing plate (blue arrow) is supported by the masonry wall. Drawing show original ventilation strategy at south face of roof curb (orange arrow).

Photo 08
Photo of the south façade at the roof, showing custom beam (red arrow), covered louvers (orange arrow), roof decking (blue arrow) and metal flashing with vent strips behind (green arrow).
Photo taken 1/18/2022.

Photo 09
Photo of roof deck bearing on the custom beam (hung from the outer wide flange column).
Photo taken 1/18/2022.

Photo 10
Photo of metal trim covering the original louver opening.
Photo taken 1/18/2022

Photo 11
Photo showing upper roof flashing, including joint at wide flange columns (red arrow) and ventilation location (green arrow).
Photo taken 1/18/2022

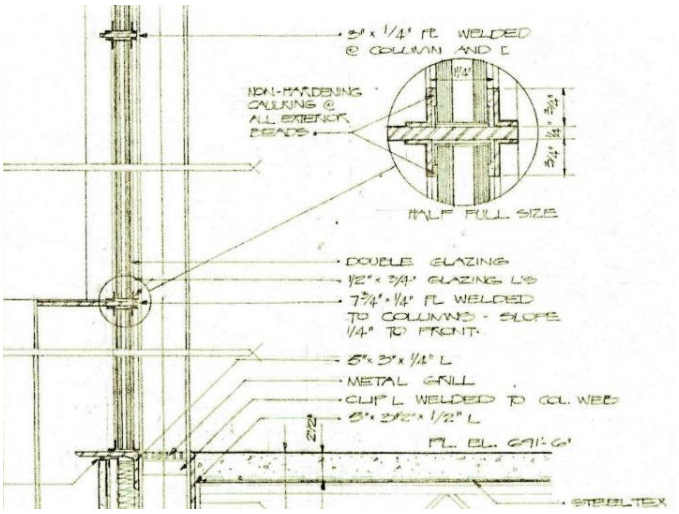


Figure 07
1959 design drawing showing the steel plate and angles that form the shelf and stops of the glazing system.

Photo 12
Photo showing lower steel shelf and window stops.
Photo taken 1/13/2022

Photo 13
Photo of north sanctuary wall, showing large arched openings (red arrow), shorter openings (yellow arrow) and 1952 building partial wall (blue arrow).
Photo taken 1/13/2022.

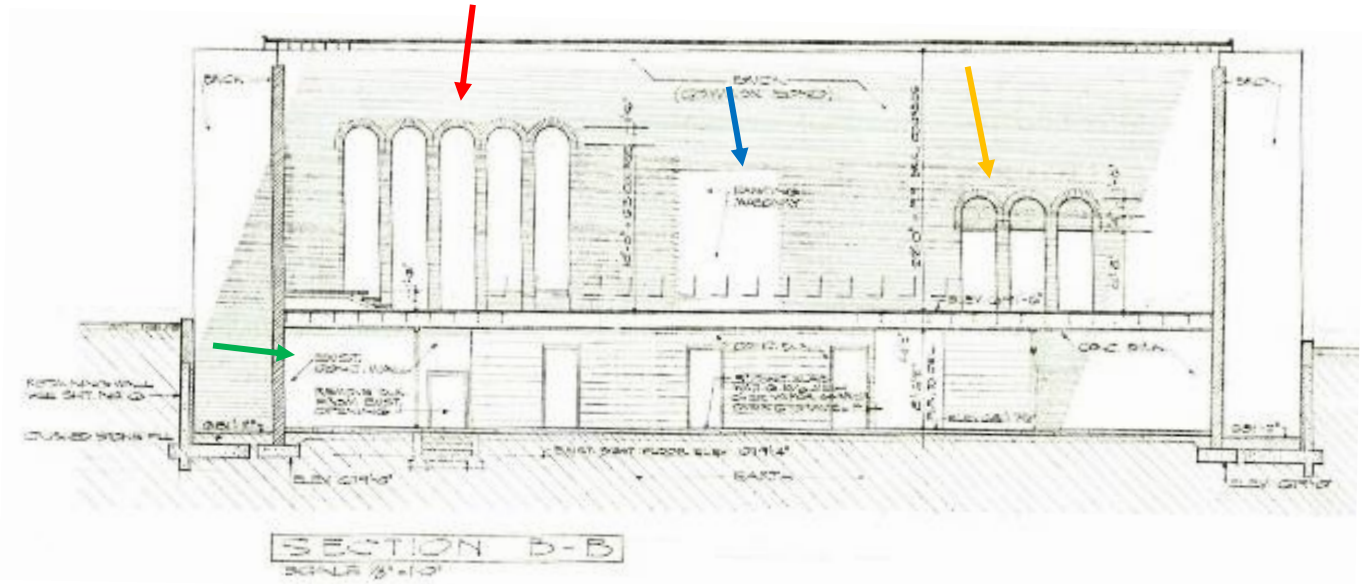


Figure 08
1959 drawing depicting the north wall, showing large arched openings (red arrow), original 1952 partial wall (blue arrow), and shorter openings (yellow arrow). Drawing also indicates portion of basement wall that was part of the 1952 building construction (green arrow).

