HGA

Lake Forest Library
Dome and Pedestal Repair Recommendations

This report presents findings from site investigation of the copper dome, masonry pedestal, and rotunda attic space performed December 2018.

INTRODUCTION

The centerpiece of the Lake Forest Public Library, and arguably its most character defining feature, is the 18' high, 33' wide copper covered dome. Water infiltration through the dome roof enclosure has been an ongoing issue throughout the buildings' history. Evidence of longterm water infiltration is notable in the attic space and dome base. The dome, originally described as lead, was replaced with lead coated copper in 1984. Restoration of interior finishes was completed shortly after roof repairs were completed. Localized deterioration of interior finishes in the rotunda has since been noted and conditions appear to be worsening. The most pressing concern is adequate protection of and long term preservation of historic interior finishes and the original rotunda murals created by nationally renown artist Nicolai Remisoff.

Staff reported accelerated deterioration of interior rotunda finishes in early 2018. Water infiltration was attibuted to the domed roof assembly. In response, the copper clad dome and associated roof features were enclosed with a protective plastic tarp. The intent of this temporary measure was to protect interior finishes from further water related damage until more extensive repair work could be undertaken. By the end of 2018 the tarp had deteriorated to a point where it was no longer serving its intended purpose. Bids were solicited from contractors to either a) install a new tarp system to stabilize conditions in the short term, or b) offer suggestions for repair. However, with no formalized plan in place, contractor proposed solutions lacked a commitment to responsible stewardship and varied considerably in their approach to durability which was reflected the range of estimated costs received.

With a legitimate concern for inclement weather and fast approaching winter conditions, a decision needed to be made quickly. Merits, disadvantages, and costs of various proposals were considered. The most cost effective solution, and the quickest one to implement, was temporary protection. This strategy did provide an adequate level of protection for nearly a year. Therefore, temporary protection is considered to be an appropriate short term protective measure, giving Lake Forest Library the necessary time to plan and prepare for a more permanent solution.

STATEMENT OF PURPOSE

In order to better understand the extent and nature of deterioration, HGA was commissioned to provide professional services for a focused condition assessment of the dome, pedestal base and attic, prior to installation of temporary protection. The specific purpose of this investigation is to observe some previously hidden conditions, verify overall dimensions, and evaluate material integrity. The broader goal of this report is to develop a strategy for treatment and options for repair along with order of magnitude cost estimating to help guide decision making.

Copper dome and stone base (1930s)

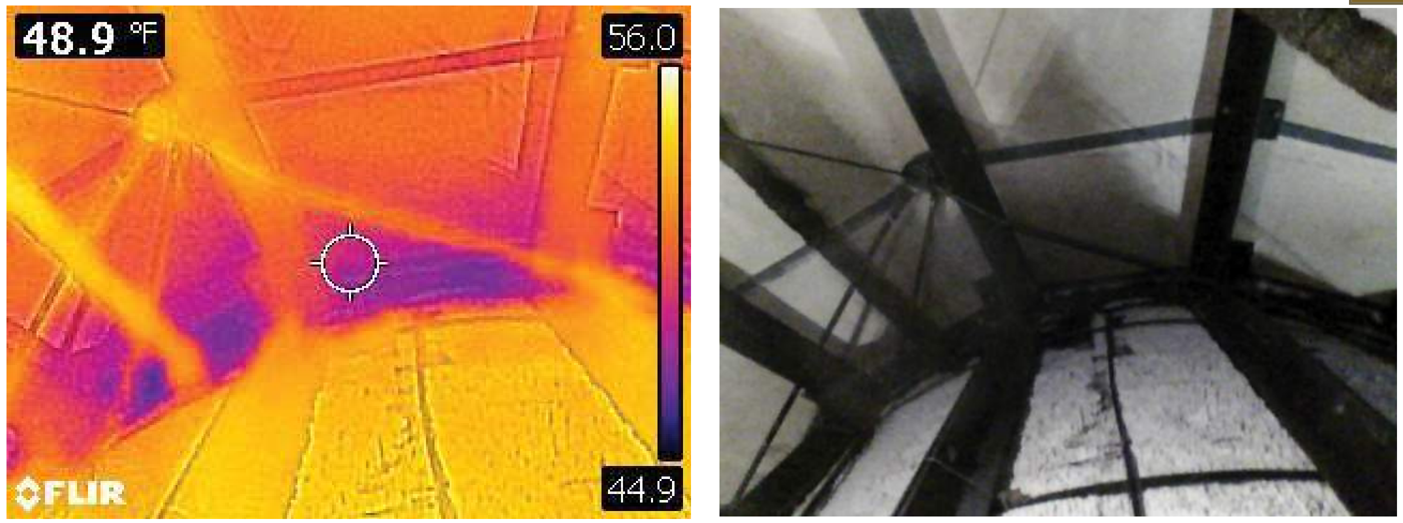
Temporary protection (July, 2018)

Temporary protection (December, 2018)

METHODOLOGY

In early 2018, Lake Forest Library commissioned HGA to provide professional services for a feasibility study which included a preliminary building condition assessment. On March 30, 2018, HGA's team of architects and engineers surveyed site conditions but were not able to directly observe the dome, copper roof assemblies, flashing terminations and transitions, soldered joints, or stone features covered by the temporary enclosure. Preliminary evaluation of the dome was based on review of materials and conditions visible from the rotunda and from within the attic space located above the rotunda and below the dome.

In December 2018, HGA was contracted to perform a focused condition assessment of the Lake Forest Library copper dome, masonry pedestal, and rotunda attic space. Senior Project Architect Stephen Peper conducted a field survey on December 17-18, 2018. Overall dimensions were field verified with hand measurements and conditions were documented with digital photography. Infrared thermography was also used to determine potential sources of air and/or water infiltration. Access was limited to areas that could be reached by ladder from the flat roof of the central north wing. Although conditions may vary slightly from one facade or corner to another, for cost estimating purposes, distress observed at the northwest corner is assumed to be typical. Estimated costs associated with the project were provided by HGA Senior Cost Estimator Mark MacDonald.



Infrared image and accompanying photo looking up at the juncture of the dome and the plaster light shaft in the attic. These images help to understand where potential water issues exist beyond what is visible to the eye.

SUMMARY OF FINDINGS

PRELIMINARY ASSESSMENT

Observations made during the preliminary investigation questioned whether the major source of water infiltration was coming from the convex sloped copper roofs at the corners of the dome base rather than the copper dome itself. Minimal water staining on the paper faced substrate forming the underside of the dome structure suggests that the copper panel and batten system was not the primary source of infiltration. Discoloration of the substrate at the base of the dome and more pronounced water staining at the wood framed knee wall, in addition to areas of isolated wood rot, indicate that the transition between the dome and vertical copper fascia panels could possibly be a contributing source. The most significant indicator of prolonged water infiltration, widespread and dense accumulation of efflorescence, was observed throughout the interior face of the brick back up wall that forms the dome base. The most severe conditions occur at areas located directly below the sloped roof assemblies at the four corners of the pedestal. The heaviest accumulation of efflorescence occurs at the lower portion of the wall, directly above the concrete beam, an area that corresponds to the perimeter gutter and stone ledge.

NOTE ON TERMINOLOGY

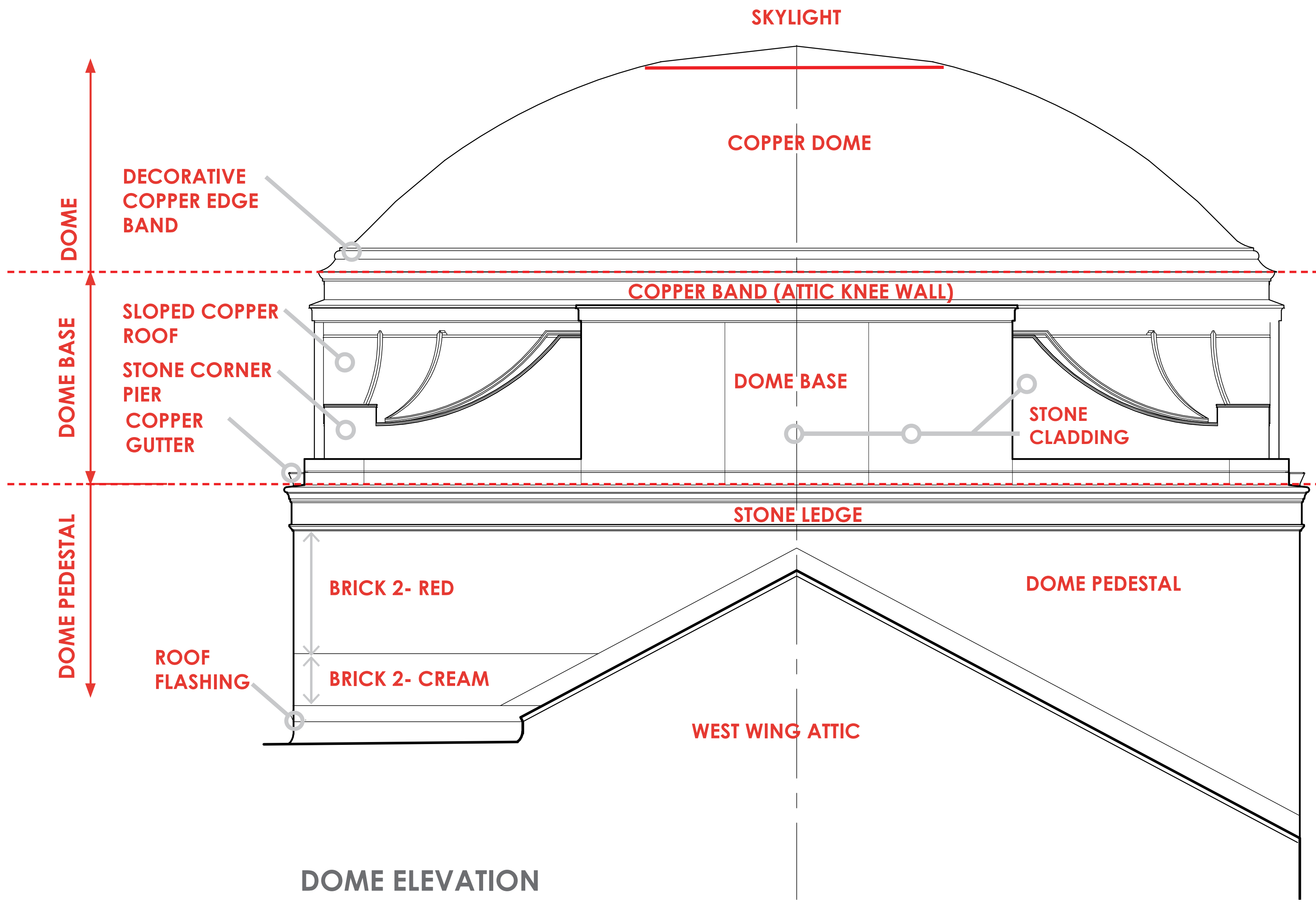
For the purpose of organizational clarity, the central wing roof assembly is divided into four major elements that are characterized by distinct construction methodology. See diagram on page 4 and 5.

1. COPPER DOME
   - A. Skylight
   - B. Copper Roofing- flat panels, battens, decorative edge band
   - C. Dome Structure- steel truss, cementitious infill, wood sleepers
2. DOME BASE
   - A. Stone Veneer Panels- brick masonry back up wall (see attic)
   - A. Square corner piers
   - B. Copper Roofing- fascia panels, sloped copper corner roofs (framing system is unknown)
3. ROTUNDA ATTIC
   - A. Brick masonry backup wall (substrate for stone veneer panels)
   - B. Wood framed knee wall (substrate for copper fascia panels)
   - C. Plaster light shaft
   - D. Rotunda Laylight
   - E. Ductwork, skylight condensate piping
4. PEDESTAL
   - A. Copper perimeter gutter & downspouts
   - B. Pedestal Flashing
   - C. Pedestal Brick (Type-1, Type-2)
   - D. Attic Access Door- wood

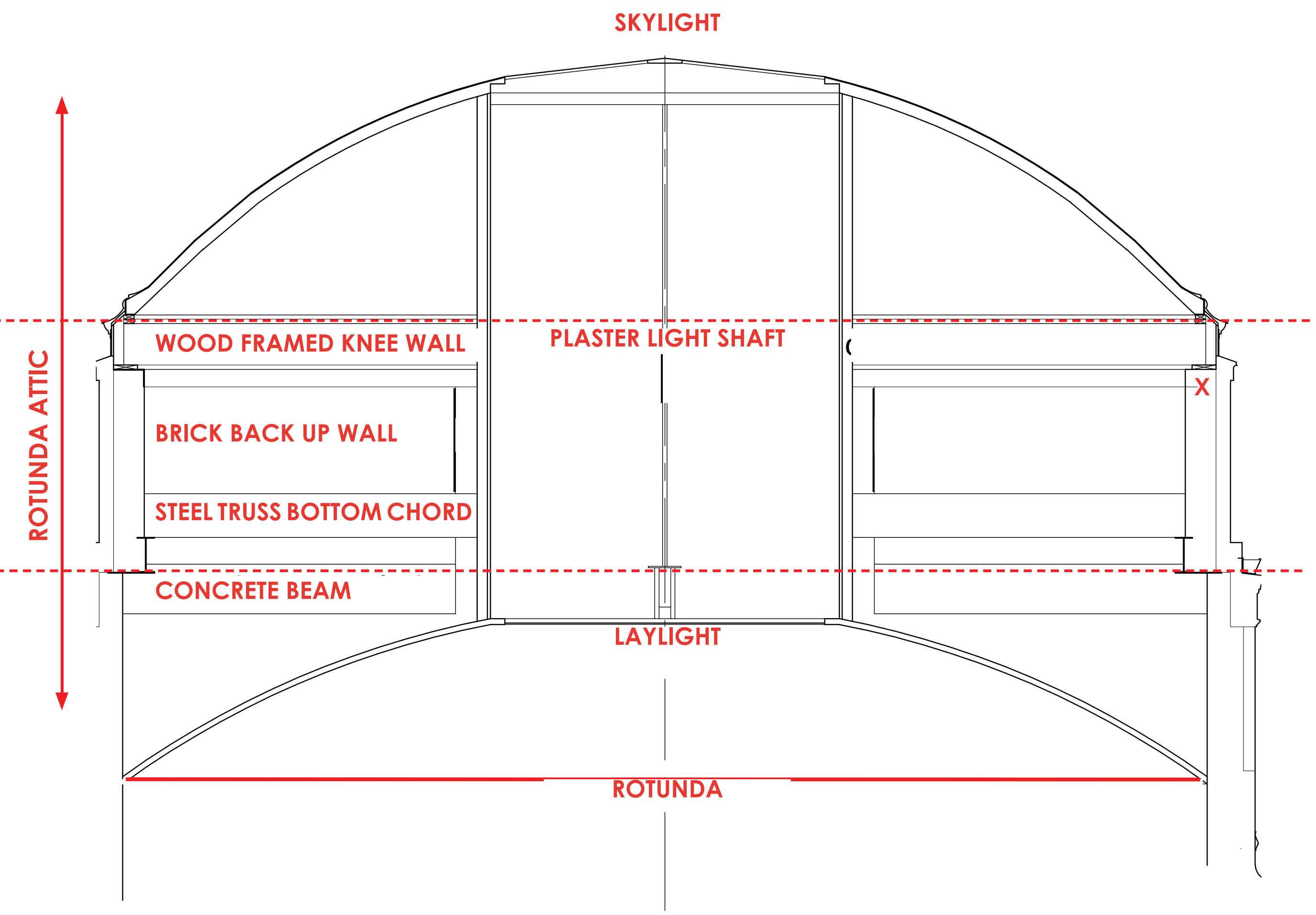

Main entrance - South facade


Aerial view - looking south

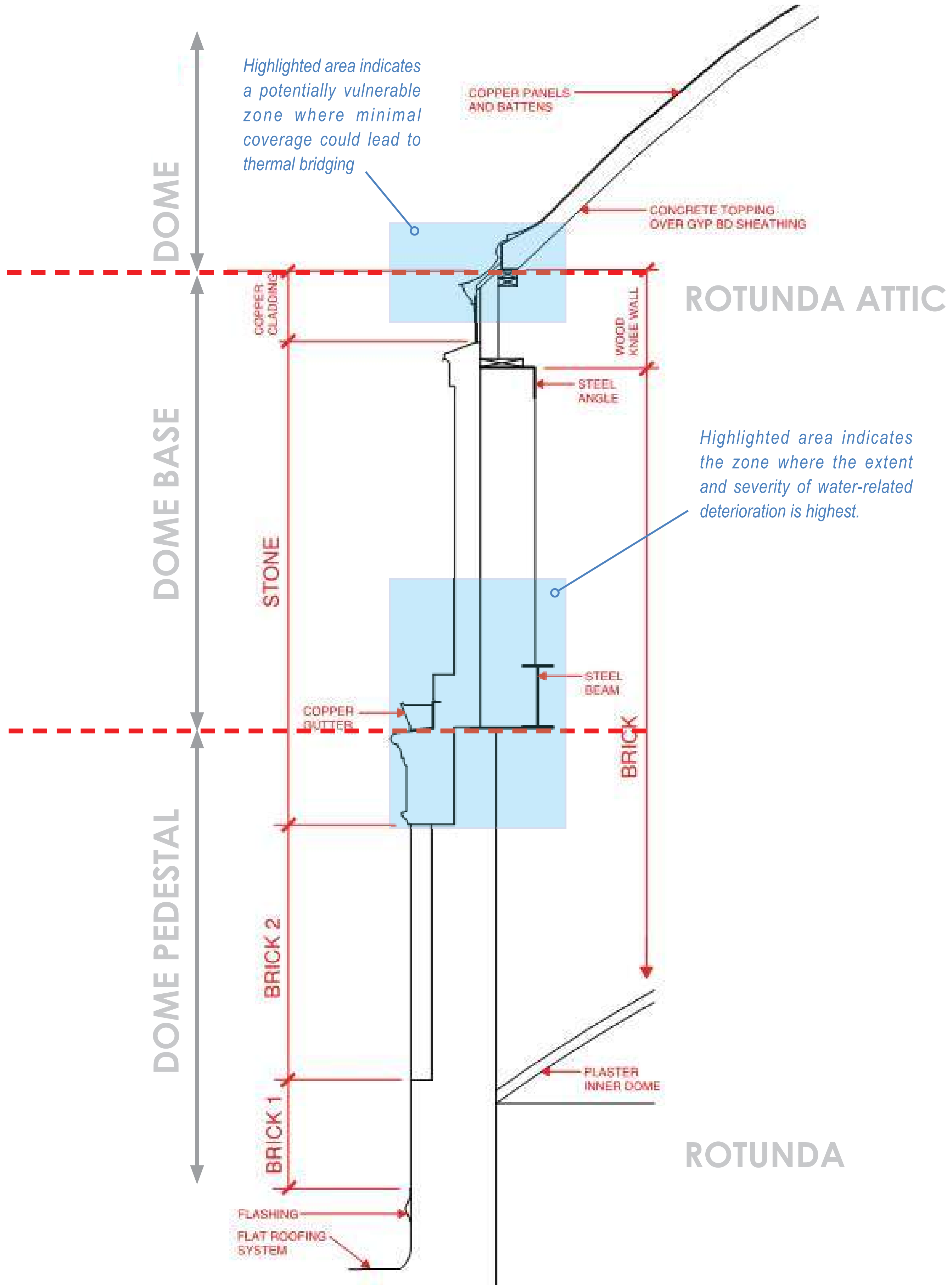

Rotunda Attic



DOME ELEVATION



SECTION THROUGH ROTUNDA ATTIC



WALL SECTION

EVALUATION

Overall, the various roofing systems and components show a higher level of distress than what would normally be expected as a result of natural weathering processes. Detailed investigative findings are documented in the following section but the most significant damage can be summarized as follows:

