



EXTERIOR ENVELOPE REVIEW

FOR

**CITY OF GRAND RAPIDS
GRAND RAPIDS AREA LIBRARY BUILDING
140 NE 2nd STREET
GRAND RAPIDS, MINNESOTA 55744**

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Project # 22-8040

September 16, 2022

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STANDARD OF CARE

The conclusions and recommendations contained herein represent our professional opinions. These opinions were arrived at in accordance with accepted engineering practices at this time and location. No other warranty is implied or intended.

Should additional data become available, our opinions will be subject to amendment to reflect the new information.

CERTIFICATION

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the state of Minnesota.

Signature:  _____

Date: September 16, 2022

Registration Number: 53975

EXECUTIVE SUMMARY

An evaluation of the exterior envelope of the Grand Rapids Library building was conducted by Encompass to review the façade conditions and provide any needed repair recommendations. The exterior components of the building façade, including brick masonry, flashings, sealants, and roofing have been reviewed through onsite observations, to evaluate their condition and performance. Water testing was also conducted at known leak location to determine the source of leaks. Deficient conditions and details have been identified during the onsite observations which are discussed in this report. Areas for potential repair include masonry wall caps, window flashings, and sealants. This report contains the findings from the observations as well as analysis and recommendations for building maintenance and repair.

1.0 INTRODUCTION/BACKGROUND

- 1.1 Encompass, Inc. has performed a review of the exterior envelope at the Grand Rapids Library building to evaluate the current façade conditions. Items for review included the exterior masonry, windows, sealant joints, claddings, lintels, parapets, and flashings. Observations were conducted on site on foot and with ladders. Encompass also conducted water testing at known leak areas to determine the possible leak sources.
- 1.2 Site observations and investigations were conducted on July 26th, 2022. Encompass personnel performing the investigations were Ben Sandvig, P.E., Jim Manfred, Senior Technician, and Layo Hernandez, Technician. The following report details the activities and observations recorded during the investigation. Referenced photographs can be found at the end of the report.
- 1.3 The Grand Rapids Library building is a wood-framed and masonry structure that was built in 2000. The building is a single-story structure with exposed interior framing and unique architecture at different areas. The façade primarily consists of brick masonry with aluminum windows and various bumpout features clad with engineered siding. The roofs are low-slope and covered with a membrane.
- 1.4 Water leaks were reported to Encompass at several locations in the building which were reviewed and tested during the site visit.
- 1.5 Overall photos of the building exterior can be found at the end of the report, photos 1 through 3.

2.0 TESTING

- 2.1 Isolated water testing was conducted at several areas where leaking has been reported in the building. The following is a summary of the testing activities.
- 2.2 Bumpout Windows – Water testing was conducted at the front bumpout windows near the main entrance (see photos 1 and 4). Water leaks were reported from the top of the window frames at the interior.
 - 2.2.1 Water spray was applied to the sealant joints above the head of the window in the overhang assembly. Water spray was applied to the vertical, skyfacing joint at the center of the window (see photo 5) and leaks were observed at the interior window framing.
 - 2.2.2 The sealants were typically failed at the center joint and at others. Joint sealant had been applied over older sealant without removing the older sealant, which results in a poorly performing joint (see photo 6). Many joints were debonded and easily removed.
 - 2.2.3 Analysis
 - The failed sealant at the window head assemblies allowed water entry into the overhead framing above the widows. Due to the existing construction,

water that enters the overhead framing will drain into the window assembly and leak into the interior.

- According to the existing details, flashing is installed within the overhang assembly, but the flashing does not have a means to drain to the exterior. See Figure 1 for the original window head and overhang detail.

2.3 Office Window – Water testing was conducted at an office window near the east entrance (see photo 7). Water leaks were reported at the window jambs at the interior, below the operable window unit.

2.3.1 Water spray was applied to the horizontal mullion below the operable window unit. Leaks were observed at the interior window framing after a few minutes of testing (see photo 8).

2.3.2 Analysis

- Water testing at the mullion indicates that there is a seal failure within the window frame assembly. Internal frame seals and/or seals around the operable units are failed. Previous sealant repairs have been attempted at this location which have not resolved the issue.

2.4 Ceiling Leak – Water Testing was conducted around a ceiling leak that was reported near the east entrance (see photo 9). Water dripping from the wood ceiling had been reported by building users, but the exact location was not confirmed.

2.4.1 Water testing was conducted at the facade and roof areas around the ceiling leak for 90 minutes and no interior leaks were detected. Testing areas included the skylights, transition flashings, masonry, roofing, window frames, and soffits.

2.5 Skylights – Water Testing was conducted at the skylights on the main roof. Water leaks have been reported at isolated locations at the skylights by building management in the past, but the most recent leaks were last seen in 2021. Leaks have not been observed or reported in 2022.