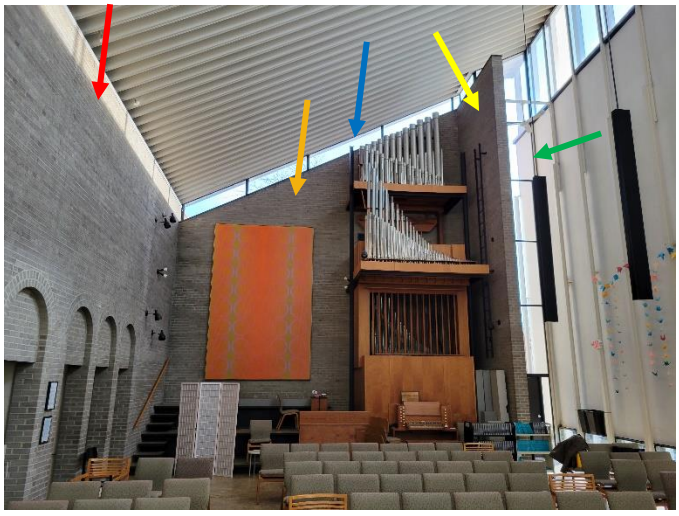


Photo 14
Photo showing north masonry wall (red arrow), east masonry wall (orange arrow), interior buttress wall (yellow arrow), clerestory window

Photo 15
Photo of the sunken lightwell on the east side of the sanctuary.
Photo taken 2/9/2022

REVIEW AND FINDINGS

St John's Unitarian Universalist Façade Study

REVIEW AND FINDINGS

In advance of a full building renovation, THP was asked to review the west, south and east façades of the 1959 sanctuary addition. The church committee has noted leaks and water infiltration along the interior stucco surface, as well as rusting of the various steel elements. During site visits on 1/13/2022, 1/18/2022 and 2/9/2022, THP observed the status of the various façades, and noted the following conditions.

STUCCO WALL SYSTEM

INTERIOR SURFACE

THP observed numerous locations of moisture damage at the interior stucco surface. The most deteriorated areas were located along the lower steel shelf, at the bottom of the stucco wall (Photo 16). At this level, the damage extended intermittently across the full width of the wall, and was concentrated most often around the columns. Deterioration was also noted around the trapezoidal ties (Photo 17). These areas of damage were not as severe as the lower areas. Minimal deterioration of the stucco was seen at the upper reaches of the wall, including where the vertical channels and ties connect the steel at the top of the inner wide flanges. On 1/18/2022, THP and ZSR removed a section of the interior stucco and metal lath to observe the inside of the cladding construction (Photo 18). Though some areas of corrosion were observed, the metal lath was structurally intact (requiring saw cutting to remove). The lathe was wire-tied to light-gauge vertical steel framing members. These members show some surface rust. Inside the wall, paper-backed batt insulation was observed. The paper facer was deteriorated and showed signs of long-term moisture degradation. The lower steel shelf was significantly corroded, along with an attached steel angle (see steel framing section below). Pack rust was visible at the excavation, which correlates to the distress and undulation noted in the steel observations section below.

EXTERIOR SURFACE

The stucco wall was recently painted, and the sealant joints replaced. THP observed several locations of moisture damage at the exterior stucco, though the majority appeared to be free of distress. Damage was observed at the three curved, cantilevered sections of cladding (Photo 19). At these locations, significant swelling of the stucco was noted, as well as rust staining, and signs of previous repairs. At these locations, the bottom off the wall includes a weep rope and hole, though no such system was called out in the 1959 design drawings. Minor stucco damage was also noted wherever the stucco meets the steel frame – at the lower shelf (Photo 20), the curved steel of the cantilevers, and the outer wide flange verticals (Photo 21). (See THP steel observations in section below for *steel* deterioration at these locations). THP also observed several locations of varying stucco surface, possibly indicating past repairs (Photo 22). At the lower stucco area (below the sanctuary floor), several small locations of cracked stucco were observed (Photo 23).

THP observed a variety of deterioration at the metal cap of the stucco system. The gasketed fasteners holding the cap to the wood blocking showed corrosion, and the gaskets were hard and cracked (Photo 24). The cove sealant between the flashing and the wide flange columns did not appear evenly applied. This sealant was hard, disbonded and cracked (Photo 25).

Photo 16
Deteriorated stucco at inside face of south façade, along the lower steel shelf.
Photo taken 1/13/2022

Photo 17
Photo showing deteriorated stucco at the inside face of the south façade, around the trapezoidal steel ties.
Photo taken 7/27/2021.