1. Mechanical damage to the copper dome- Temporary protection implemented earlier in 2018 was held in place by wood slats screwed into the flat copper panels of the dome and convex sloped corner roofs. This installation technique, which created hundreds of penetrations, has compromised the integrity of the entire roof system. Options for repair are limited.
2. Execution- Inappropriate repairs and improper execution the work noted throughout are a common source of water infiltration.
   - Roofing- The previous copper roof replacement project was design build. Although work was performed by skilled metal workers, installers may or may not have had roofing experience. As installed, joint system design and termination details do not follow best practice industry standards for copper roofing and there are no provisions for thermal movement. Extensive repairs would have been likely even if damage from temporary protection could have been avoided. Replacement provides a unique opportunity to incorporate innovative design solutions that improve performance and long-term durability.
   - Masonry Joints- Stone joints, originally filled with cementitious mortar, have been covered or randomly replaced with sealant. Sealed joint systems impact the drying potential of masonry walls and trap moisture, creating saturation zones that are vulnerable to frost activity. Sealant is used inappropriately and is improperly installed, both cohesive and adhesive failures are noted throughout.
3. Unusual original design- Several original architectural features have unique properties that contribute to diminished integrity of the exterior envelope- some interfere with the buildings' water shedding capabilities, others create an unfavorable conditions that prevent drying or cause thermal gradients that may lead to condensation. Integrated design solutions that mitigate these conditions should be explored.
   - Convex copper roofs- Convex copper roofs funnel water toward the back side of the corner piers instead of moving water away from the structure. Concentrated runoff from roofs is directed down the face of the stone wall over a vertical masonry joint. Improvements, such as crickets or diverters, can be incorporated without detracting from the overall historic character.
   - Water management- Gutter location prevents efficient water management. Water from the dome runs down the face of the stone wall before it is captured at the gutter on the stone ledge at the top of the pedestal. Further investigation is required to evaluate capacity.
   - Thermal Bridging- The dome, base and pedestal assemblies are not insulated and the attic space is not actively heated or ventilated. However, the attic space draws heat passively from the interior rotunda space below. Steel systems at the base of the dome and at the skylight have very little coverage and are likely forming a thermal bridge. Data collected from temperature and humidity monitors will inform treatment recommendations by providing more detailed information on building performance and the buildings response to cyclical change.
4. Natural Weathering- Decay is a natural process for all materials exposed to water, wind and sunlight. Although typically a slow process for durable materials like stone, the rate of decay of Lake Forest stone features has likely accelerated due to prolonged water saturation, frost activity, repeat wetting and drying cycles, and extensive biological growth. Widespread stone damage (fragmentation, spalling, cracking, soiling) is particularly severe at corner piers and limited replacement is anticipated.

TREATMENT RECOMMENDATIONS

GENERAL TREATMENT RECOMMENDATIONS

The Lake Forest Library is an important contributing resource in the Lake Forest Historic District and is worthy of the highest level of protection. Given its prominence and level of architectural integrity, preservation of the building's historic character is highly desirable. Important architectural features, elements, materials, and details should be repaired and protected in compliance with the Secretary of the Interior's Standards for Rehabilitation. Necessary repairs to original materials should minimize the degree of intervention; when replacement is necessary, in-kind or compatible substitutes that convey the visual appearance of the original material are recommended. New interventions should be executed to avoid or minimize adverse effect on the historic structure, integrated seamlessly with existing, or in an aesthetic vocabulary that is sympathetic to the original construction.

RECOMMENDATIONS

HGA proposes a baseline scope of work in order to restore integrity to the various building systems that make up the dome, base and pedestal. Although repair is always the preferred starting point, the nature and extent of observed damage to the copper roofing system favors a replacement strategy. System replacement presents an unusual opportunity to implement improvements, especially in areas where current detailing is contributing to the damage of adjacent systems and historic fabric. Given the cultural significance and vulnerability of the Remisoff murals in the rotunda, options for added protection, enhanced performance, and long term durability are also offered for consideration.

BASELINE SCOPE OF WORK

1. COPPER DOME

The dome is in poor condition. Because copper roofing is not original, and the current design is likely contributing to the damage of adjacent systems and historic fabric below, a replacement strategy is recommended. Although there is no documentation of original design intent, the current design aesthetic appears to be consistent with historic photographs. Therefore, design for replacement should strive to replicate characteristics of existing construction.

A. Skylight (GOOD): Clean and re-glaze. Skylight condensate pan will need to be field verified and may need to be re-sealed.

B. Copper Roofing (POOR): Existing copper roofing is not original- remove and replace all copper features, including: curved pans, battens, vertical copper fascia panels, decorative perimeter band with flared edge. Document, measure, and match existing decorative feature profiles, panel sizes, and material characteristics (20 oz. Revere Freedom Gray is recommended basis of design). Details must allow for copper expansion and contraction characteristics. Note: staggered transverse seams are industry standards, adjacent dome panels are aligned in the current configuration.

C. Dome Structure (EXCELLENT): Perimeter edge angle and steel truss components- remove corrosion, prime and re-coat with high performance paint

D. Dome Substrate (FAIR- GOOD): Cementitious infill- prepare surfaces to receive new roofing system- patch and fill voids as required to create a smooth, stable surface

- Wood sleepers- provide solid nailing surface for new batten system- consolidate wood, fill holes with epoxy

E. Underlayment (UNKNOWN): Remove existing and install new breathable underlayment and slip sheet in order to minimize the impact of roof envelope changes- 30# saturated felt minimum.

2. DOME BASE

The dome base is in fair to poor condition. Copper roofing is not original and the current design is likely contributing to the damage of adjacent systems and historic fabric below. However, because this zone has a high level of historic integrity, a repair strategy is recommended. The goal is to retain as much original material as possible. Design improvements are acceptable as long as the historic character of the building is retained.

A. Copper cladding- copper transition from dome to base (poor): Replace copper cladding and ornamental profiles. Evaluate substrates and insulate.

B. Stone Veneer Wall Panels (FAIR): Clean and repoint

C. Stone Ledge (POOR): Repair cracks, fill voids on skyward facing surfaces with appropriate patch material

D. Square Corner Piers (POOR): Replace severely damaged stone, rebuild backup brick masonry as required. Identify potential sources for new stone and develop an appropriated stone cleaning protocol

E. Sloped Copper Corner Roofs (POOR): Replace copper roofing and all associated flashing. Evaluate roof framing system and substrate.

3. ROTUNDA ATTIC

The attic, considered building support space, has minimal architectural significance. Alterations that improve durability and/or enhance performance are acceptable. Interventions should have low impact on the historic structure and should be compatible with original fabric. Following analysis of temperature and humidity monitoring, evaluate options to insulate and/or ventilate the attic space.

A. Brick Masonry Backup Wall (FAIR)- Remove efflorescence and loose material

B. Wood framed knee wall (FAIR)-Consolidate decayed wood, repair with epoxy, fill gaps to mitigate air infiltration. Provide additional support where needed to correct deflection. Replace only if severely deteriorated

C. Plaster light shaft (GOOD)- Clean, repair and repaint plaster, seal openings

D. Rotunda Laylight (GOOD)- Clean glass

E. Mechanical Ductwork (GOOD)- Repair or replace mechanical duct insulation

F. Skylight condensate piping (FAIR)- Provide new condensate pan, piping, and insulation (existing may be asbestos containing)

G. Insulate knee wall

4. DOME PEDESTAL

A. Copper perimeter gutter & downspouts (POOR)- Replace

B. Copper Flashing (POOR)- Replace sealant.

C. Face Brick (GOOD)- Minimal repointing

D. Attic Access Door (POOR)- Restore wood

5. ROTUNDA

A. Repair and repaint plaster ceiling and walls

B. Seal ceiling penetrations sprinkler heads

C. Restore Remisoff murals

ENHANCED PERFORMANCE - In addition to the baseline scope of work, the following improvements could be considered:

A. Develop strategy to insulate the attic
B. Design mechanical system for active temperature and humidity control in the attic space
C. Replace attic access door with insulated panel
D. Provide new attic light fixtures and ballasts
E. Provide safe, OSHA compliant access and catwalk system

ENHANCED DURABILITY - In addition to the baseline scope of work, the following improvements could be considered:

1. COPPER DOME
   A. Provide self-healing adhered membrane over batten wood blocking
   B. Consider waterproofing options that are compatible with copper roofing
   C. Upgrade waterproofing system under copper roofs to fluid applied membrane
   D. Provide a more robust roofing system- use heavier gauge copper or add stainless steel sub-roof below copper
2. DOME BASE
   A. Reconfigure corner roof wedge panels to improve water management at back side of corner piers
   B. Install waterproofing over corner roof substrate
   C. Install new roof counter flashing that is cut into masonry joints
3. ROTUNDA ATTIC
   A. Mechanically ventilate the attic space in order to promote drying of masonry walls and reduce thermal bridging

CONCLUSIONS

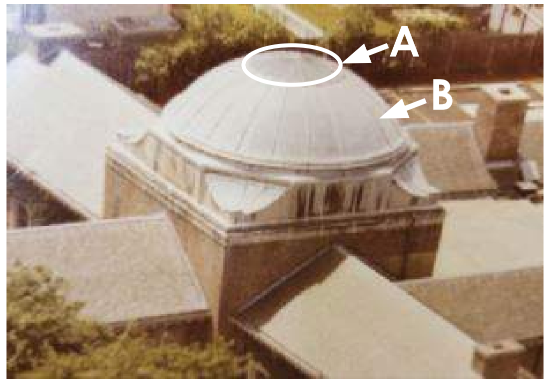
The baseline scope of work would restore the integrity of the Lake Forest Library. It would look and function much as it does today but the potential threat of water infiltration would be reduced substantially. Additional enhancements that extend the level of protection, improve performance and/or increase durability are also offered for consideration. In various combinations, these options could help minimize stress on the building, mitigate risk to the Remisoff murals, and reduce operating costs.

Given current conditions and the limited effectiveness of temporary enclosures, the recommended time line for repair is six months to a year. A developed set of Construction Documents that outline design intent and specifications for repair would facilitate the bidding process and help Lake Forest Library secure more accurate bids. Additional investigation may be required to refine Construction Documents and cost estimates.

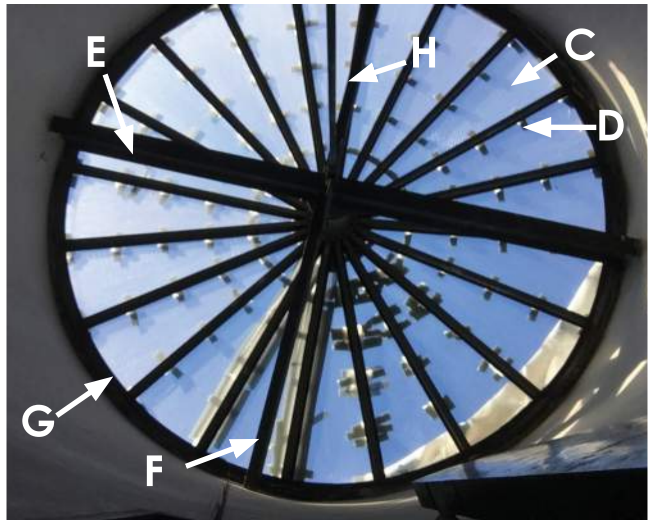
COPPER DOME | SKYLIGHT

The skylight at the top of the dome was not accessible from the outside. Observation was limited to what could be seen looking up from the plaster light shaft.

- The skylight size appears to match that of the layight, about 10-feet in diameter.
- There are 20-panes of glass equally spaced and pie shaped.
- There appears to be a copper condensate gutter visible around the outside perimeter.
- Tape for the temporary tarp suggests there are battens over each radial mullion.
- Just under the condensate gutter, an east-west beam spans the opening. In the same plane, a smaller beam spans north-south. At the intersection of these two beams, the steel rod extends down to support the laylight frame and chandelier. It appears a center post sits on top of the beams in the center to support the skylight peak.



Skylight at top of dome



Skylight -view from plaster light shaft (looking up)

PHOTO KEYED NOTES

A. DOME SKYLIGHT.

B. DOME COPPER PAN AND BATTEN ROOF.

C. SKYLIGHT GLASS PANE.

D. SKYLIGHT MULLION.

E. EAST-WEST BEAM.

F. NORTH-SOUTH BEAM.

G. SKYLIGHT CONDENSATE GUTTER.

H. STEEL ROD TO SUPPORT LAYLIGHT AND ROTUNDA CHANDELIER.

KEY FINDINGS

1. The conditions of the glazing seals is not known, but assumed to be at the end of their life.

2 The transition detail between the skylight glass and the copper dome roofing is also not known. This detail is critical to keeping water out of the dome.

RECOMMENDATIONS

1. Reglaze skylight glass panes.

2. Repair condensate gutter and connections to condensate drain lines.

COPPER DOME & DOME BASE | ROOFING & CLADDING

The central dome is clad with flat copper panels that are installed from the bottom course up. Copper panels have up-turned side legs that are likely clipped and fastened at raised vertical battens. Battens are approximately 2 3/4" wide and 2" tall and are approximately 3" apart at the base. The battens terminate with a capped end.

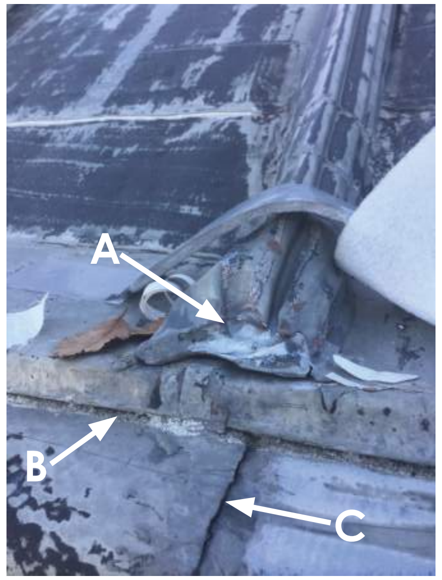
- The copper pans did not appear to have the required extensions at each batten, which can allow wind driven rain to penetrate the vulnerable joints.
- It was not clear what lock joint was used to connect the transverse seam between the roof pans. A minimum 2" lap is required on slopes greater than 6/12 and 4" on lesser slopes. There appear to be solder patches along these joints at each batten. These panel joints should not be soldered to allow the panels to move independently.
- Batten caps, which are approximately 12-inch segments, are tack soldered to the copper pans at multiple points on both sides. Sometimes these battens straddle the transverse copper pan joints and the battens are soldered to multiple pans which could be affected by the pan's movement.
- No exceptional damage was observed on the copper panels a the northwest corner, however, access to the dome panels was restricted and limited.
- Where the copper pans transition at the base of the dome, copper panel strips were installed to transition to a flared edge. These panel joints are lapped and soldered at a joint aligned with the roof battens. The transverse joints appear to be locked with a clip. These joints also appear to be tack soldered. The panel flares and hooks to a formed copper, decorative edge band. The bottom edge of the band has a vertical leg that laps over the wall fascia panels below that curve around the dome. This sandwich is anchored with fasteners with washers at 8-inches o.c. It is believed these anchors embed into the wood substrate at the knee wall. All laps of the copper are shingled, but it is not clear what type of lap or clip method is used.
- The roof panel and batten juncture at the skylight was not observed. This is a critical joint that should be reviewed.

KEY FINDINGS

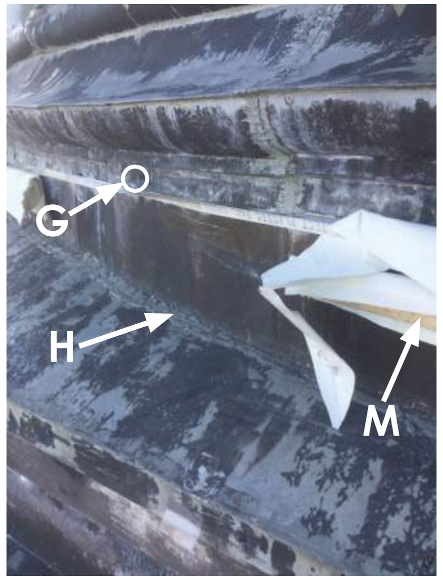
1. Many soldered joints appear to be insufficient and not properly sweated, and a some have failed completely.
2. No expansion joints were observed around the copper base that is both pinned and soldered.
3. Newspaper articles indicate the contractor used 50/50 solder with the lead coated copper. Lead coated copper requires 60/40 (lead/tin) solder.

RECOMMENDATIONS

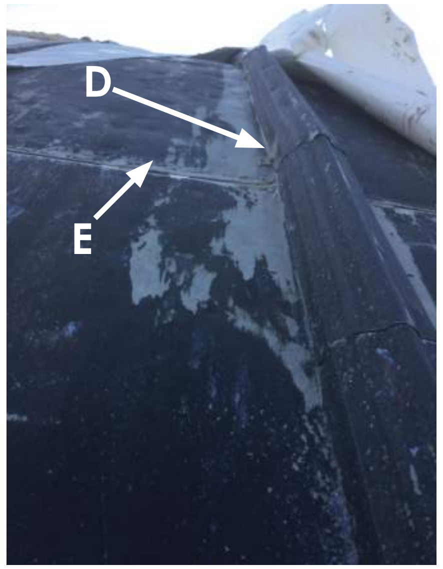
1. Remove all copper pans and battens as well as ornamental cladding and fascia.
2. Remove all paper and membranes.
3. Repair cementitious and wood substrates.
4. Install new copper roofing system including paper and membranes.



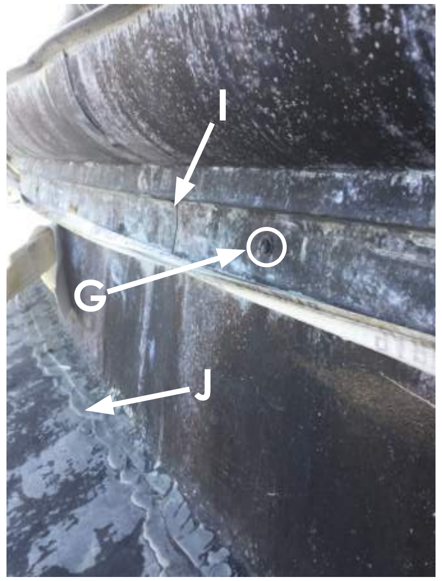
Roof transition at dome base



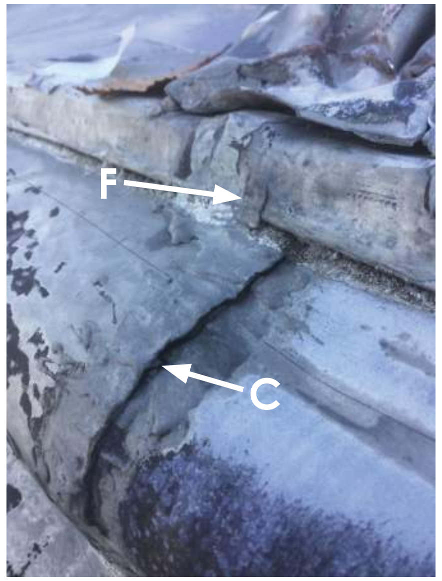
Dome base copper



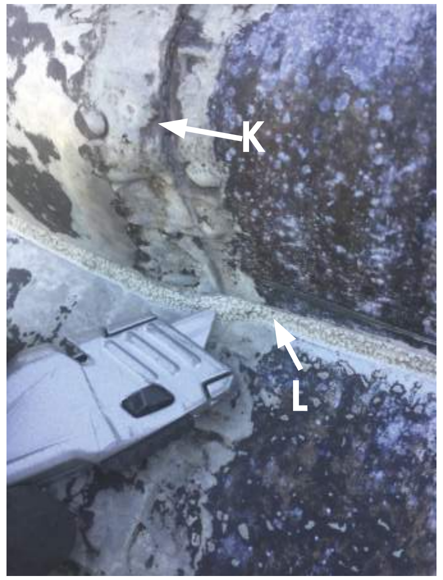
Dome roof pans and battens



Dome base fascia



Solder joint at roof base



Sealant at joint in ornamental copper

PHOTO KEYED NOTES

A. DAMAGED ROOF BATTEN.

B. JOINT BETWEEN TRANSITION NOT FULLY LOCKED. AGED SEALANT VISIBLE.

C. FAILED SOLDER JOINT.

D. TACK SOLDER AT BATTENS.

E. DOME COPPER PANEL LOCK JOINT.

F. ROOF TRANSITION PANELS ARE SOLDERED TO ORNAMENTAL COPPER BAND PANELS AT THESE JOINTS, PINNING THE PANELS TO EACH OTHER AND RESTRICTING MOVEMENT.

G. ANCHORS ON THE VERTICAL SURFACE OF THE CORNAMENTAL COPPER. IT IS ASSUMED THESE ANCHORS ALSO PIN THE COPPER FASCIA PANELS THAT WERE SET FIRST AGAINST CURVED WALL BEHIND. IF THE HOLES WERE NOT SLOTTED, THE PANELS WOULD BE RIGIDLY HELD IN PLACE AND RESTRICT MOVEMENT.

H. INSUFFICIENT SOLDER JOINT.

I. SPLICE IN DECORATIVE COPPER PANEL. THIS JOINT DOES NOT APPEAR TO BE SOLDERED AND MAY BE THIS WAY TO ALLOW EXPANSION. HOWEVER, THE PANELS ARE SOLDERED ON THE TOP SURFACE.

J. CRACK IN SOLDER SHOWS INSUFFICIENT LAP OF FASCIA COPPER OVER HORIZONTAL COPPER.

K. IT IS UNKNOWN IF THE CRACKS IN THESE SOLDERED JOINTS ARE ALL THE WAY THROUGH THE LAP OR JUST PARTIAL.

L. THE PURPOSE OF THIS OLD SEALANT AT THIS JOINT IS UNKNOWN. THE SEALANT APPEARS TO BE PAST ITS SERVICE LIFE.

M. WOOD STRIPS USED TO HOLD TIGHT THE TEMPORARY PROTECTION TARP HAVE ANCHORS THAT PENETRATE THE COPPER PANELS. THE ANCHOR HOLES HAVE DAMAGED THE COPPER AND MAY PROVIDE LOCATIONS FOR AIR AND MOISTURE TO PASS THROUGH.

COPPER DOME | STRUCTURAL SYSTEM

The dome structure is visible from the attic space.

- The central dome is supported on framework of steel trusses laid out on a radial grid pattern. There are three trusses per side of octagon and the top cord slopes at about 45 degrees. Between these trusses, running eccentrically around the dome, are 2-inch 'T' sections about 48-inches apart.
- A continuous 3x5 angle, curved to match the radius of the dome, is attached to the terminal ends of the steel trusses just above the wood framed knee wall. The angle supports the double 2x4 plate.
- Sections between the trusses are spanned with paper faced sheathing which appears to be an early gypsum-based product approximately 3/4 inch thick. Visible from the attic, yellowed, paper faced, flat panel sheeting serves both as an interior finish as well as the form work for the dome.
- The curvature of the dome is created with lightweight concrete topping poured between the wood sleepers over the gypsum substrate. The substrate is visible through an investigative opening created adjacent to the bottom angle on the west side of the dome. The opening was presumably created to determine the composition and construction methodology of the dome. Welded wire fabric is visible within the topping which has an overall thickness of 4" at this location. More investigation is required to determine the exact nature of this material, including it's thicknesses across the dome and the integration of the wood sleepers.
- A wood 2x4 rafter is also visible through the inspection opening. It is possible that this wood member extends vertically to the skylight. Wood sleepers were likely installed as a nailable surface for copper roofing panels and may also give shape to the dome, possibly serving as form work or a screed for poured material. The condition of this wood member could not be verified, further investigation is required to confirm its condition, configuration and purpose.
- A felt membrane was observed over the concrete topping and wood member, creating the dome.

KEY FINDINGS

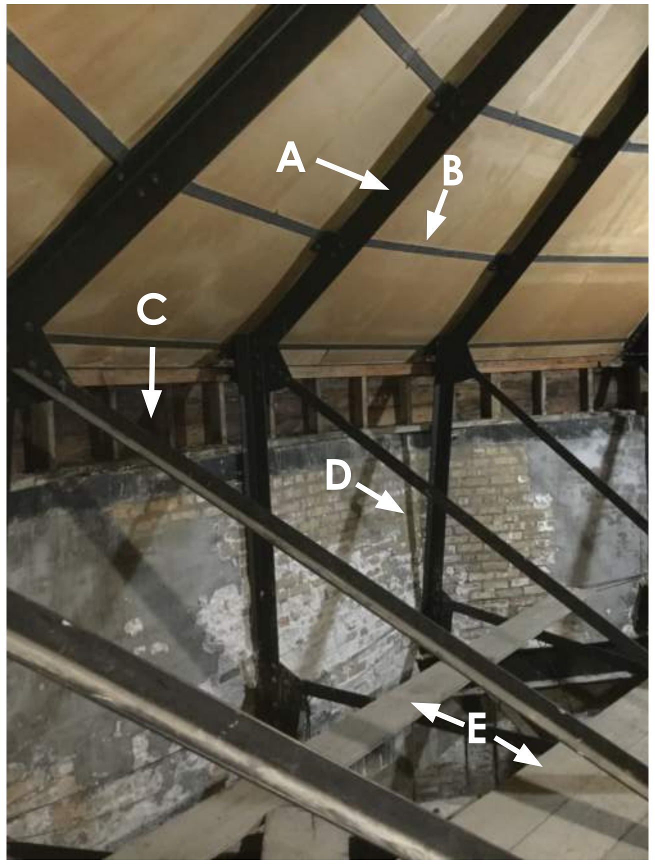
1. Steel assemblies are in excellent condition.

2. Water intrusion through the dome materials does not appear to be substantial. Isolated areas of water infiltration are noted on the underside of the sheathing. Although water stains occur at various locations around the dome, most staining appears at the steel 'T' segments where there are breaks and potentially cracks through the dome substrates. None of the stains appear to be current. The sheathing appears to be solid and no bulges or cracks were noted.

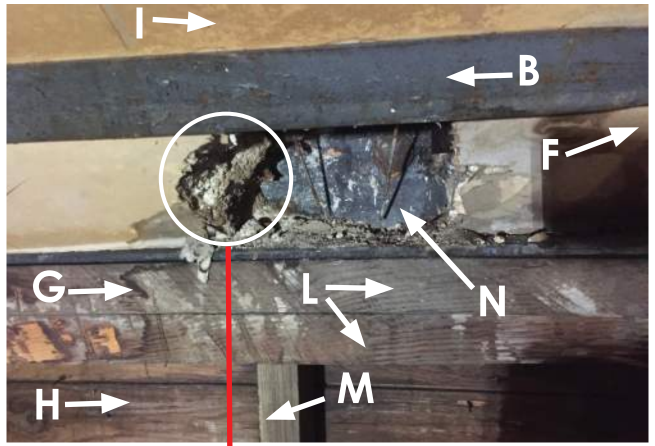
RECOMMENDATIONS

1. Further investigation of the dome is necessary to confirm substrate construction and conditions.

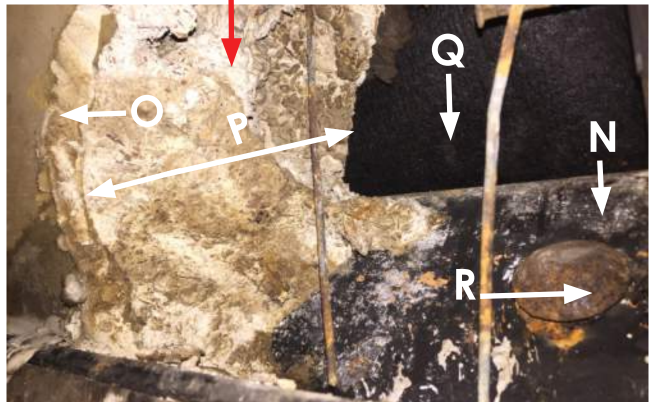
2. Seal all penetrations through the sheathing.



Rotunda attic

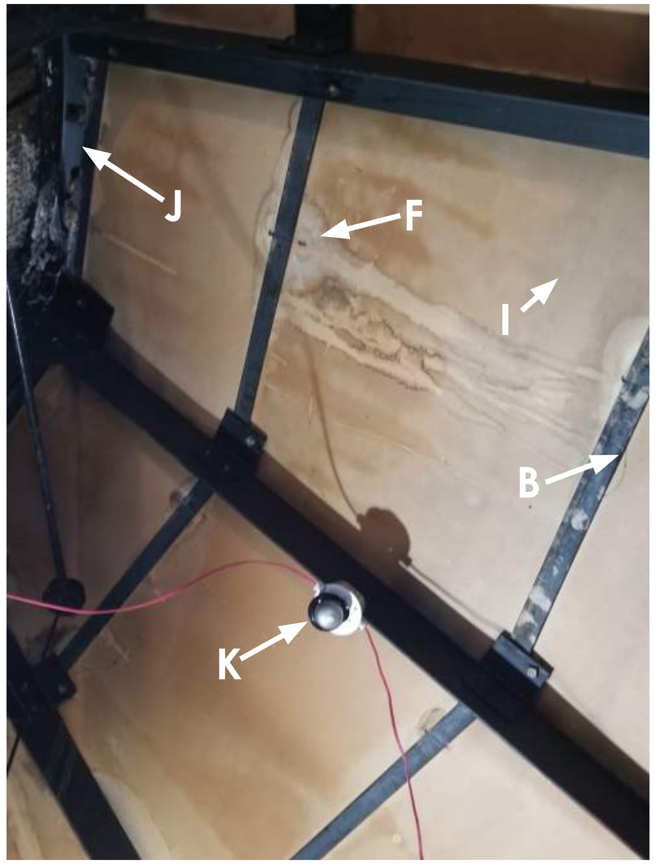


Dome transition to knee wall



Detail of dome contstruction

Rotunda attic



Underside of dome structure

PHOTO KEYED NOTES

A. DOME TRUSS.

B. STEEL 'T' MEMBERS BETWEEN TRUSSES ABOUT 48" ON CENTER.

C. WOOD KNEE WALL.

D. BRICK MASONRY WALL OF DOME BASE.

E. WOOD PLANK CATWALK.

F. OLD WATER STAINS ON THE GYPSUM BOARD SHEATHING.

G. OLD WATER STAINS ON THE WOOD KNEE WALL G.

H. T & G WOOD SHEATHING.

I. GYPSUM SHEATHING EXPOSED TO ROTUNDA ATTIC SPANNING BETWEEN STRUCTURAL T'S.

J. COMPRESSION RING CONNECTING ALL THE TRUSSES NEAR TEH SKYLIGHT.

K. LIGHT FIXTURE.

L. DOUBLE WOOD TOP PLATES.

M. WOOD STUDS AT 16-INCHES ON CENTER.

N. 3X5 PERIMETER, CURVED STEEL ANGLE.

O. GYPSUM SHEATHING.

P. CONCRETE DOME TOPPING.

Q. ASPHALT FELT UNDERLAYMENT.

R. ANCHOR BOLT HEAD. ASSUMED ATTACHES EXTERIOR WOOD SHAPING ORNAMENTAL COPPER.

S. CONCRETE TOPPING REINFORCING.

T. WOOD SLEEPER WITHIN THE CONCRETE DOME TOPPING.

DOME BASE | STONE VENEER WALL PANELS, LEDGE, AND SQUARE CORNER PIERS

The base of dome is of brick masonry construction clad with Bedford limestone veneer panels. Stone panels and architectural features show signs of distress. Stone distress ranges from isolated minor cracks to severe and widespread deterioration at corner piers. Distress conditions are directly related to water infiltration.

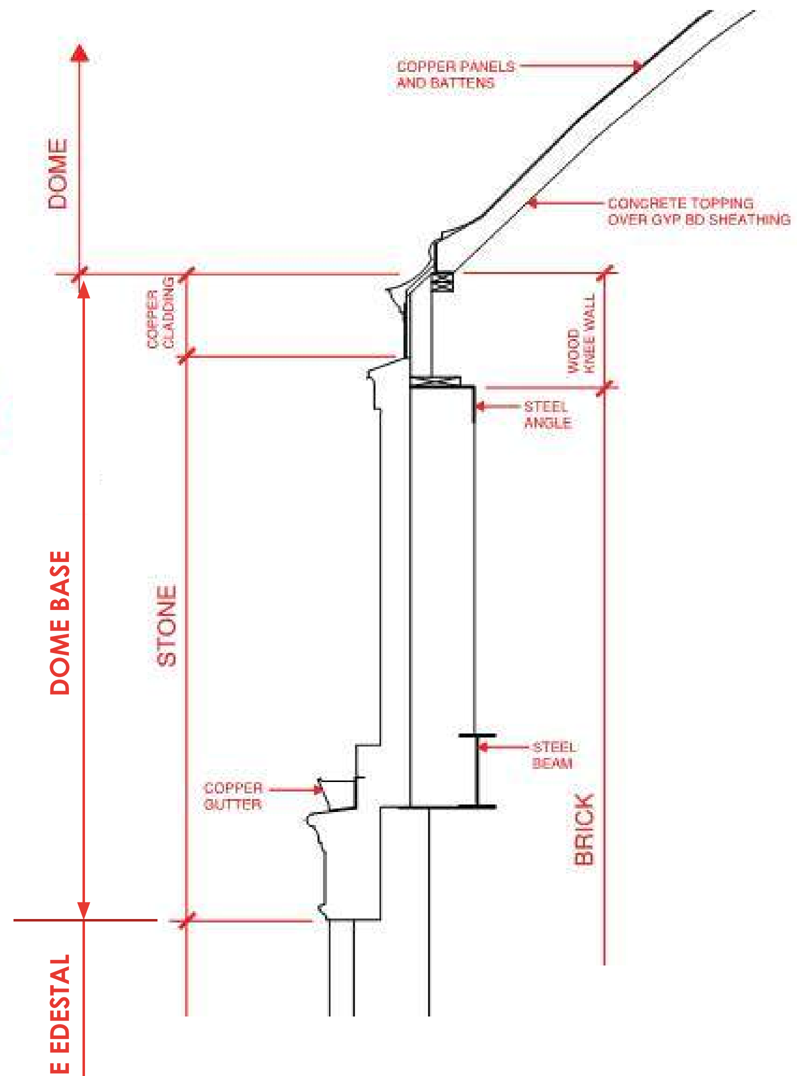
- Stone is discolored. Dark coloration is likely a combination of atmospheric soiling, water staining, and biological growth.
- Shallow surface spalls are noted on skyward facing surfaces of wash ledges at or near joints.
- Larger cracks and horizontal joints have been repaired with sealant several times. Joints have not been properly prepared, sealant demonstrates both adhesive and cohesive failure.
- Corner piers show the most severe signs of distress including outward rotational displacement.
- Stone joints are pointed with mortar in some areas, sealant in others.

KEY FINDINGS

1. Further investigation is required to determine the nature and extent of severe stone damage. Some replacement is anticipated.
2. Sealant may be trapping moisture and preventing natural drying of the stone.
3. Cracks and spalls at joints could be related to ferrous anchor corrosion.
4. Parallel vertical cracks at pier corners could be the result of repeated freeze/thaw activity in combination with anchor corrosion.
5. Horizontal cracks at corner piers are related to outward rotational movement of the panel, likely due to frost action.
6. Joints are deteriorated, comprehensive repointing is recommended.

RECOMMENDATIONS

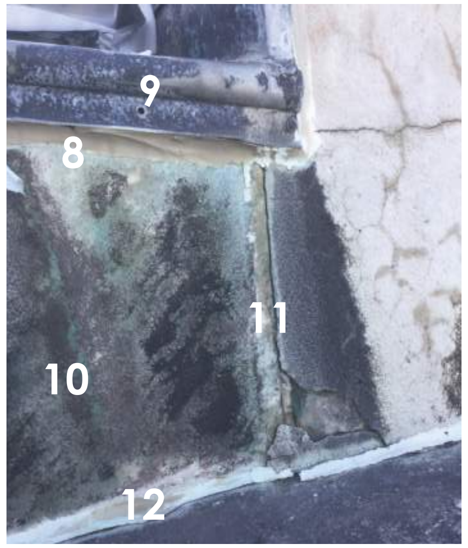
1. Clean stone and repoint joints.
2. Repair cracks.
3. Replace severely damaged stone and rebuild back-up brick masonry as required.
4. Develop an appropriated stone cleaning protocol.



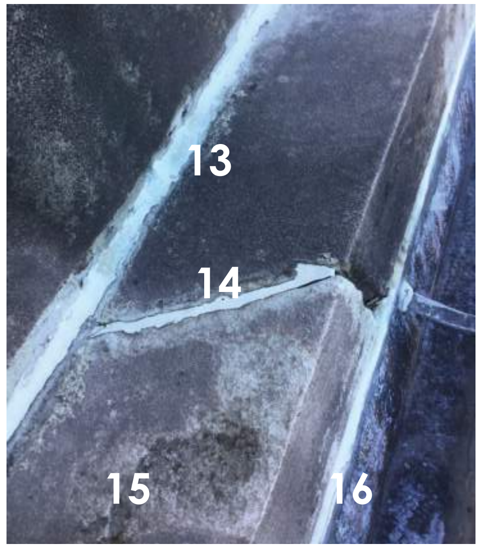
DOME SECTION

Stone conditions at corner pier

Stone conditions at corner pier



Stone joint at corner pier



Stone ledge below corner pier

Stone ledge below corner pier

PHOTO KEYED NOTES

1. ADHESIVE FAILURES AT VERTICAL AND HORIZONTAL STONE JOINTS (LIKELY DUE TO IMPROPER SURFACE PREP AND/OR PROLONGED SATURATION OF MASONRY BACKUP ALONG WITH OUTWARD VAPOR DRIVE).