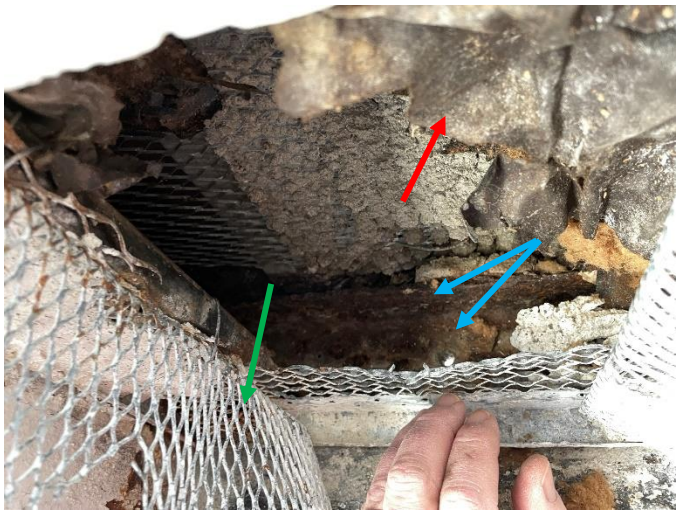


Photo 18
Photo showing interior of stucco cladding system, including insulation (red arrow), metal lathe (green arrow) and lower steel shelf with attached angle (blue arrow).
Photo taken 1/18/2022

Photo 19
Deteriorated stucco at exterior face of cantilevered, curved cladding section. Note weep rope and hole (red arrow).
Photo taken 1/18/2022

Photo 20
Minor *stucco* deterioration at base of cladding, adjacent to steel shelf plate. (See THP steel observations in section below).
Photo taken 1/18/2022

Photo 21
Minor stucco deterioration where stucco meets outer wide flange column.
Photo taken 1/18/2022

Photo 22
Minor variation in stucco finish, indicating possible past repair.
Photo taken 1/18/2022

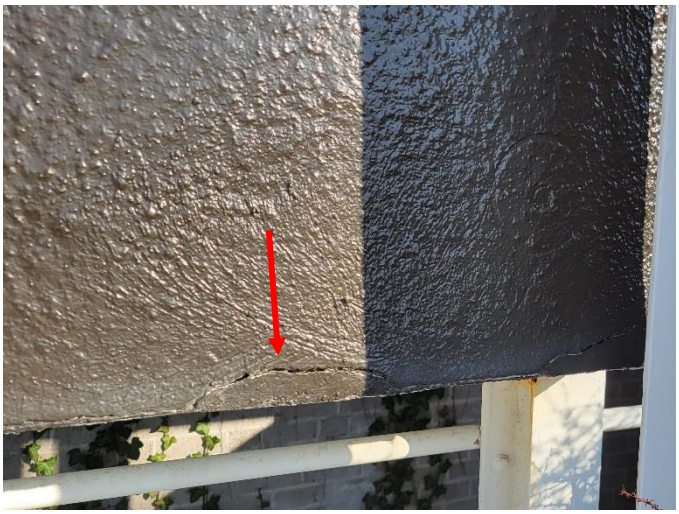


Photo 23
Minor deterioration at lower stucco cladding and soffit (enclosing floor framing).
Photo taken 1/18/2022

Photo 24
Stiff, disbonded and cracked sealant and deteriorated fastener and gasket at bent metal cap flashing.
Photo taken 1/18/2022

Photo 25
Stiff, disbonded and cracked sealant at bent metal cap flashing.
Photo taken 1/18/2022

STEEL STRUCTURAL ELEMENTS

PAIRED COLUMNS

THP observed the paired steel columns from an aerial lift as well as from the ground. At grade, the concrete bearing plate caps appeared pitted, and in some locations were easily chipped with a hammer (Photo 26). Towards the east and west ends of the south façade, dirt and plants have covered the top of the concrete caps. At these locations, the steel columns have significantly rusted and exhibit section loss, due to constant contact with wet material (Photo 27). At other locations, small amounts of corrosion were observed where the steel is embedded in concrete.

Several sections of the columns appear to have never been painted – likely due to accessibility issues (Photo 28). The eastern most vertical window has a narrow clearance, creating difficult working conditions. In these areas, the columns appear to have surface rust. Minimal corrosion was noted elsewhere on the columns.

Several items are anchored to the steel columns, included former louver mounting flanges, and various mounts for signs and banners (Photo 29).

HORIZONTAL STEEL SHELVES AND TIES

THP observed significant deterioration of the lower horizontal steel shelf (Photos 30 & 31). From the exterior, approximately 75% of the length of the plate shows at least moderate deformation/sagging, and approximately 50% shows signs of significant pack rust and material expansion. The plate steel undulates upwards of 1" between vertical columns. The pattern indicates severe pack rust and distress of the plate, which is constrained by the columns, but free to expand and bend at the mid-point (between the columns). As mentioned in the stucco observations above, where ZSR removed a section of stucco, the top surface of the plate can be seen to have significant rust (Photo 32). A small angle, (which appears to support the metal lath) is also significantly rusted. Several of the small steel angles that form the window frame stops have broken free from the plate, due to corrosion/expansion.

The trapezoidal ties that connect the inner and outer wide flange columns show signs of water damage (Photo 33). Those ties visible from the exterior have surface corrosion, and the protective paint coatings have disbonded. Ties visible from the interior also show signs of moisture damage. The stucco surrounding these ties has bubbled, and some streaking of rust is visible.

The upper steel shelf also exhibits some corrosion, as observed from the exterior via an aerial lift, and from the interior via binoculars (Photos 34 & 35). This corrosion appears to only be surface rust, though additional observation and assessment is recommended during the design phase.