2. MULTIPLE STONE CRACKS PARALLEL TO VERTICAL JOINT (LIKELY DUE TO FROST ACTIVITY).

3. WIDESPREAD STONE SURFACE DECAY (POSSIBLY DUE TO HIGH VELOCITY/HIGH VOLUME WATER RUNOFF FROM COPPER DOME ABOVE).

4. WEATHERED SEALANT, IMPROPER INSTALLATION.

5. MULTIPLE CRACKS IN STONE PIER PANEL. THE PANEL IS DISPLACED IN AN OUTWARD DIRECTION AT THE BASE RESULTING IN FORMATION OF A FULL WIDTH HORIZONTAL CRACK. CRACK LOCATION LIKELY CORRESPONDS TO STONE ANCHORAGE.

6. DECAYED STONE (FRAGMENTATION, SPALLING) AT BOTTOM CORNER ADJACENT TO COMPROMISED VERTICAL STONE JOINT (LIKELY DUE TO FROST ACTIVITY).

7. ADHESIVE FAILURE - HORIZONTAL SEALANT JOINT SYSTEM.

8. JOINT SYSTEM FAILURE (SEE 1, 4).

9. POORLY DESIGNED FLASHING DETAIL AT ROOF TRANSITION FUNNELS WATER TO BACKSIDE OF PIER AND CONCENTRATES RUNOFF DIRECTLY OVER VERTICAL JOINT.

10. STONE DISCOLORATION. DARK STAINING CORRESPONDS TO WATER RUNOFF, AREAS EXPOSED TO LONG PROLONGED SATURATION LIKELY HAVE BIOLOGICAL GROWTH IN ADDITION TO ATMOSPHERIC SOILING.

11. FAILED MORTAR JOINT SYSTEM - SEPARATION ALONG VERTICAL JOINT MARGIN.

12, 13, 16, 17. FAILED SEALANT JOINT SYSTEM - ADHESIVE FAILURE AT HORIZONTAL JOINTS.

14. SERIOUS CRACK (>1/2" WIDTH) AT STONE LEDGE UNIT. FAILURE OF IMPROPER SEALANT REPAIR.

15. MILD STONE SURFACE DETERIORATION (SEE 3).

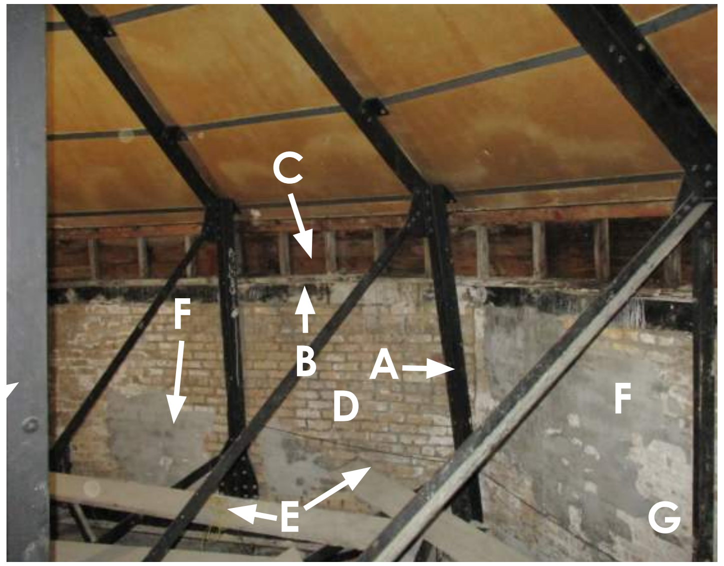
18, 19. SERIOUS STONE SURFACE DETERIORATION (>1/2" DEPTH).

ROTUNDA ATTIC | BRICK MASONRY

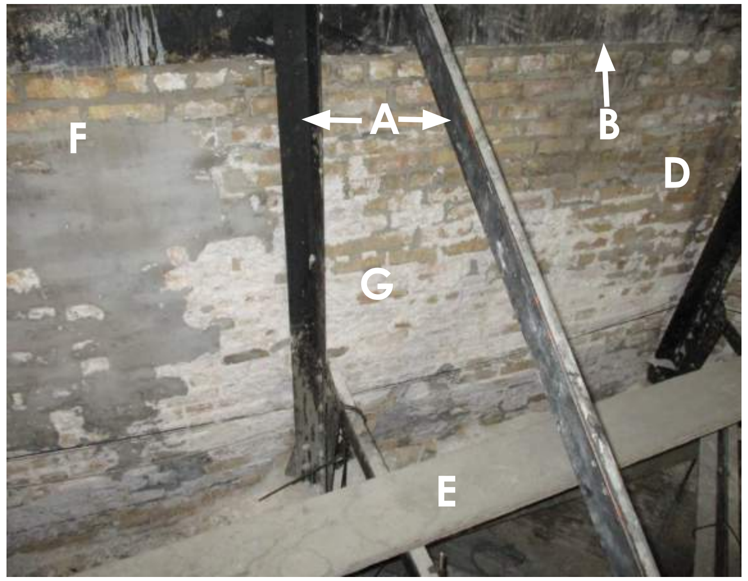
The interior face of the brick pedestal, observed from the rotunda attic, shows sign of extensive water infiltration including: staining and heavy deposits of thick, white efflorescence and evidence of past repairs to brick and mortar.

- Backup masonry is constructed with cream color brick
- Brick walls are constructed on top of concrete beam
- Brick wall is capped with a steel angle or channel shape

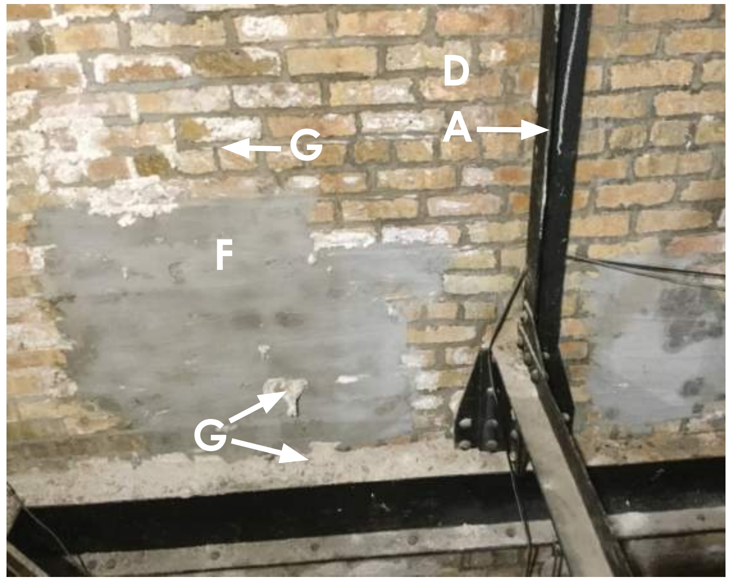
Rotunda attic



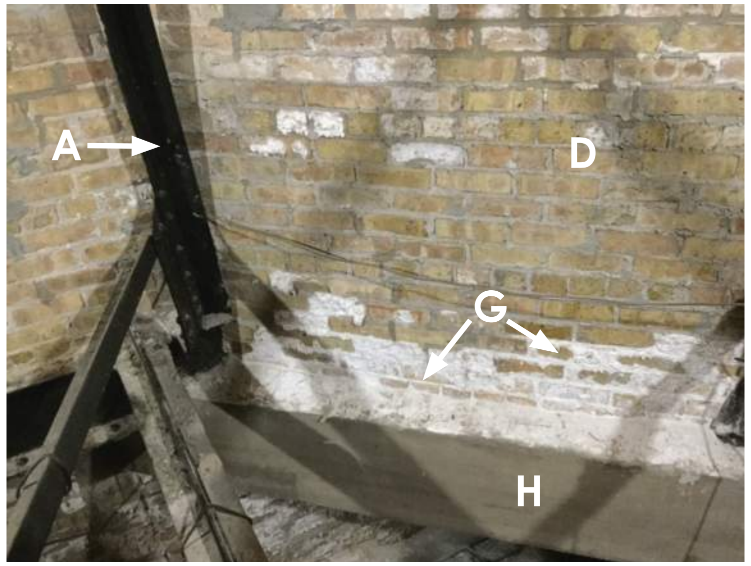
Rotunda attic



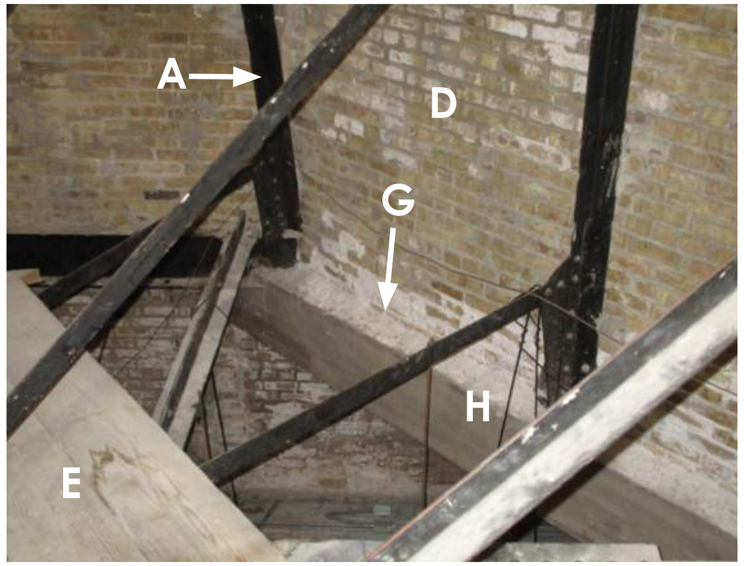
Rotunda attic masonry wall conditions



Rotunda attic masonry wall conditions



Rotunda attic masonry wall conditions



Rotunda attic masonry wall conditions

PHOTO KEYED NOTES

A. DOME TRUSS.

B. STEEL MEMBERS ON TOP OF MASONRY WALL.

C. WOOD KNEE WALL.

D. BRICK MASONRY WALL OF DOME BASE.

E. WOOD PLANK CATWALK.

F. PARGE COATING OVER MASONRY.

G. EFFLORESCENCE.

H. CONCRETE BEAM.

KEY FINDINGS

1. Past repairs (parging with cementitious coating, repointing) have been ineffective. Vapor drive will force moisture accumulation in and behind the stone wall to dry to the interior. High lime mortars, in the presence of moisture, can develop efflorescence at the surface. More serious conditions can lead to subflorescence.

2. Surface spalling is also noted on the interior face of brick units.

RECOMMENDATIONS

1. Remove inappropriate patch material, loose material and efflorescence off of all surfaces including walls, beams and plaster, inner dome.

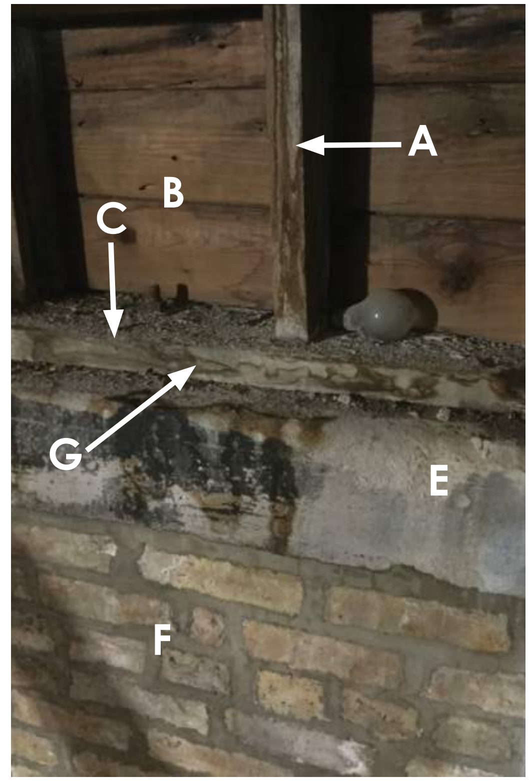
ROTUNDA ATTIC | WOOD FRAMED KNEE WALL

A band of vertical copper panels creates a transition between the curvature of the copper dome above and the masonry pedestal below. Copper panels are attached to a wood framed ‘knee wall’ that is visible from the attic. Wood construction is set on top of the brick masonry pedestal walls. The wood framing stands about 18 3/4” tall- from the top of the masonry to the bottom of the continuous steel angle that forms a perimeter band at the base of the dome.

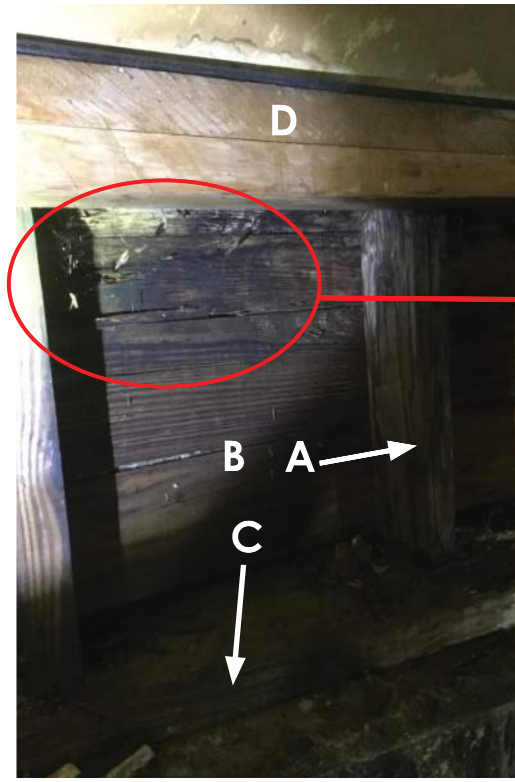
- The wood 2x bottom plate, bearing directly on the masonry wall, varies in depth. Because the masonry pedestal wall is octagonal in shape, and the wood wall is circular, the wood plate cantilevers over the masonry walls at the eight corners.
- The double top plates of this wall are anchored to the bottom leg of the continuous perimeter angle at the base of the dome, forming a circle approximately 32-feet in diameter.
- Top and bottom wood plates are not in the same plane. Vertical wood frame members, 2x4 studs at 16-inches on center, are seated on the bottom 2x wood plate and extend upwards and behind the top double plate. The top edge of these studs are cut at a 45-degree angle matching the roof slope. The high edge of these studs aligns with the joint of the double top plates. The outside height of the studs is 14-inches tall.
- The outside face of the knee wall is covered with three courses of 1x6 tongue and groove sheathing boards. The top board is cut short, to about 3 1/2”. The top slope of the wood studs is also a clad with what appears to be a similar 1x wood board which extends over the wall sheathing. Ferrous nails were noted projecting though this roof sheathing board that suggest additional blocking may be applied on top of these boards to help build a base to support the perimeter copper profile.

KEY FINDINGS

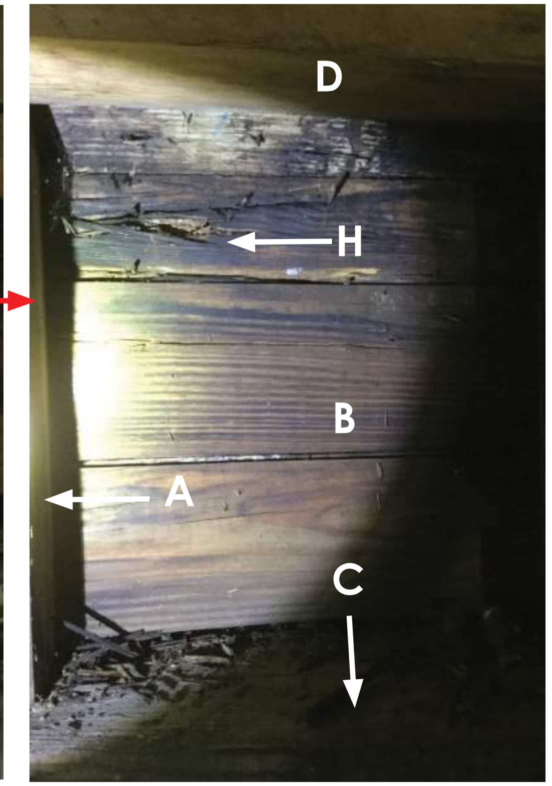
1. Wood framing is not supporting the dome
2. Water stains are visible on wood plates, studs, and sheathing throughout.
3. Several 1x sheathing boards are rotted
4. Unsupported sections of the knee wall spanning between walls at the corners could experience deflection.
5. Asphalt felt membrane lapped over wood sheathing is visible through holes in the wood sheathing. Gaps and holes in the sheathing provide opportunities for air and moisture to transfer between the exterior and the dome attic spaces.
6. The top of the exterior stone appears to sit about 1-inch above the bottom plate.



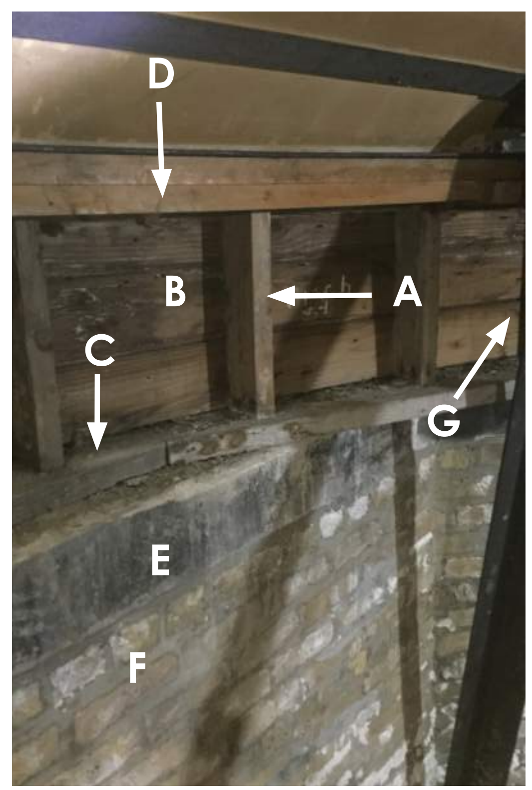
Wood knee wall bearing on masonry wall



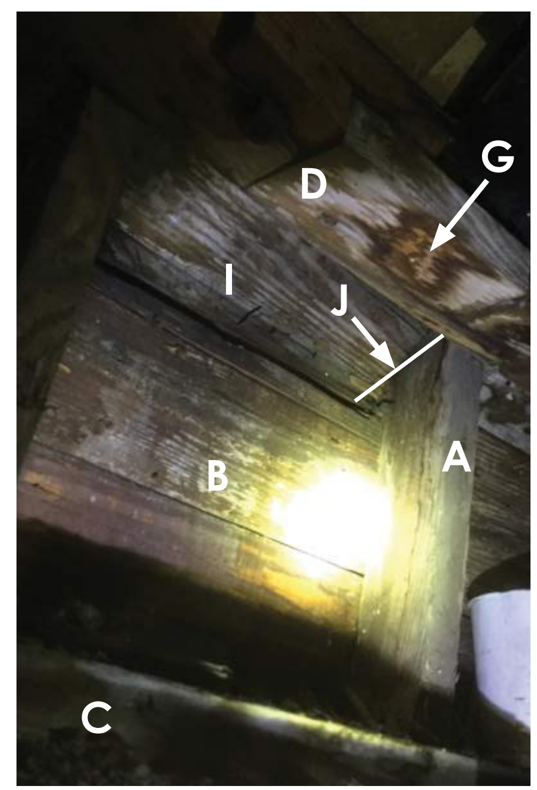
Wood sheathing at wood knee wall



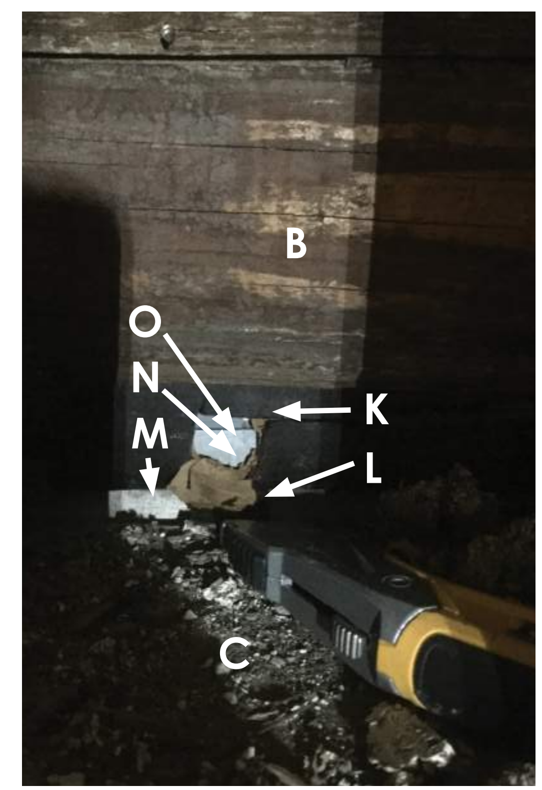
Deteriorated wood sheathing



Wood knee wall between dome and base



Wood knee wall sheathing, studs, and top plates



View thru hole in wood sheathing

RECOMMENDATIONS

1. Consolidate decayed wood, repair with epoxy.
2. Fill gaps to mitigate air infiltration.
3. Provide additional support where needed.

PHOTO KEYED NOTES

A. WOOD STUDS OF KNEE WALL.

B. WOOD SHEATHING.

C. BOTTOM PLATE OF WOOD KNEE WALL.

D. TOP PLATES OF WOOD KNEE WALL.

E. STEEL MEMBERS ON TOP OF MASONRY WALL.

F. BRICK MASONRY WALL OF DOME BASE.

G. WATER STAINING.

H. ROTTEN WOOD SHEATHING.

I. SLOPED, WOOD ROOF SHEATHING.

J. TOP OF STUDS CUT AT 45-DEGREE. ROOF SHEATHING ALSO SLOPES AT 45-DEGREES.

K. ASPHALT FELT MEMBRANE.

L. BUILDING PAPER SLIP SHEET.

M. STONE.

N. UPTURNED LEG OF HORIZONTAL COPPER THAT SITS ON TOP OF STONE SILL.

O. COPPER FASCIA.

ROTUNDA ATTIC | PLASTIC LIGHT SHAFT

In the center of the rotunda attic is a cylindrical light shaft, with a 10-0" wide inside diameter, that connects the rotunda ceiling laylight to the exterior skylight at the top of the dome. The shaft height is approximately 15-feet tall. The vertical legs of the dome trusses form the outside edge of the shaft enclosure.

- The wall of the shaft assembly is constructed with metal lath set into a grid of steel T's.
- The inside face of the cylinder has a smooth plaster finish painted white.
- There is a single door opening into the light shaft off the north end. The door is curved to match the shaft radius and has a lever and a latch. The door has a plate indicating it was made by Perkinson & Brown out of Chicago.
- There are 3-steel ledges that project into the light shaft at approximately 24-inches above the laylight in line with the 8-inch square plate noted in the Laylight section. The three ledges are located at 1/3 points around the cylinder. It is assumed these ledges provide anchor points to allow beam planking to support work within the shaft.
- A single metal rod, hung from a steel beam located toward the top of the shaft, supports the rotunda chandelier.

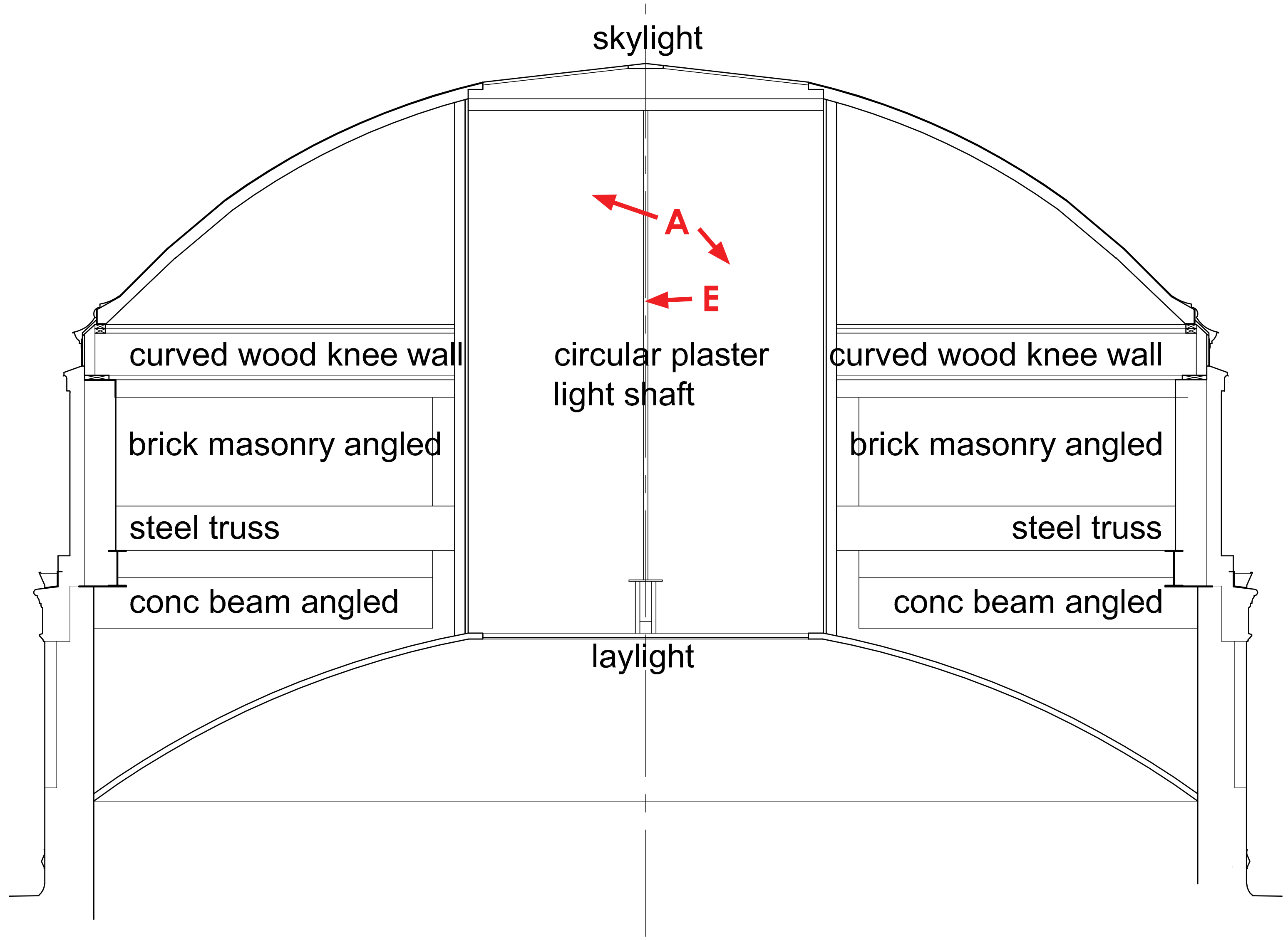


PHOTO KEYED NOTES

A. SMOOTH FINISH OF PLASTER LIGHT SHAFT.

B. STAINING ON INSIDE FACE OF PLASTER LIGHT SHAFT.

C. METAL LEDGE - ASSUMED TO ACCOMMODATE SUPPORT BOARDS WHEN WORKING IN SHAFT.

D. LAYLIGHT.

E. STEEL ROD TO SUPPORT LAYLIGHT AND ROTUNDA CHANDELIER.

F. EXPOSED PLASTER OF LIGHT SHAFT FROM ATTIC SIDE.

G. STEEL TRUSS.

H. WOOD CATWALK.

I. SKYLIGHT CONDENSATE GUTTER.

J. SKYLIGHT.

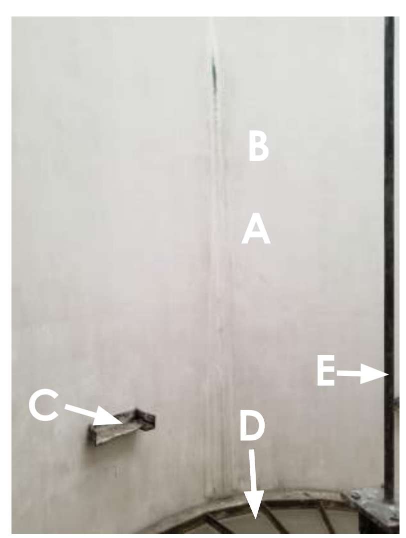
K. CURVED STEEL DOOR INTO PLASTER LIGHT SHAFT FROM ATTIC.

KEY FINDINGS

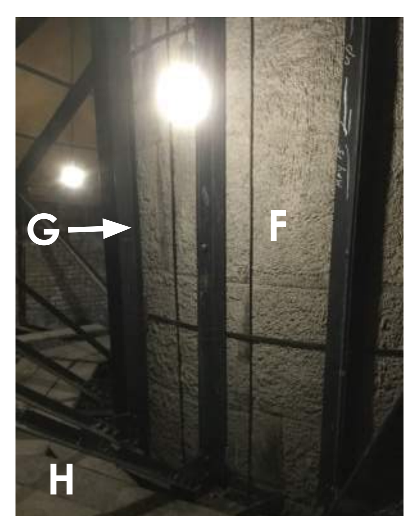
1. Streaking was observed on the curved plaster walls of the light shaft. The stains appear in two locations, at points that appear to correlate with the locations of the condensate drain lines. The stains become more pronounced a few feet below the skylight and streak down the wall for several feet.

RECOMMENDATIONS

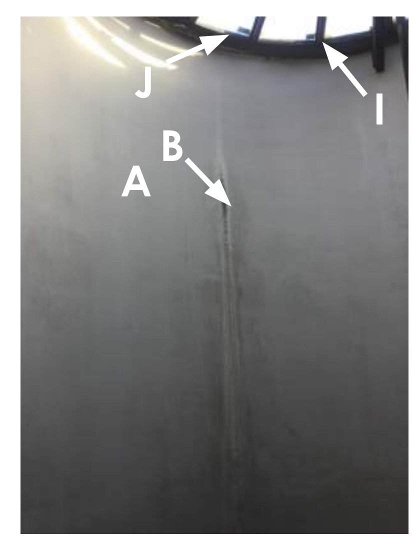
1. Clean and repaint inside plaster of light shaft.
2. Further investigation is required to determine the cause of the streaks.
3. Add weather stripping to door to seal against air leakage to and from the lightshaft.



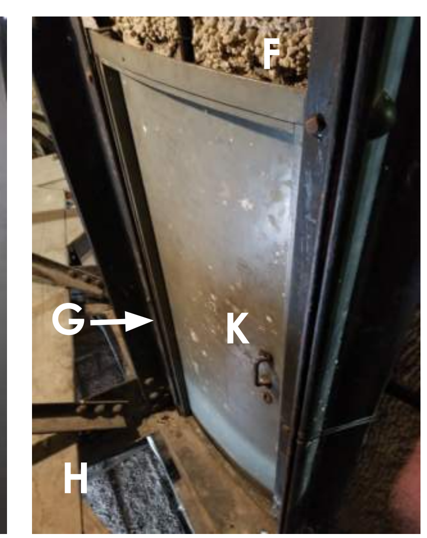
Plaster light shaft - SE direction



Plaster light shaft - view from attic



Plaster light shaft - SE direction



Door into plaster light shaft from attic

ROTUNDA ATTIC | ROTUNDA LAYLIGHT

At the center of the rotunda ceiling, an original glass laylight provides a soft glow of natural light to interior space. Translucent glass diffuses light brought in from the outer dome skylight above. The steel framed laylight assembly is accessed from the attic by way of a small metal door on the north side of the plaster light shaft,

- The Laylight consists of 20-equal, pie-shaped panes of diffused glass.
- The glass panes sit on inverted 'T' framing that extend out radially. Steel caps are set over the frame legs to hold the glass in place. The outer perimeter frame is an angle with the bottom leg facing inward to rest the glass. There is no cap or stop over the glass at ends, which are segmented straight between each frame.
- In the center, all the dividing frame members attach to a steel angle ring that is approximately eight inches in diameter. The chandelier light fixture is to attached a steel framed 'box' assembly at the center of this ring. The box assembly, constructed with four small (1 1/2") steel angles, is about 24" tall. The box assembly is capped with an 8-inch square plate, about 1/2" thick. A steel rod, hung from a steel beam toward the top of the light shaft, provides the structural support for the chandelier and laylight.
- A conduit runs across the laylight to provide power to the chandelier.

KEY FINDINGS

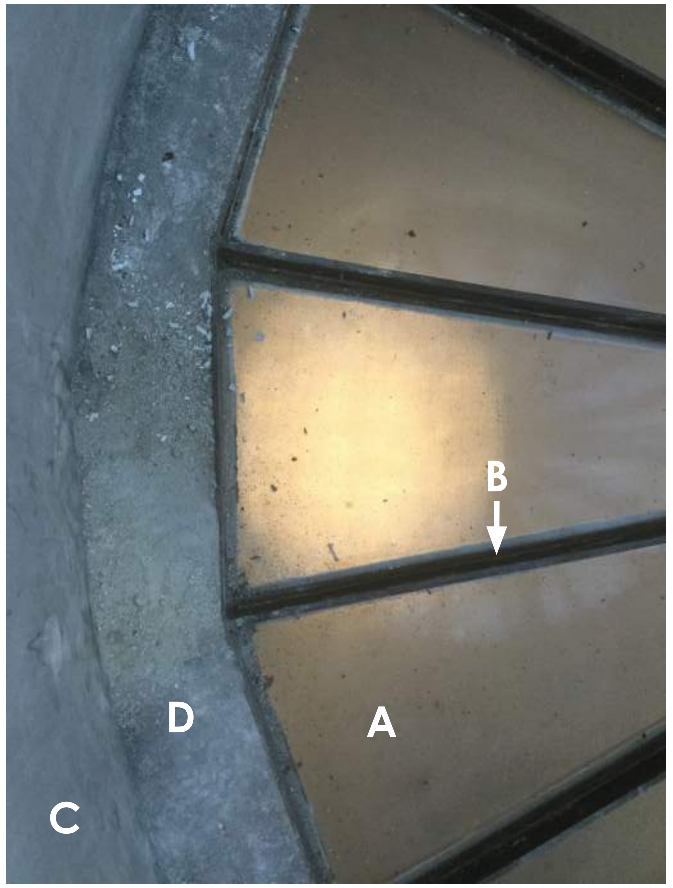
1. Laylight is supported in the middle by an assembly of angles and plates that is hung by a steel rod from a beam just below the skylight.

2. The glass and frame appear to be in good condition.

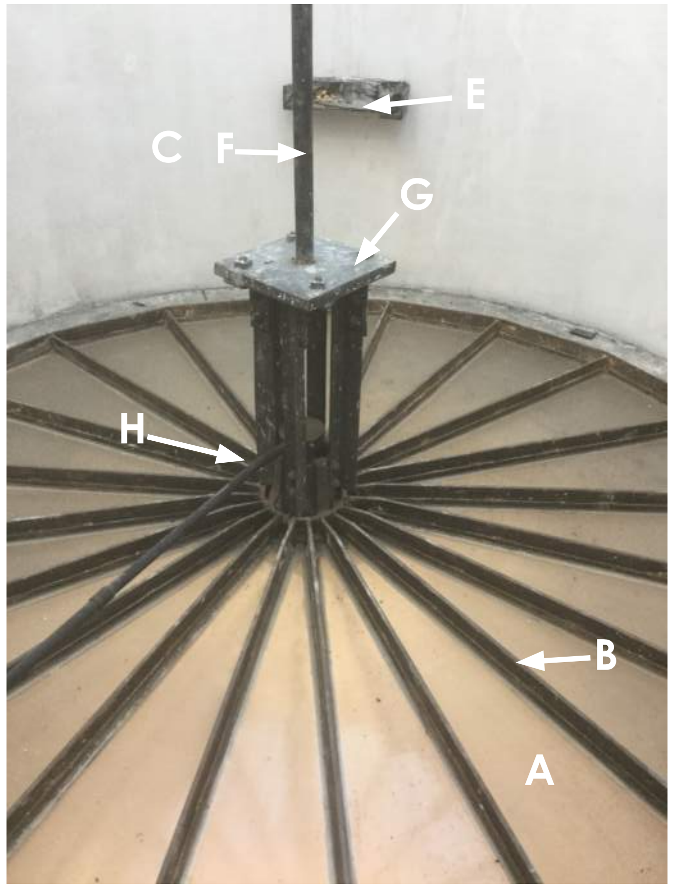
RECOMMENDATIONS

1. Clean laylight glass.

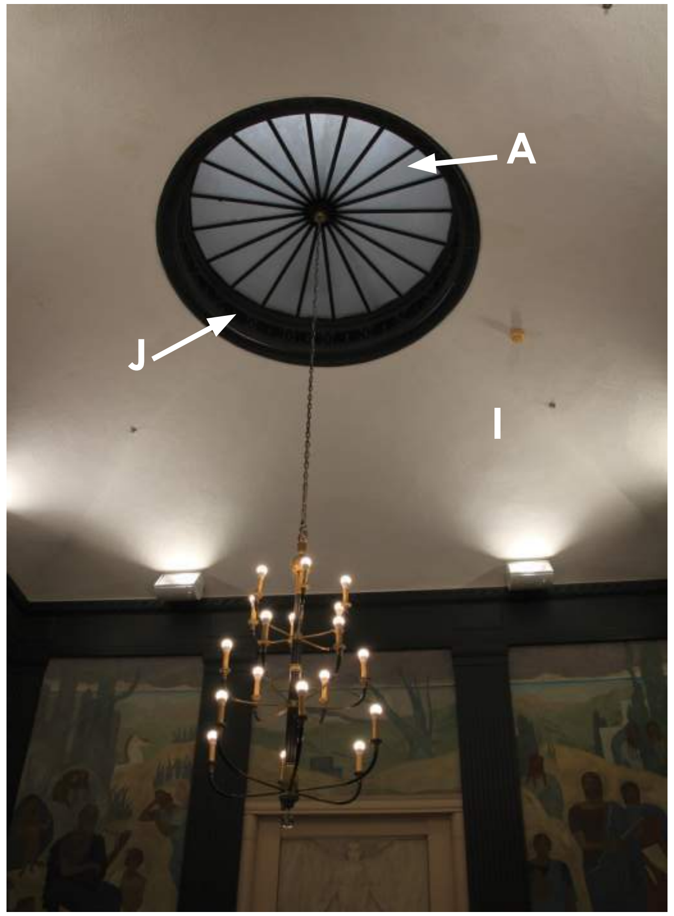
2. Seal gaps between frame and plaster and at chandelier attachment.