ROOF STRUCTURE

THP observed the exterior sections of roof structure and decking from the aerial lift on 1/18/2022. THP did not observe significant amounts of corrosion of the upper custom beam. Some surface rust was observed on the bearing portion itself, as well as some build-up of animal excrement (Photo 36). Surface rust was also observed on the outside of the rake beam (Photo 37), including more significant pitting at the lower end of the beam where it bears on the masonry buttress wall and abuts a bent metal parapet cap (Photo 38).

THP did not observe corrosion of the exposed roof deck members – however, paint was significantly disbonded from the decking (Photo 39).

CONCRETE SUPPORT ANGLES

On either side of the sanctuary, flanking the south façade, are small sections of concrete slab that form the door landings. The outer edges of these landings are cantilevered, and the inner edges bear on ledge angles, which are in turn mounted to the masonry buttress walls. At both side of the sanctuary, the angles are significantly deteriorated, and some spalling concrete and corroded rebar was present on the underside of the slab (Photo 40). Surface corrosion is present at the built-up steel that forms the outer-edges of the slabs. Both concrete landings show diagonal cracks across the outer corner. Chain-dragging of the slab indicated that approximately 25% of the concrete has delaminated (Photo 41).

Photo 26
Typical column bearing, showing some deterioration of concrete and corrosion of steel.
Photo taken 2/9/2022

Photo 27
Significant corrosion of steel column exhibiting section loss (typical of columns at either end of south façade).
Photo taken 2/9/2022

Photo 28
Photo looking up within the eastern window opening, showing section of unpainted, rusting outer wide flange column.
Photo taken 1/18/2022

Photo 29
Photo showing miscellaneous hangers mounted to steel columns (red arrow).
Photo taken 1/18/2022

Photo 30
Significant deterioration of lower shelf steel plate. Swelling is indicative of pack rust.
Photo taken 2/9/2022

Photo 31
Undulation indicating additional deformation of lower steel shelf due to corrosion/pack rust.
Photo taken 2/9/2022

Photo 32
Significant corrosion of lower shelf, along with small, attached angle.
Photo taken 1/18/2022

Photo 33
Photo of corrosion at trapezoidal steel ties.
Photo taken 1/18/2022

Photo 34
Photo of surface rust at upper steel plate (as seen at façade end, behind bent metal cap piece).
Photo taken 1/18/2022

Photo 35
Deterioration of sealant between curved steel top shelf and stucco system.
Photo taken 1/18/2022

Photo 36
Photo showing corrosion and animal excrement at roof deck bearing plate (part of built-up custom roof beam).
Photo taken 1/18/2022

Photo 37
Photo showing minor corrosion on the roof rake beam.
Photo taken 1/18/2022

Photo 38
Photo showing corrosion at lower bearing of roof rake beam, where beam bears on the masonry buttress wall.
Photo taken 1/18/2022

Photo 39
Photo showing debonding of paint at exterior section of roof decking.
Photo taken 1/18/2022

Photo 40
Photo showing underside of cantilevered landing slab, with corroded support angle (red arrow) and spalling concrete (blue arrows).
Photo taken 2/28/2022

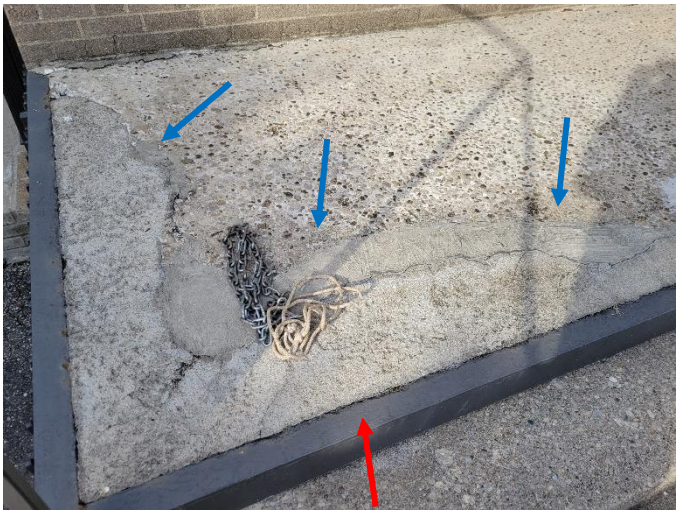


Photo 41
Photo of surface corrosion on cantilevered steel (red arrow) and cracked/delaminated concrete along outside edges of slab.
Photo taken 2/28/2022

WINDOW SYSTEM

Deterioration was noted at multiple parts of the window system.

- Insulation glazing units (IGU), or the glass panes, are typically free of cracks and fogging. This indicates the IGU gaskets are still functioning. One IGU was cracked.
- At the lower steel shelf, pack rust and corrosion of the plate steel has caused several angle glazing stops to either corrode or break free (Photo 42).
- Similar corrosion and deterioration of the stops of the clerestory windows was visible via binoculars (Photo 43).
- The exterior sealant between the outer frame and the insulated glazing has stiffened and disbonded in some locations.
- The steel window system around the flanking sanctuary entry doors is rusted. The bottoms of the doors themselves are significantly rusted (Photo 44).
- The support angle set in the masonry buttress wall (that anchors the window system) is exposed in some locations. The visible sections of steel have some surface rust. Additional cracks in the mortar above and below are visible (Photo 45).

Photo 42
Photo showing loose angle glazing stop at lower shelf.
Photo taken 2/9/2022

Photo 43
Photo showing loose angle glazing stop at upper shelf.
Photo taken 1/18/2022

Photo 44
Photo showing rust at glazing system around entry door, and corrosion of door itself.
Photo taken 1/18/2022

Photo 45
Photo showing surface rust at window anchor angle, as well as deteriorated sealant around glazing.
Photo taken 2/9/2022

MASONRY WALLS

THP observed several areas of deterioration at the various masonry walls.

NORTH SANCTUARY WALL

- Where the north wall meets the east and west walls, it appears that the brick of two walls were not toothed together or connected. A vertical joint existing between the two walls is filled with mortar. Typical of both the interior and exterior of the building, isolated areas of this mortar are loose, cracked or missing. (Photo 46 & 47). No other connection between the walls is readily visible or indicated on the drawings.
- Where the north wall extends past the building perimeter to form the east buttress wall, it is capped with bent metal flashing that shows some surface rusting. A stepped horizontal crack exists in the bed joints 5 and 6 courses from the top of the wall (Photo 48). This upper section of wall is shifted out of plane with the wall below (Photo 49). Evidence of past repairs can also be seen (multiple layers of mortar are visible).
- Where the north wall extends to form the west buttress wall, some isolated areas of spalled and cracked bricks and mortar were observed. The bent metal cap here also appears to have surface rust.

EAST WALL

- Where the east masonry wall turns to form an exterior buttress, the cast stone cap is loose, and is not anchored to the wall below (Photo 50). Some evidence of prior repair can be seen, as evidenced by different color mortar joints and infill brick (Photo 51).

WEST WALL

- Similar evidence of past repair can be seen at the west wall buttress.

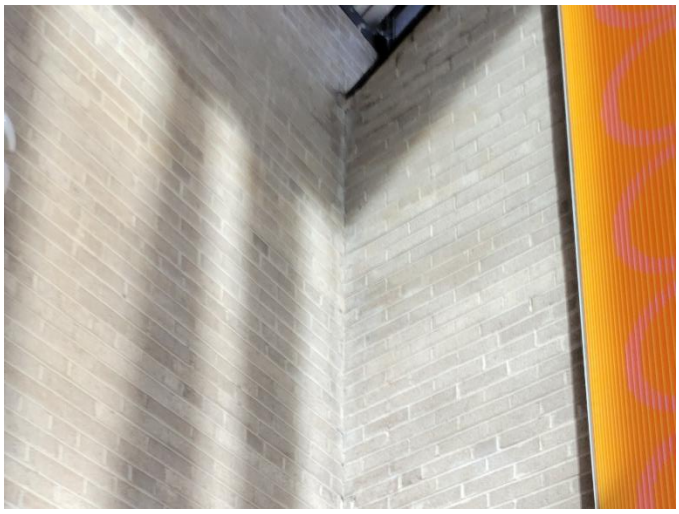


Photo 46
Photo showing inside corner where the north masonry wall meets the east wall. Mortar at this joint is loose.
Photo taken 1/18/2022

Photo 47
Photo showing outside corner where north masonry wall meets the east wall. Mortar at this joint is loose or missing.
Photo taken 1/18/2022

Photo 48
Photo showing corroded bent metal flashing cap, and loose bed joints at masonry buttress wall.
Photo taken 1/18/2022

Photo 49
Photo showing shifted section of masonry wall.
Photo taken 1/18/2022

Photo 50
Photo showing disbonded mortar and loose wall cap at east wall buttress.
Photo taken 1/18/2022

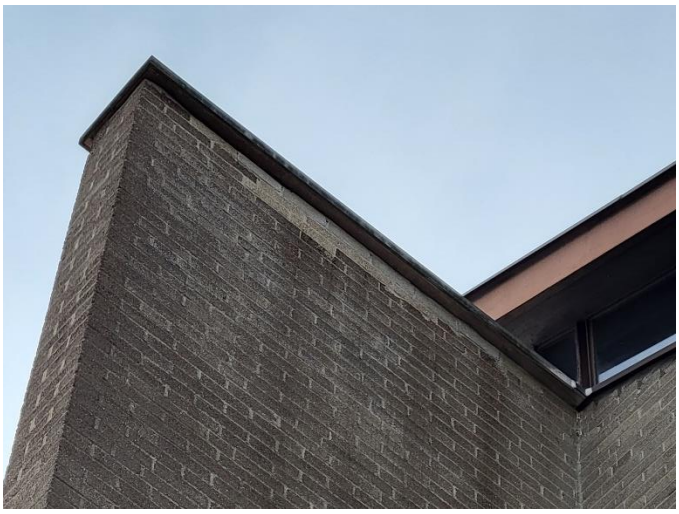


Photo 51
Photo showing evidence of past masonry repairs (included unmatched brick and mortar) at back of east wall buttress.
Photo taken 2/9/2022

DISCUSSION AND RECOMMENDATIONS

DISCUSSION AND RECOMMENDATIONS

The existing stucco and brick wall systems are considered 'barrier wall' systems. Basically, all moisture that comes in contact with the walls is shed. The masonry walls have a limited capacity to absorb some of the moisture that hits it – which will in turn migrate back out of the system as environmental conditions allow. Distress or deterioration of the various wall components allows moisture to infiltrate the wall, remain trapped, and further compound the deterioration of the wall. Critical for the longevity of these walls systems is the maintenance and repair of the various system pieces to keep the water out, such as sealants and mortar joints.