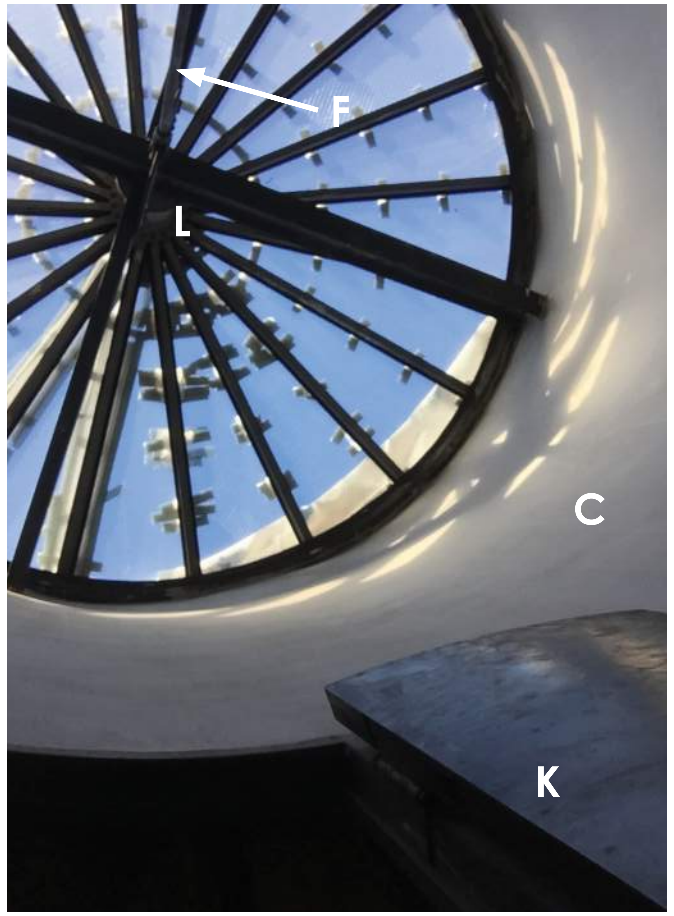
Laylight in plaster shaft



Laylight in plaster shaft



Laylight view from rotunda



Skylight view from within light shafft

PHOTO KEYED NOTES

A. LAYLIGHT GLASS PANE.

B. MULLION

C. PLASTER WALL FINISH.

D. PLASTER OR CEMENTITIOUS LEDGE.

E. STEEL SUPPOT LEDGE.

F. STEEL ROD TO SUPPORT LAYLIGHT AND ROTUNDA CHANDELIER.

G. LAYLIGHT STEEL SUPPORT.

H. ELECTRICAL CONDUIT TO SERVE ROTUNDAT CHANDELIER.

I. PLASTER CEILING IN ROTUNDA.

J. WOOD TRIM AT LAYLIGHT .

K. CURVED STEEL DOOR INTO PLASTER LIGHT SHAFT FROM ATTIC.

L. SKYLIGHT.

ROTUNDA ATTIC | MECHANICAL DUCTWORK

The rotunda attic is not conditioned or ventilated. The unconditioned space functions as a pass through zone for mechanical ducting and sprinkler system piping serving adjacent wings.

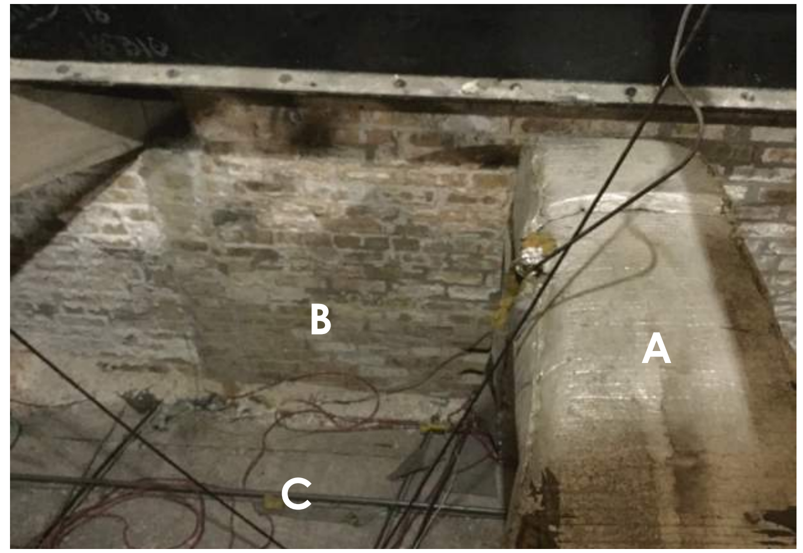
- Ductwork in the attic runs eat-west just above the inner dome and wraps around the center plaster lightshaft. The ducts enter into the attic through openings in the brick walls just above the plaster ceiling of the rotunda.
- Sprinkler piping crisscrosses the rotunda attic and enters to the south wing attic space through a small opening at the base of the pedestal wall
- Three condensate lines, collecting moisture from the dome skylight condensate gutter, are also routed through the space. Condensate lines, run to the north side of the attic, merge alongside the knee wall and continue as a single pipe down the face of the brick back-up wall. At the base of the wall, the pipe turns horizontally and penetrates the north perimeter masonry wall. Condensate is discharged approximately 28” above the roof membrane, slightly east of the access door.

KEY FINDINGS

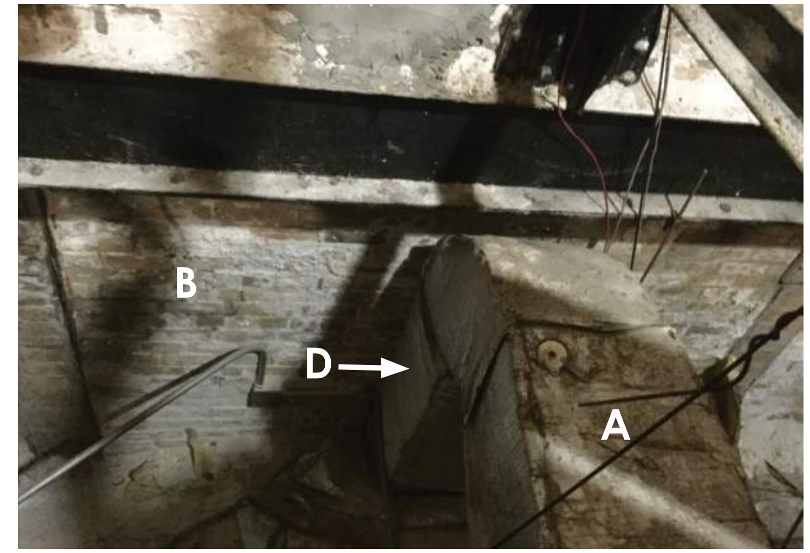
1. Ductwork does not necessarily align directly with staining patterns observed on the rotunda ceiling below
2. Ductwork is wrapped in foil faced insulation, but the seams have separated.
3. Condensate pipe is wrapped with unknown material which could potentially be asbestos containing.

RECOMMENDATIONS

1. Remove old ductwork insulation wrap and install new insulation over ductwork.
2. Separate ductwork from steel truss members to prevent condensation due to thermal transfer.
3. Inspect and repair condensate piping.
4. Remove old condensate piping insulation and install new sealed piping insulation.
5. Repair condensate pipe thru exterior wall. Install new drip spout to prevent water from running on face of masonry.

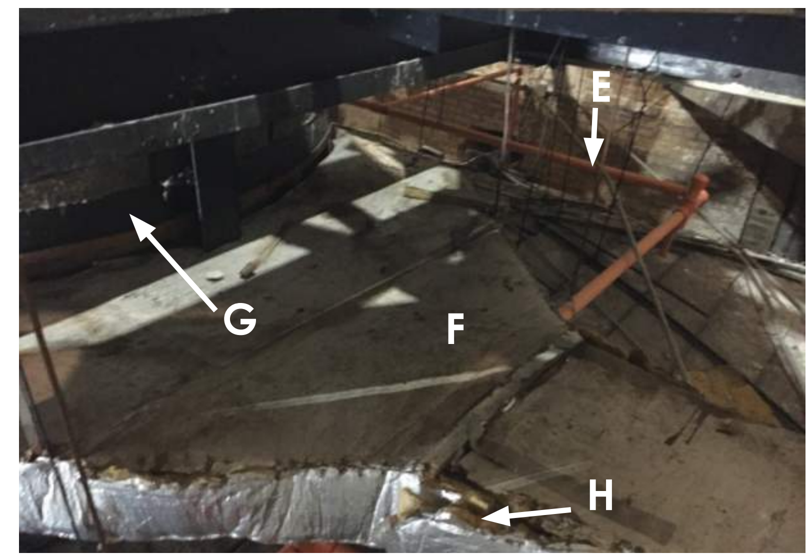


Ductwork on the east side of the attic

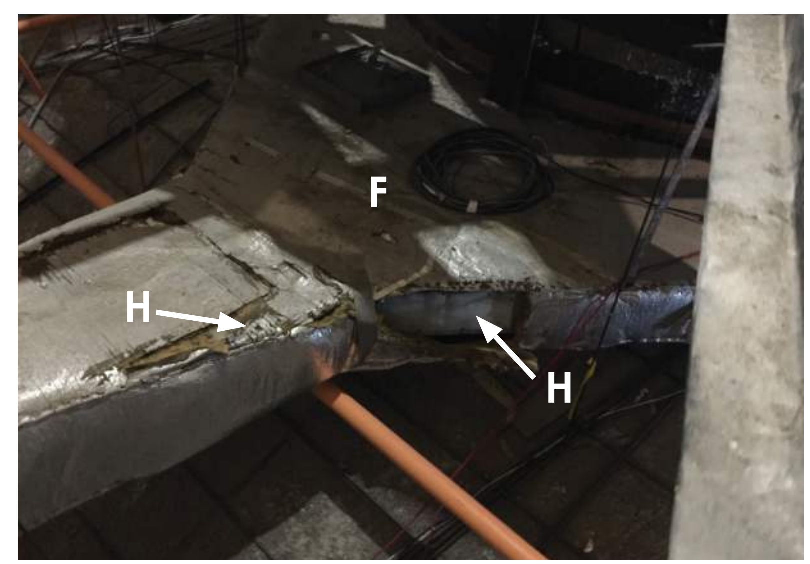


Ductwork on the west side of the attic

Skylight condensate piping collects on the north side of the attic



Ductwork spreads around the base of the plaster light shaft



Deteriorated duct insulation

PHOTO KEYED NOTES

A. DUCTWORK IN THE ATTIC.

B. BRICK MASONRY WALL OF DOME BASE.

C. BACK SIDE OF ROTUNDA DOME,

D. DUCTWORK PENETRATION THRU MASONRY WALL.

E. SPRINKLER PIPING.

F. DUCTWORK FLARES AND WRAPS AROUND LIGHT SHAFT BASE.

G. LIGHTSHAFT BASE.

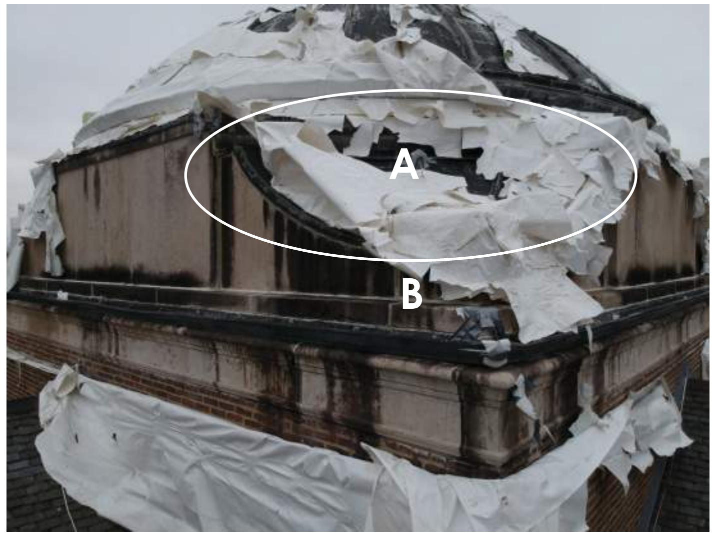
H. DUCTWORK INSULATION IS DETERIORATING.

I. SKYLIGHT CONDENSATE PIPING WRAPPED IN AN UNKNOWN INSULATION.

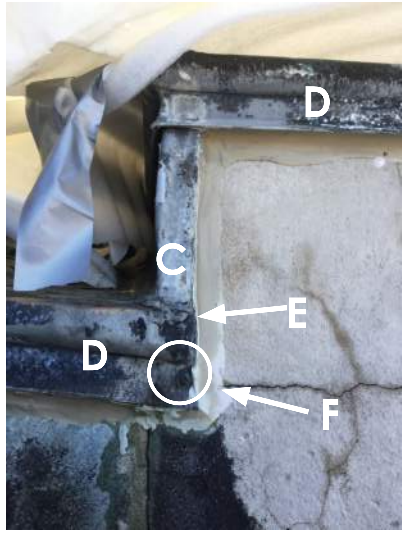
DOME BASE | SLOPED COPPER CORNER ROOFS

The shallow dome sits on a rectilinear stone-clad brick base that is square in plan and chamfered diagonally at the corners. The 'sliced' corners create an octagonal shaped roof line at the top of the base. The perimeter of the upper section of the wall is detailed with a slightly overhanging stone coping cap. The sloped section of roof at the pedestal corners is divided into four equal wedge shaped, convex copper roof sections that funnel to a point behind the offset corner piers. Although the concave curvature of the sloped corner sections creates an interesting contrast with the reverse curvature of the dome above, the design has the unfortunate consequence of funneling water toward the backside of the corner piers.

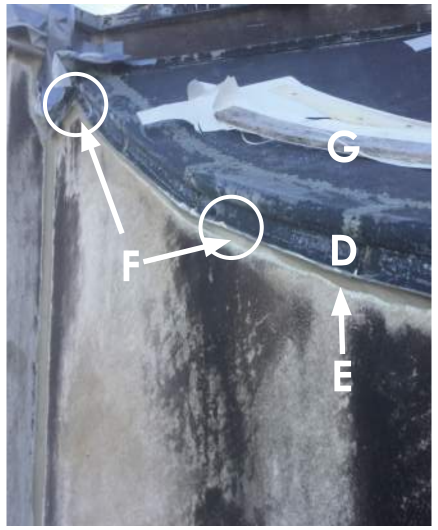
- Each convex, copper clad corner is triangular in plan with sides about 9-feet long. Each copper roof consists of 4-copper sections separated by 3-battens. Copper battens are a series of segments tack soldered to the base sheets. In plan, the corner is a 45-degree corner to the dome base. It consists of a transition from the copper sloped dome to a masonry, stone angled base. At the corners, the copper continues with an inverted or convex slope to a corner stone pier.
- Copper seams were noted to be lapped and soldered. No rivets were observed. The extent of the laps is not known. Solder was applied with a single pass and dressing, stitching was not observed on any of these joints.
- The panel joints likely occur under the battens but this was not observed. Typically, the panels have an upturned leg and are fixed to the substrate with several vertical clips. The battens are a series of segmented pieces that are shingle lapped and tack soldered to the base sheets. There are gaps along the edges except where they tack soldered. Each joint of the batten segment also appears to have been soldered.
- On the roof facing sides of the corner piers, copper roofing is extended up the vertical face of the stone, about 5-inches up, where a step in the stone provides a slight overhang. It is assumed that there is a stone joint at this location and the copper is returned into the stone joint. Sealant is applied liberally over the joint. The copper then turns horizontal and turns over the copper concave panels along a straight edge. It is assumed these panels are locked at this joint and held in place with clips. No signs of stress (warping) was observed at these locations.
- Soldered joints were thin, and some cracks were noted, however, it was not clear if these cracks continued through the joint.
- The copper roof edge wraps the face of the stone pier and terminating about 2 1/2" from the corner. This copper edge is a rolled, radius with a vertical leg and an angled drip. The vertical leg is anchored into the stone or substrate with copper or brass screws with washers at no particular interval. Under the drip edge is a consistent, large sealant joint. It appears as if this is the top of the stone panels.
- The roof substrate is unknown, but is likely a built-up layer plywood over shaped wood sleepers.



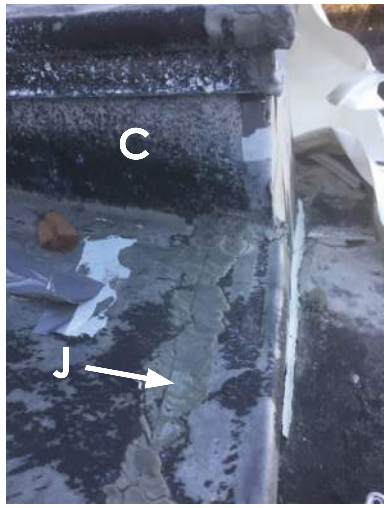
Northwest sloped corner - obscured by tarp



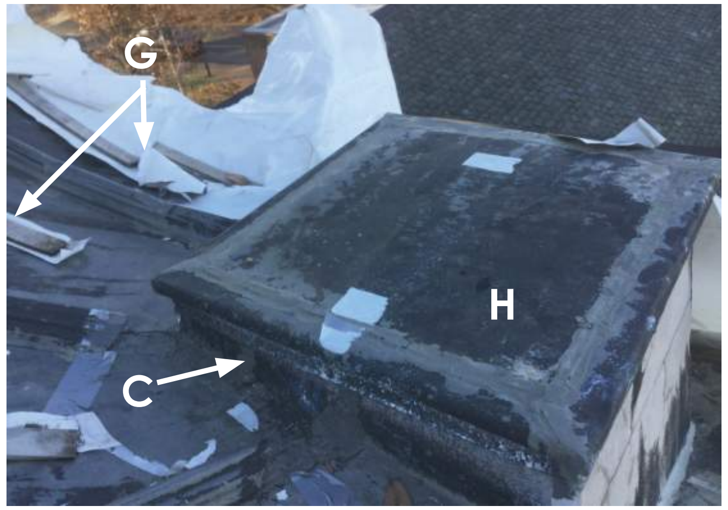
Copper and pier juncture



Typical copper roofing edge



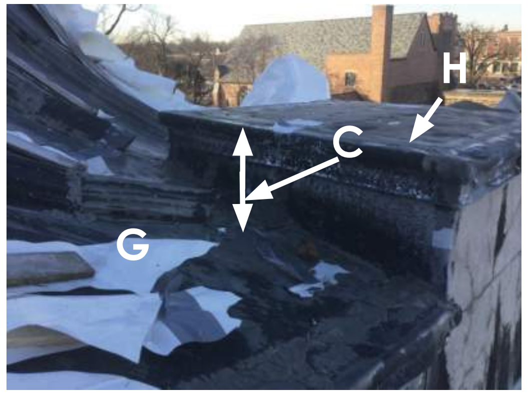
Pier and copper roof juncture



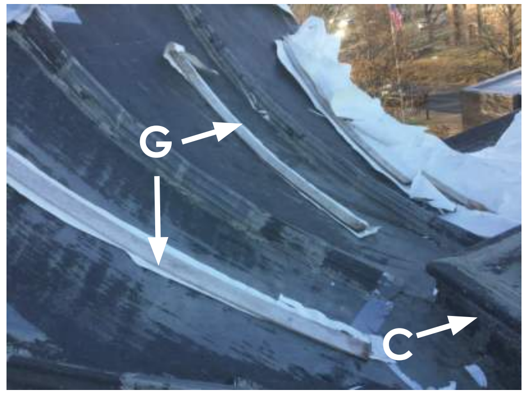
Typical pier at sloped corner

Typical batten on sloped corner roof copper

Stone joint at corner pier



Copper and pier juncture



Battens on typical sloped corner roof copper

KEY FINDINGS

1. Broken and poor soldered joints that may allow water intrusion.
2. Gaps at batten caps may allow water behind joints.
3. Water from roof runs to back side of pier where joints and battens are subject to water intrusion.