STUCCO WALL SYSTEM

The majority of the deterioration observed by THP was concentrated on the south façade, in the stucco wall and it's supporting steel shelf. Specifically, the deterioration seems concentrated at the bottom of the assembly. As mentioned, this wall is considered a 'barrier wall' system. The design relies on the outer surface of the system to keep water completely out. Any water that does enter the system would migrate to this lowest level (the steel plate). THP did not find any indication in the design drawings that the system was designed to 'weep', or remove water that might enter between construction layers. Though a few weeps were observed on the underside of the lower steel shelf, their placement was inconsistent - leading one to believe they were installed as a remedial effort at locations of recurring damage. (The weep locations did correspond to areas with the most extensive damage).

CAP FLASHING REPAIR

Water is potentially entering the stucco system at the top of the wall, along the intersection of the bent metal flashing and the vertical steel. By extending the vertical steel past the top of the wall, the original building design has created a very difficult situation to mitigate water intrusion. As installed, the flashing pitches water forward onto the back of the steel flange, relying on a single bead of sealant at this joint. This sealant has since failed, allowing water infiltration.

The sealant between the cap flashing and the clerestory glazing is another suspect location, where water may be entering the system. This joint is somewhat protected, due to the overhanging roof above. However, the sealant is stiff, disbonded and cracked and is recommended for replacement. If water does bypass this sealant, it can reach the upper steel shelf and from there find its way into the wall (through the blocking attachment locations and down the wall system).

THP recommends that the sheet metal flashing of the cap be replaced. After removing the existing flashing and blocking, the steel horizontal shelf should be checked for deterioration, primed and painted. Blocking should be reinstalled/replaced, and new sheet metal flashing installed. The sheet metal should be shaped so as to direct water away from the sides/backs of the wide flange columns. Where the flashing meets the glazing, silicon wet seal can be applied.

WINDOW & PERIMETER SEALANTS

The sealant around the perimeter of the steel frame is stiff, disbonded and cracked. Window sealants are similarly deteriorated. All sealants should be replaced.

FINISH REPAIR

At the exterior, THP recommends removal of deteriorated stucco at the tips of the curved, cantilevered sections. Loose and uneven material should be removed, and new stucco applied over the existing lathe (provide new lathe where existing is deteriorated). Where the steel shelf is recommended for replacement (see steel section below), an approximately 12" tall section of stucco will also be required to be replaced along the entire width of the system. After these exterior repairs are complete, deteriorated stucco finish at the interior will need to be repaired. This includes areas of damage along the lower shelf, as well as the areas around the trapezoidal steel ties (see steel section below for repair of the steel itself). Loose material should be removed, and new stucco applied. Once all stucco and steel repairs are complete, both interior and exterior walls should be repainted. This will provide a consistent appearance and provide a warranted system (as compared to individual repair areas).

INSULATION REPLACEMENT

THP's thermal scans indicated a consistent reading, which implies that the insulation is present and attached to the sub-framing (and has not fallen within the cavity). Based on distress patterns and the excavation it is clear the batt insulation is being exposed to moisture. The moisture deteriorates the paper facer and reduces the overall performance of the insulation. Ideally, the insulation would be replaced. To replace the insulation, it is anticipated that large areas of the stucco wall will need to be removed to provide access. This work will add significant cost and increase the construction impact to church operations. Tests could be completed to assess the cost to replace vs. the value of the new insulation, but this is outside the scope of this report. If final stucco repairs expand or the project includes expanded wall repairs, then THP recommends replacing the insulation. A line item for this work is not included in this report's opinion of probable costs.

STEEL STRUCTURAL ELEMENTS

The corrosion of steel is a progressive chemical process, that if left unchecked, will eventually return steel back into an iron dust. As material rusts away (section loss), the strength of the steel member decreases. Initial mostly cosmetic 'surface rust' will develop into 'pitting', followed by 'pack' rust. During this last form of deterioration, multiple layers of expanded rust form on the surface of the steel, expanding to upwards of ten times its original thickness. This expansion has the force to deform and shift various building elements. As previously mentioned, the design of the steel structure at St John's is very unique, but the design creates detailing and waterproofing challenges. Different areas have suffered varying degrees of steel corrosion due to several design or environmental issues:

THERMAL BRIDGING

The extensive use of steel members that connect from the outside of the building to the interior results in significant thermal bridging. (Thermal bridging is the transfer of thermal load across the building envelope via conduction). Such bridging not only affects the comfort of the interior environment but can also create condensation points in or on the wall system. When warm moist interior air encounters cold steel structural members, moisture in the air may condense. Such condensation may be one of the sources of the stucco deterioration seen in the south façade (such as the deterioration at the trapezoidal ties).