RECOMMENDATIONS

1. Remove sloped copper roofing and pier caps.
2. Repair substrates and repair or replace as necessary.
3. Install new copper roofing and pier caps.

PHOTO KEYED NOTES

A. COPPER ROOFING AT SLOPED CORNERS.

B. STONE CLAD PIER AT SLOPED CORNERS.

C. VERTICAL COPPER PANELS SOLDERED TO SLOPED COPPER PANELS ON BACK SIDES OF THE PIER. WATER IS CHANNELED TO THIS AREA BY THE BATTENS. THE VERTICAL FACE OF THE PIER IS LESS THAN 3-INCHES TO THE PIER CAP EDGE AND THE JOINT TO THE PIER CAP APPEARS TO BE OPEN.

D. TYPICAL COPPER EDGE PROFILE AT WALLS AND PIERS.

E. SEALANT AT ALL COPPER STONE JUNCTURES. IT IS NOT CLEAR HOW THE COPPER IS TERMINATED, BUT APPEARS TO BE A STRAIGHT EDGE SET IN SEALANT.

F. SCREW ANCHORS AT SLOPED COPPER EDGES SUGGEST COPPER IS NOT TERMINATED INTO A JOINT AND THAT THERE IS A WOOD SUBSTRATE UNDERNEATH.

G. SCREWS USED TO ANCHOR THE WOOD STRIPS, THAT HELPED HOLD DOWN THE TEMPORARY TARP, PUNCTURE THE COPPER PANELS AND MEMBRANE SUBSTRATES.

H. COPPER PIER CAP WITH SOLDERED TYPICAL EDGE. IT IS NOT CLEAR HOW THE CAP IS SECURED.

I. COPPER, SEGMENTED BATTEN CAPS. TACK SOLDERED TO SLOPED COPPER PANELS. BATTEN SEGMENTS ARE SHINGLE LAPPED AND SOLDERED. HOWEVER, THESE JOINTS HAVE FAILED.

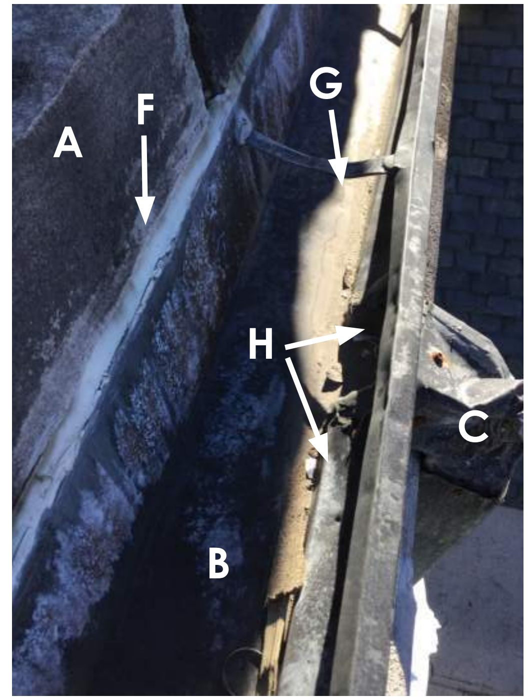
J. COPPER EDGES ARE LAPPED OVER THE SLOPPED COPPER PANELS AND THE SOLDERED JOINTS HACE CRACKED. IT IS NOT CLEAR IF THESE JCOINTS HAVE FAILED.

K. SOLDERED JOINTS BETWEEN THE SLOPED COPPER AND THE CERTICAL COPPER AT THE PIER HAVE FAILED.

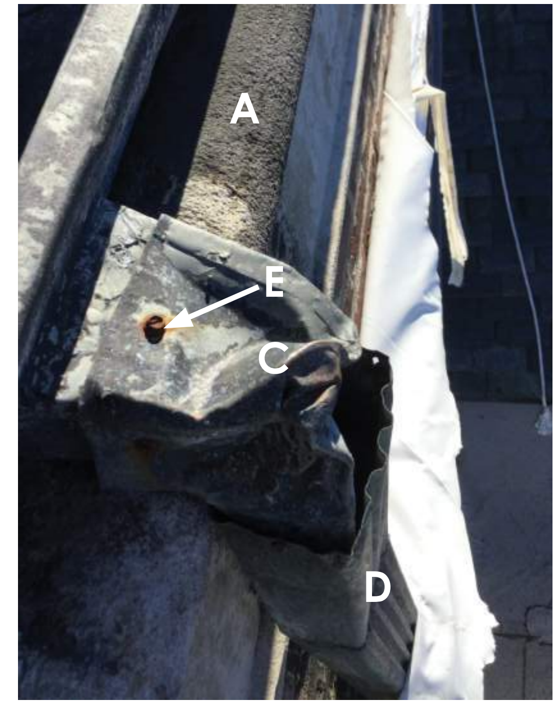
DOME PEDESTAL | COPPER GUTTER AND DOWNSPOUTS

A continuous copper gutter wraps the dome base, sitting on a sloped stone ledge at the top of the pedestal. The gutter is a K-style profile but with a straight sloped face. It is 5-inches high and 4 1/2" across the bottom with a flare of 2" at the top.

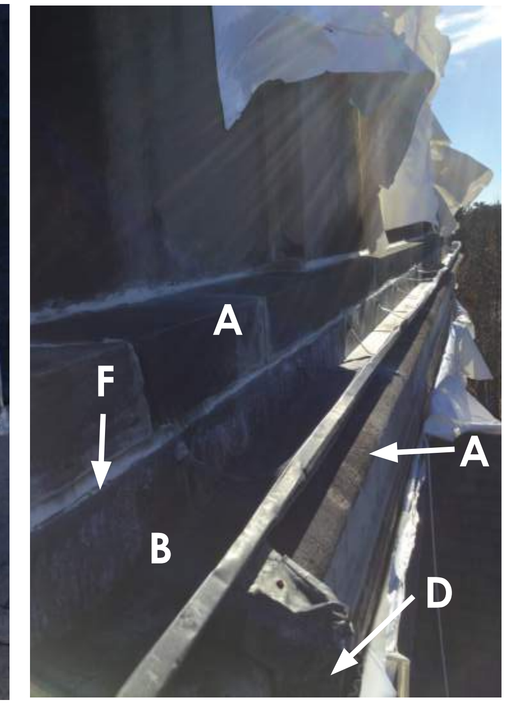
- The back leg of the gutter is continuously set into a stone joint reglet. The reglet joint is currently covered with sealant.
- The gutter has straps at 24" on center, and pan soldered joints at 8'-0" on center and 32" from corners. Many of the straps are bent or broken.
- The front edge of the gutter is damaged.
- No anchors were observed on the gutter walls or at the reglet joint. Straps are likely attached to the back wall of the gutter with rivets. All these strap tabs are covered with sealant and the anchors were not confirmed.
- Two downspout were noted for this gutter- one off the west and one off the east sides of the pedestal. Both downspouts discharge about 8-inches above and onto the flat roof. There is no splash block under these downspouts. These downspouts are a nominal 3" x 4" lead coated copper with the outside face corrugated. The elbow transition from the gutter to the west side downspout has been damaged and joints were broken. The soldered joints of the elbow and the gutter were also damaged. On the west downspout elbow, a ferrous anchor was noted on downspout at leader head. The anchor was likely not part of this gutter installation and was likely added recently.



Copper gutter and downspout elbow on west side



Copper downspout elbow



Copper gutter along west side

PHOTO KEYED NOTES

A. STONE PEDESTAL.

B. LEAD-COATED COPPER GUTTER AROUND PEDESTAL.

C. COPPER DOWNSPOUT ELBOW.

D. COPPER DOWNSPOUT - ONE ON TEH EAST AND ONE ON THE WEST SIDES OF THE PEDESTAL.

E. FERROUS ANCHOR AT ELBOW TO GUTTER SLEAVE.

F. REGLET JOINT WITH SEALANT WHERE BACK WALL OF GUTTER TERMINATES AROUND PEDESTAL.

G. DAMAGED GUTTER STRAPS.

H. SOLDER JOINTS AT SLEAVE AT GUTTER DISCHARGE ARE BROKE

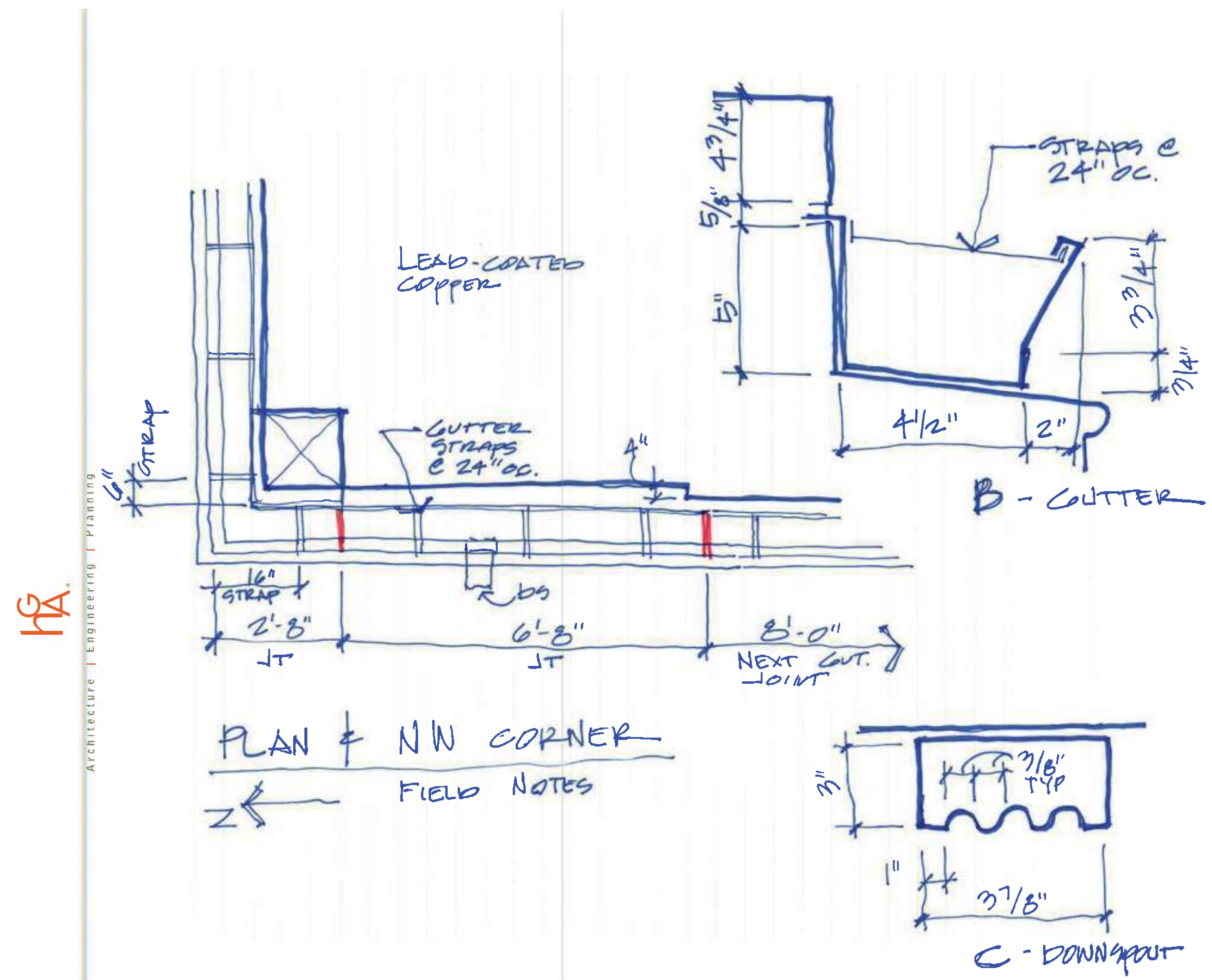
KEY FINDINGS

1. Some cracks were noted in the soldered joints of the copper gutter, but it was not clear if these were all the way through.
2. The gutter, straps, sleave, and elbow all showed signs of damage.
3. It is assumed the vertical leg of the gutter terminates into a reglet. This stone joint is filled with sealant. Some some adhesion failures were observed at this joint.

RECOMMENDATIONS

1. Remove the existing gutter and downspouts and Install a new copper gutter system including copper downspouts.

- Incorporate expansion joints at the gutter
- Provide sufficient slope along length of gutter to downspouts.
- Review and evaluate reglet terminations
- Review gutter anchorage
- Size downspouts correctly
- Provide splash blocks



DOME PEDESTAL | COPPER FLASHING

The masonry (brick) walls of the pedestal terminate three ways. On the East, South, and West elevations, the adjacent slate roof butts up to the pedestal wall and is flashed. On the North elevation, and for about 12-feet of the East and West elevations, the flat roofing system terminates against the pedestal wall and is flashed. On the South elevation, two small sections of brick wall continue all the way down to the grade.

The flashings at the flat roof appear to be a pre-finished galvanized with anchors into the brick every 18-24-inches. These anchors have been covered in sealant. The top edge of this flashing is flared and the valley is filled with sealant. The sealant appears to be Urethane and it shows signs of cracking and appears brittle. Some newer patches were also observed.

The flashings on the sloped slate roofs is a stepped galvanized flashing. The bottom leg of this flashing rests on the top faces of the sloped slate shingles and the top edge is stepped and tucked into the brick mortar joints. These reglet joints are filled with a similar urethane sealant which is also brittle and cracking the end edge of the stepped flashings, where they transition to the flat roof flashings, is just a hemmed, returned edge along the face of the brick. This edge is closed with a bead of sealant. It is not clear how the sloped slate roof waterproofing membranes terminates along the pedestal brick walls.

KEY FINDINGS

1. The sealants at all the roof flashings have reached the end their service life and are now cracking and separating.
2. Sealant color does not match the brick or the flashings.

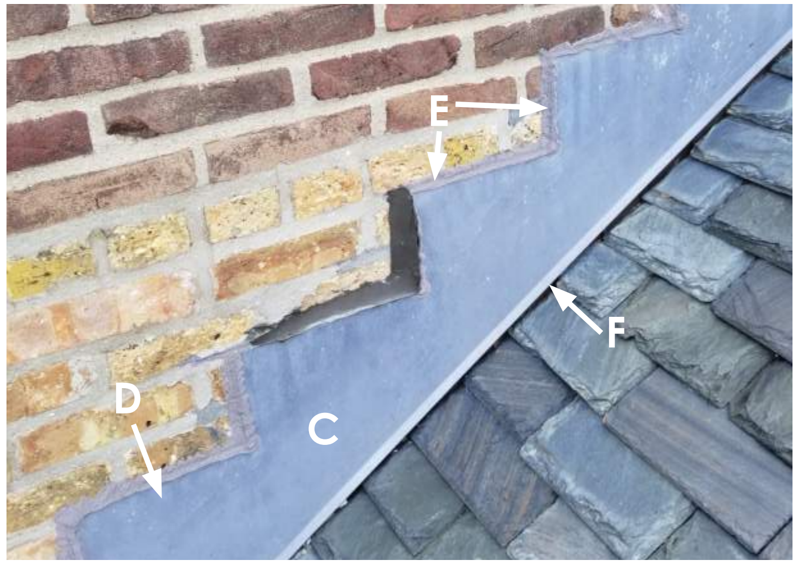
RECOMMENDATIONS

1. Remove and replace all flashing sealants- color to match substrates.
2. Replace flashings with new copper flashings where visible to public.

Dome flashing at flat roof

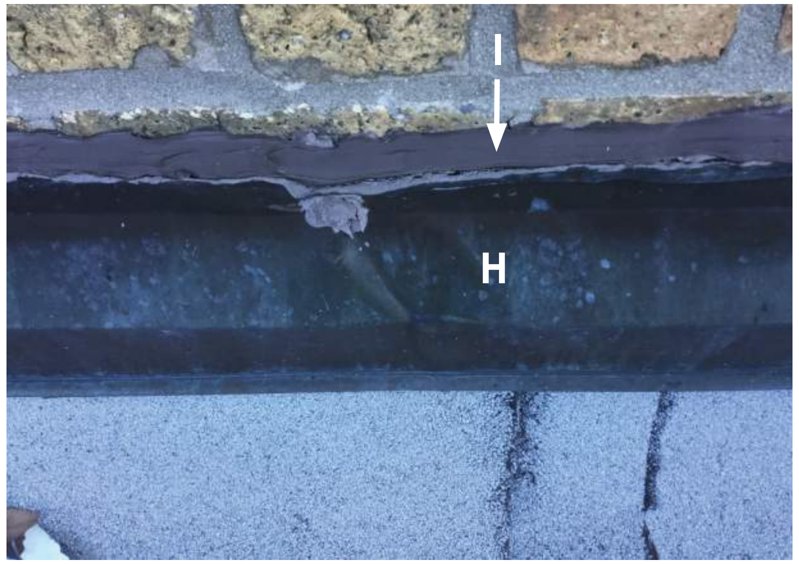
Flashings at west side of dome

Flashings at east side of dome



Stepped flashings at the sloped tile roofs

Flashing transition at east roof junctures



Damaged flashing and sealant patch at north roof

PHOTO KEYED NOTES

A. PREFINISHED ROOF COUNTERFLASHING ANCHORED TO PEDESTAL BRICK WALLS WITH ANCHORS ABOUT 16-INCHES ON CENTER.

B. SEALANT ALONG THE TOP EDGE OF THE FLAT ROOF COUNTERFLASHING.

C. STEPPED, GALVANIZED ROOF COUNTERFLASHING FLASHING.

D. SEALANT AT THE STEPPED FLASHINGS IS AT THE END OF ITS LIFE. SEALANT COLORS DO NOT MATCH BRICK OR FLASHINGS. SOME SEALANT HAS BEEN PATCHED RECENTLY.