This issue is integral to the original design of the structure and cannot be easily mitigated without significant modification to the wall construction and change in the architectural character of the building - essentially, a full rebuild of the wall would be required. Instead, THP recommends that repairs be completed to address the deterioration, along with modifications to the flashing to minimize water and moisture vapor infiltration into the

wall system (to reduce condensation). If these initial repairs are completed successfully, then the church should anticipate maintenance repairs on a 15-20 year cycle to maintain sealant joint and minor wall repairs.

CONTACT WITH GROUND MOISTURE

Some corrosion was noted where the paired steel column members are embedded in the concrete. Most of the concrete caps are intact, though the material itself is pitted and was easily chipped. At the majority of the column pairs (17 of the 21) THP only observed surface deterioration of the steel. These areas should be cleaned, prepared and painted. At the outer most column pairs (4 of the 21 locations), more significant deterioration was observed, including areas with section loss. This additional deterioration is due to soil and plant material that is in direct contact with the steel. These areas should be cleared of excess soil and plants, and the soil regraded (both to eliminate direct contact, and to direct water flow away from the steel. After clearing the area, the steel should be evaluated and reinforced as necessary (including removal of concrete caps, welding of new steel plate onto the flanges, and replacement of the caps).

COLUMN PAINTING

The majority of the paint finish on the vertical steel columns seems to be well bonded and intact. Where surface corrosion was observed, the column should have loose material remove, and the steel prepared and repainted. In addition, THP noted areas where the columns appear to have never been painted, due to the tight access. These areas should also be painted – either by removing the glazing units to provide access from the interior of the building, or by using custom extension tools to reach the steel from above and below.

STEEL SHELF REPLACEMENT

As mentioned in the stucco section above, the bulk of the water damage appears at the bottom of the cladding system. Water has likely pooled on top of the lower horizontal steel shelf, facilitating the corrosion of the steel plate and the deterioration of the stucco. THP observed significant deformation and expansion of the steel due to pack rust. Based on the extent of the damage, THP recommends that the entire shelf be replaced. THP recommends that several improvements be considered regarding the design of the new shelf.

- At the exterior edge, the shelf design should incorporate a drip edge, to keep any water rolling down the outside face of the stucco from entering the system.
- Though the recommended repair of the cap flashing will reduce water entering the system, condensation may still cause some moisture to collect inside the wall. The top surface of the new shelf should be coated with a water-proof membrane, including back and end dams.
- While the stucco wall is not a "cavity wall system", THP recommends adding regular weeps to allow for any moisture inside the system a pathway to the exterior.

ROOF STRUCTURE REPAIR

THP noted several areas of corrosion in the structural steel roof beams. Areas of surface rust should be cleaned, prepared, and painted. At the bottom of the rake beam, where the steel has pitted, the parapet cap should be reworked to better shed water away from the beam (see masonry section below). Corroded steel should be prepared and repainted. The metal roof deck should similarly be stripped of all loose paint, prepared, and repainted. THP also noted an opening between the interior and exterior of the building at the end of the metal decking, that has been temporarily filled with wire brushes. This gap should be closed.

CONCRETE SLABS AND STEEL SUPPORT ANGLES

The steel angles supporting the landings at the flanking sanctuary doors have corroded, likely due to water and salt exposure over time. The joint between the masonry wall and the concrete slab is not sealed, allowing water between the concrete and masonry to reach the steel. Given the difficulty of accessing this steel, THP recommends the concrete be temporarily shored, loose steel removed, and a new galvanized steel angle be installed under the slab. New cove sealant should be installed at the joint between the slab and the masonry, to limit future water intrusion.

The delaminated areas of concrete (approximately 25% of the slabs) should be removed. The outer steel beams should be cleaned and coated with epoxy paint, and concrete then repoured. At the underside of the slab, loose concrete should be removed, exposed rebar coated with epoxy, and new concrete patch material installed.

Given the pattern of the concrete deterioration, it is possible that deflection of the outer steel cantilevered beam has allowed the concrete slabs to crack. THP suggests that an additional supporting steel be installed to limit similar future deterioration. A new footing, post and drop beam should be installed, set back from the slab edges.

WINDOW SYSTEM

The careful use of light is one of the main design elements of the 1959 sanctuary space. This is partially achieved with thin-sightline steel windows. The window system is relatively simple – steel plates and angles are used to form glass pockets, and thin steel angles are attached as glazing stops. Achievement of an air/water seal relies on sealant. Typical of industrial style windows from this era, the windows lack thermal breaks, weeps, and gaskets. Over time, the lack of these elements has resulted in corrosion of the steel elements, water intrusion, failure of several window stops, and some broken glass. While full replacement of the system could provide better performing windows, such a change will be expensive, require the wall to be reworked and change the architectural character of the windows/wall. Instead, THP would recommend restoring the existing system.

THP recommends that the glass from the window systems be temporarily removed, the steel frames repaired, and the glass be reinstalled and sealed. The interior steel stops should be replaced in kind. All steel should be cleaned of loose material, prepared, and repainted (including the inside of the glass pocket). New silicon sealant should be installed.

Where the vertical strip windows are anchored to the masonry, THP recommends that the loose mortar be removed, repaired and new anchors installed. In conjunction with this repair, the steel should be prepared and painted. The angle should be anchored to the masonry with mechanical fasteners, and the joint filled with silicone sealant.

THP also recommends that the doors of the window system be replaced with compatible, insulated metal-clad doors. Continued maintenance of these area will be required, given the likely continued exposure to water and salt.

MASONRY WALLS

Given the climate of Cincinnati, multiple cycles of freeze-thaw can have significant effects on masonry construction. If moisture is allowed to enter a wall, the expansion of the water as it freezes has the ability to

debond courses of masonry, and spall the face of individual bricks. The following masonry repairs are recommended to repair and prevent masonry damage:

- At both interior and exterior inside corners, where the intersecting masonry walls are not toothed together, a new sealant joint should be provided. All loose material should be removed from the joint, mortar cleared, and the new joint installed.
- At the exterior east end of the north masonry wall, the top 6 courses of should be removed and rebuilt. Salvage brick should be used when possible, supplemented by new brick to match. Both horizontal and vertical reinforcing should be provided.
- The bent metal cap flashing at both exterior ends of the north walls should be replaced. The new cap flashing should be detailed so as to provide turned-up 'side dams' to prevent water pooling at the steel roof beam
- At the exterior buttress portions of the east and west walls, loose stone caps should be removed. Loose mortar should be repaired. The stone caps should then either be reinstalled with new through-wall flashing and anchors, or replaced with bent metal flashing to match the adjacent walls.
- Not included in the opinion of cost, but worth further discussion, is whether to address areas of previous repair in this area. The non-matching mortar and brick could be replaced to better match the surrounding, original masonry.

OPINION OF PROBABLE COST

St John's Unitarian Universalist Façade Study

OPINION OF PROBABLE COST

PROBABLE COST BREAKDOWN

THP has developed a recommended series of repairs. The total opinion probable cost is $272,000.00. A complete breakdown of the recommended scope and associated probable costs is included at the end of this report section.

Figures are an opinion of probable cost in 2022 dollars. Contractor overhead and profit along with Consulting fees is included in the costs. The current construction market is very volatile with shortages of materials and labor. THP anticipates this continuing through 2023. THP does not warrant the opinion of probable cost and final project costs may vary due to changes in design, contractor bidding, market forces, and unknown field conditions.

All findings and recommendations are based on conditions existing as of the date of the Survey and assume the original design and construction of the church met appropriate standards. Unless otherwise noted in this report, review of conditions hidden or indeterminable from visual assessment were excluded from THP's scope of work. Analysis of the structure for code compliance with original or present-day codes is excluded.

THP's professional services are performed in accordance with generally accepted professional standards of care appropriate for the size, complexity, schedule and other characteristics of this project, and the recommendations provided are appropriate given the scope of our review. THP cannot precisely predict when structural and waterproofing components may fail or otherwise require additional repair. This report contains no express or implied warranty concerning the observations, conclusions and recommendations. Conditions change with time and use of the facility, thereby meriting further inspection as well as potential changes in the recommendations contained herein. It is possible that the need for repairs or maintenance identified through this report may be accelerated due to conditions or events outside of THP's control, which may include events that occur after the Survey was completed. It is critical that the Client/Owner timely implement the repairs and maintenance identified in the report and periodically re- evaluate for future repairs and maintenance.

The conclusion and recommendations in this report are provided for repair/maintenance planning and budgeting purposes. This report is not intended to be used as a construction document.

St. John Unitarian Universalist Façade Repair

Opinion of Probable Cost

Effort[1]		**Estimates**[2][3]
South Column Flashing Roof Flashing Replacement	$	5,000.00
South Upper Window Restoration	$	17,000.00
South Lower Window Restoration	$	15,000.00
South Vertical Window Restoration	$	26,000.00
East Rake Window Restoration	$	4,000.00
West Rake Window Restoration	$	4,000.00
East Vertical Window Restoration	$	7,000.00
West Vertical Window Restoration	$	7,000.00
South Glazing IGU Replacement	$	1,000.00
South Elevation Cap Flashing / Column Flashing	$	6,000.00
South Elevation Plate Replacement	$	19,000.00
South Elevation steel plate stucco repair	$	2,000.00
South Elevation stucco repair	$	5,000.00
South Elevation Grade Adjustement	$	11,000.00
South elevation Exterior Steel Coating	$	9,000.00
South elevation Exterior stucco coating	$	4,000.00
South elevation Interior stucco coating	$	3,000.00
South elevation interior steel coating	$	5,000.00
Exterior roof steel repair and paint	$	3,000.00
North Wing Wall (east and west)	$	14,000.00
Masonry Pointing	$	2,000.00
Repaired steel at landing slab	$	3,000.00
Landing slab repair	$	8,000.00
New Posts at landing slab	$	5,000.00
Wing wall caps	$	2,000.00
Aerial platforms	$	13,000.00
Scaffolding	$	52,000.00
Contingency[4]	$	34,000.00
2021 Subtotal	**$**	**286,000.00**

The following notes supplement the Opinion of Probable Cost and are referenced as a superscript where applicable.

NOTES:
(1) Refer to Discussion and Recommendation section of this report for additional information.
(2) Probable costs are based on 2022 dollars.
(3) Probable costs include allowances for Contractor general conditions and A/E fees.
(4) Contingency funds for unidentified scope and hidden conditions.