E. THE HORIZONTAL LEGS OF THE STEPPED FLASHINGS APPEAR TO BE SET INTO THE BRICK MORTAR JOINTS, HOWEVER, THE VERTICAL LEGS DO NOT.

F. COUNTERFLASHING WITH A SMALL LEG RETURN ONTO SLOPED SLATE ROOFING. IT IS NOT SURE HOW THE ROOF FLASHING BELOW IS TERMINATED.

G. THE GALVANIZED COUNTERFLASHING LAPS OVER THE ROOF COUNTERFLASHING WITH SOME SEALANT ON THE JOINTS. IT IS NOT CLEAR HOW THE ROOF MEMBRANE IS SEALED, TERMINATED BEHIND THIS JUNCTURE.

H. DAMAGED ROOF COUNTERFLASHING.

I. NEW SEALANT OVER EXISTING SEALANT. OLD SELANT DOES NOT APPEAR TO HAVE BEEN REMOVED COMPLETELY BEFORE THE INSTALLATION OF THE NEW SEALANT.

DOME PEDESTAL | FACE BRICK

The dome pedestal is a brick masonry wall on all four sides. Each side of the pedestal square base is approximately 34-feet. The pedestal brick wall is approximately 16 1/2 inches thick and on the east, north, and west sides, is banded with two brick types. On the south facade, the red brick clads the entire pedestal and walls down to the grade.

Access to observe the exterior conditions of the exterior brick was limited to what could be observed from the north flat roof.

Brick 1 (lower original yellow brick): approximately 21” of exposed brick above the roof flashings on the north, east, and west sides of the dome base. On the east and west sides, the slate roof rides up over this brick. The bricks are 2 ¼” x 7 7/8” but do vary a little. The mortar joints are an average of ½”. Three courses measured between 8 ¼” and 8 ½” across the walls. This brick and mortar appeared to be in good shape, no spalls or cracks were observed. Brick is running bond, but 2-courses are header bond. These 2-courses are 6-rows apart.

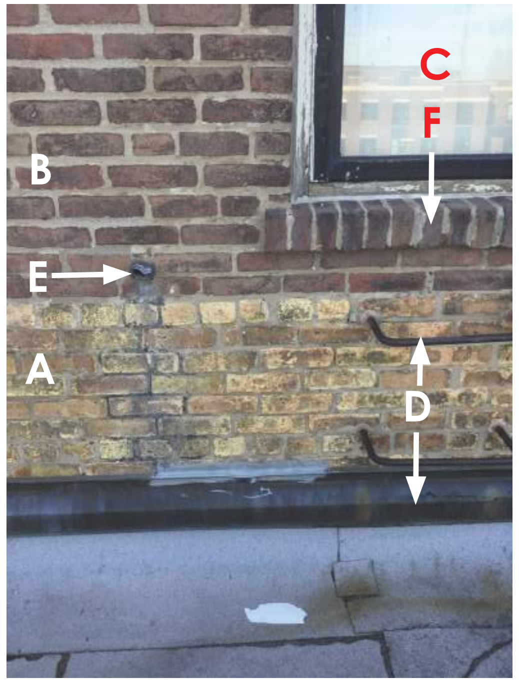
Brick 2 (upper original red brick): approximately 49 ½” of brick on top of the yellow brick and below the stone cap of the dome base. This brick is on all four sides of the dome base and is the same exterior brick as on the rest of the building. These bricks were measured to be 2” tall and of lengths between 7 ½” to 7 7/8”. The mortar joints were large, between ¾” and 1”. 3-courses measured between 8 ½” to 9” across the wall. This brick also looked to be in good shape and no spalling or cracking was observed. This brick is also running bond and every 6-course has an alternating header and stretcher pattern. A window is cut into this brick, centered on the north wall. The opening is 34” wide x 40 ¼” tall. There is a brick sill with a ¼” slope and about a 1 ½” projection. The window head is stone on the outside and a steel beam/plate on the inside.

KEY FINDINGS

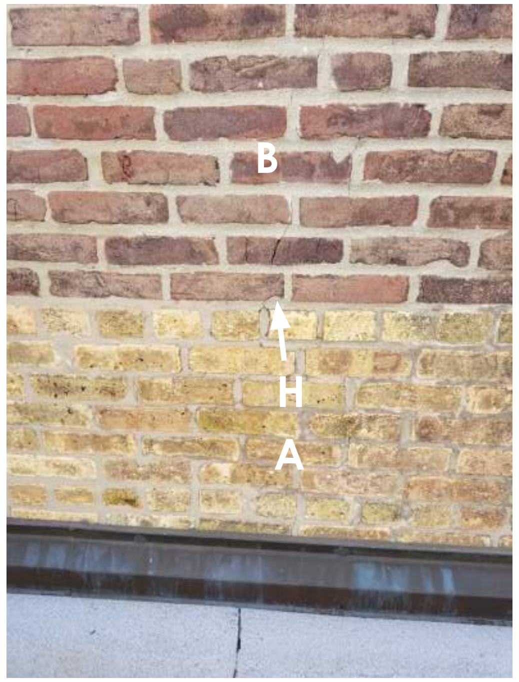
1. The sealants at all the roof flashings have reached the end of their service life and are now cracking and separating.
2. Sealant color does not match the brick or the fl ashings.

RECOMMENDATIONS

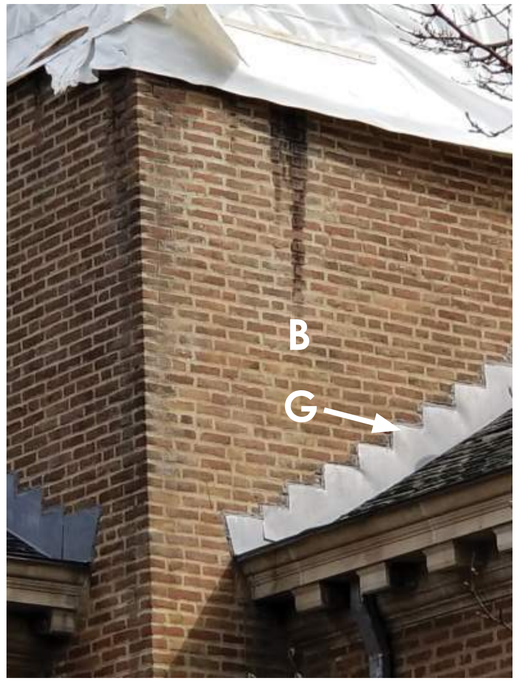
1. Remove and replace all flashing sealants- color to match substrates.
2. Replace flashings with new copper flashings where visible to public.



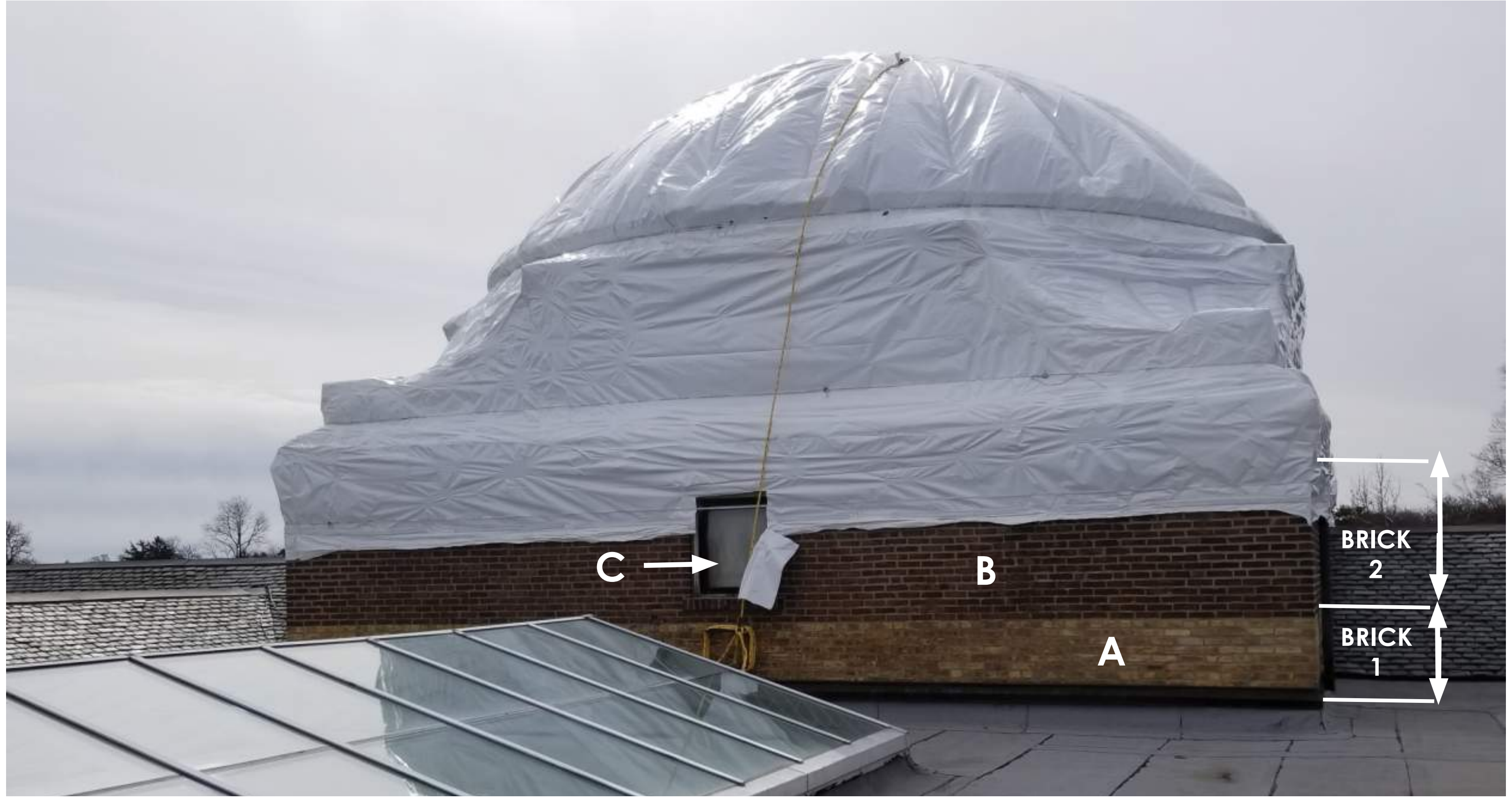
North elevation at enrty door/window



North elevation at entry door/window



Stepped counterflasshings at the northeast corner



North elevation of the dome pedestal

PHOTO KEYED NOTES

A. BRICK 1.

B. BRICK 2.

C. ATTIC OPENING - WOOD FRAMED DOOR WITH A NEWER ALUMINUM WINDOW WITH A CONTINUOUS HINGE THAT SWINGS OUT.

D. REBAR RUNGS EMBEDDED INTO THE BRICK.

E. SKYLIGHT CONDENSATE DISCHARGE PIPE. PIPE END IS DAMAGED AND IT IS NOT CLEAR IF IT IS FUNCTIONAL. STAINING ON BRICK BELOW SUGGESTS THIS MAY STILL DRIP WATER.

F. BRICK SILL.

G.STEPPED GALVANIZED COUNTERFLASHING WITH SELANT APPLIED TO TOP EDGES.

H. CRACKED MORTAR JOINTS TO BE REPOINTED.

DOME PEDESTAL | ATTIC ACCESS

The access to the dome from the roof is through an opening on the north face of the dome pedestal wall, about 42" above the roof surface. The opening appears to be original with a wood door and wood framing in a masonry opening.

- The wood door swings inward and has a hasp latch and pull. The wood door and frame have been painted but coatings have failed and bare wood is exposed in many places on the frame.
- A newer aluminum, continuously hinged window that swings out was added and closes against the wood framing. The window is held in place with a bent nail
- The masonry sill consists of rowlock coursing with a slight slope (about ¼") and a 1 1/2" overhang. No cores were observed on the end units.
- The opening head is the underside of the stone base.
- Compressible weatherstripping has been installed around the wood door.
- Sealant was observed at the joint between the wood frame and the masonry wall and sill. The sealant has separated from the surfaces and was also cracked and hard.
- Two rungs, constructed out of reinforcing bars, provide steps to climb into the attic access opening.
- A small wood platform on the inside protects the plaster rotunda ceiling and provides a landing for a wood access ladder to the attic space.

KEY FINDINGS

1. The wood ladder and loose laid 2x plank catwalk system is not OSHA compliant.

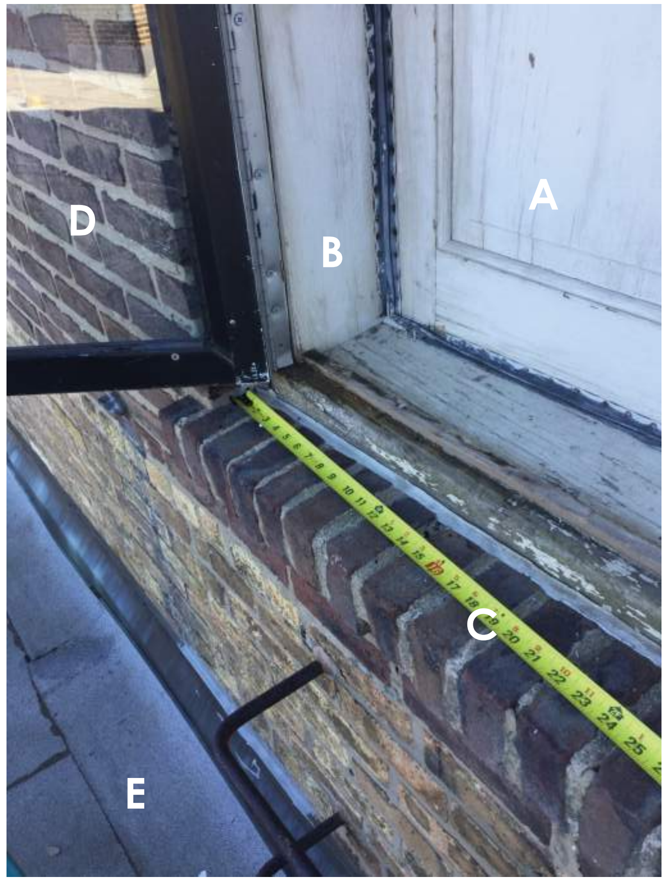
RECOMMENDATIONS

1. Install new permanent catwalk system in attic, allowing access around the light shaft and to critical perimeter points.

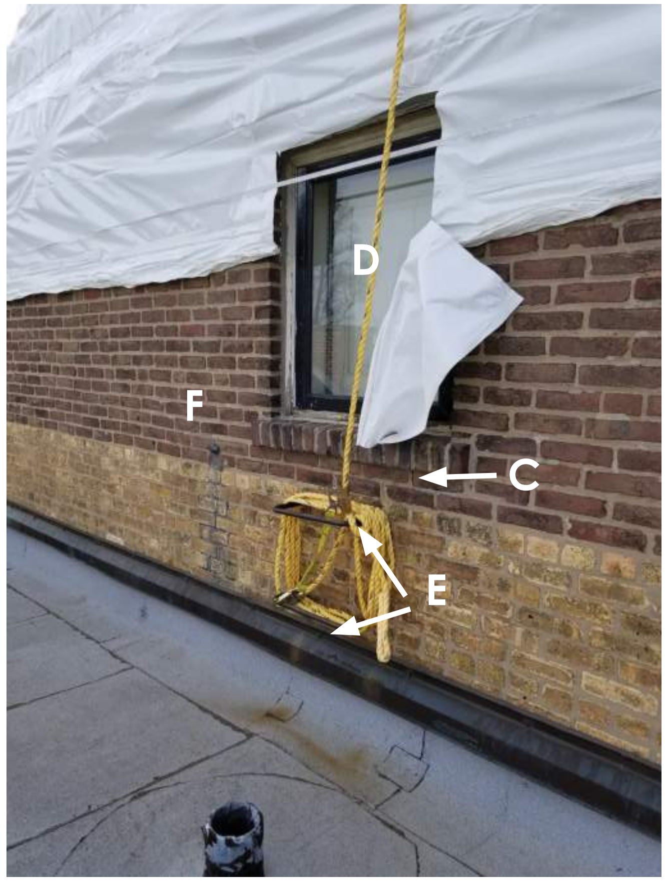
2. Remove rebar rungs on the exterior brick and replace with new steps to access door on north facade.

3. Replace wood ladder in attic with compliant ship ladder stair.

4. Replace wood planks in attic with permanent walk system.

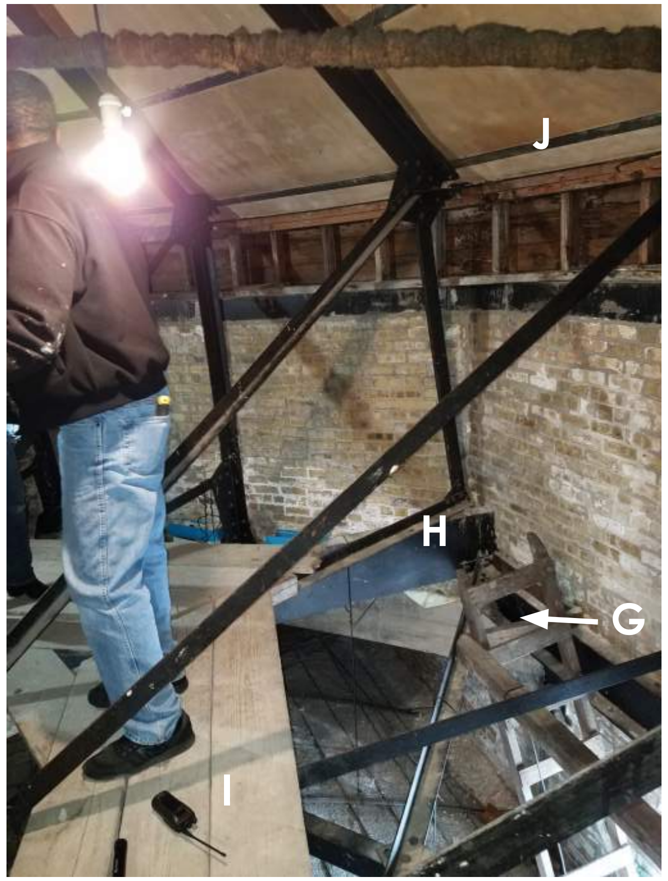


Exterior access door and rung ladder



Exterior access door off north facade inside attic looking down to exterior acess door

Inside attic looking down to exterior access door



Inside attic looking at ladder to truss beam

PHOTO KEYED NOTES

A. WOOD ACCESS DOOR INTO ATTIC.

B. WOOD FRAME AGAINST MASONRY OPENING.

C. BRICK SILL.

D. NEWER ALUMINUM WINDOW, WITH A CONTINUOUS HINGE ANCHORED TO THE WOOD FRAME.

E. REBAR LADDER RUNG ACCESS.

F. SKYLIGHT CONDENSATE DISCHARGE PIPE.

G. WOOD LADDER UP TO STEEL TRUSS BEAM.

H. WOOD ENTRY PLATFORM ON TOP OF INNER DOME.

I. WOOD CATWALK PLANKS AROUND LIGHT SHAFT.

J. WRAPPED SKYLIGHT CONDENSATE PIPING.