2.5.1 Water testing was conducted at two primary areas of the skylights where leaks have been reported in the past, at the center and the east end of the skylight assembly (see photo 10). Water testing consisted of applying water spray to all parts of the skylight in a sequential fashion, starting at the base of the assemblies up to the masonry walls.

2.5.2 Water testing was conducted at the two locations for approximately 60 minutes each and no leaks were detected.

2.5.3 Analysis

- Water leaks have not been observed in the building recently and may not be an active or persistent problem.
- Water stains were observed around the skylight framing from past moisture intrusion.

- The existing sealants are in poor to fair condition at the skylights, with failures noted. Various sealant repairs have been executed at the skylights in the past.
- Existing drawings show a through wall flashing detail at the heads of the skylights which is different than what is currently installed. The current flashings terminate at the wall exterior which rely on a sealant joint that is currently failed (see photo 21). Failed sealants and the existing configurations at the existing flashings could be contributing to moisture intrusion.
- The skylights should be monitored for ongoing issues, and they should be maintained properly to extend their performance.

3.0 OBSERVATIONS

3.1 Brick Façade

- 3.1.1 The façade primarily consists of red brick masonry units and mortar (see photos 1 through 3 and 11). The masonry is the exterior barrier component of the cavity wall system.
- 3.1.2 Through wall flashings are installed throughout the façade to drain and divert moisture out of the wall assembly (see photo 12).
- 3.1.3 Flashing is typically installed over the brick lintels (see photo 13). Some window and door location did not include a drip edge.
- 3.1.4 Water staining was observed at north facing brick at stem walls above the roof (see photo 14). Water stains were typically located within 10-15 brick courses from the top of the walls. The tops of the brick walls are covered with prefabricated concrete cap panels and flashing. The flashing is installed under the caps and appears to be a copper membrane product. The flashing does not have a rigid drip edge (see photo 15).
- 3.1.5 Generally, the masonry is in good condition with only minor deterioration or damage observed at isolated locations (see photo 16).

3.2 Siding

- 3.2.1 Horizontal lap siding is installed at the rear of the building in different locations, primarily at the large bumpout features (see photo 2). The siding is an engineered product that is coated. The exterior siding has been replaced recently, according to building management.
- 3.2.2 Wood siding and wood soffits are present at the roof overhangs at all elevations. Minor water stains were noted at some of the exposed wood soffits (see photo 17).

3.3 Windows

- 3.3.1 Window units are installed at the library building in various, unique configurations. The majority of the windows are curtain wall assemblies constructed with aluminum framing. Seals and joints around the windows and glazing are in fair condition, with some failures observed (see photo 18).
- 3.3.2 Skylights are installed at the top of the south facing roof (see photos 19 and 20). Water testing did not result in any water leaks at the skylights. Sealants at the head flashings were typically failed (see photo 21). Failed sealants and repairs were also typical at various joint locations (see photo 22). The existing drawings show a through wall flashing detail at the adjacent masonry wall, which differs from the current configurations, see Figure 2 and photo 21. Water stains were present at sporadic locations of the framing beneath the skylights (see photo 23) indicating that water intrusion has occurred in the past.

3.4 Sealants

- 3.4.1 Joint sealant is present at the perimeters of the window and door frames. The window/door perimeter sealant was typically deteriorated and was cracking or failed at various locations (see photos 24).
- 3.4.2 Joint sealant was installed at the base of exterior siding at the window heads with no weep or drainage above the window (see photo 25). At some locations this sealant was failed.
- 3.4.3 The sealant at masonry and concrete cap joints was typically in fair condition, with localized failures noted (see photo 26).
- 3.4.4 The joint sealants at metal flashings were typically in poor condition (see photo 27).

3.5 Roof

- 3.5.1 The roofing installed at the library is a green PVC membrane roofing material (see photo 28). The roofing is installed with ridge pieces adhered to the membrane which visually produces a look like a metal roof with seams, and snow guards are also present at the ends of the roof. The existing roofing was reportedly installed to replace the original roof soon after initial construction.
- 3.5.2 Isolated patch repairs were noted at the roof membrane in several locations. Various roofing seams exhibited some minor wear and deterioration (see photo 29), as well as corners and terminations (see photo 30). Water stains, discoloration, and organic growth was also present on the north roof elevations where less sun exposure is lower. No other deficiencies were observed at the membrane.

4.0 ANALYSIS

4.1 Masonry

4.1.1 The existing masonry façade is generally in good to very good condition. The brick units and mortar are typically sound and show very little signs of deterioration. Minor deterioration is present in small, isolated areas as a result of age-related deterioration.

4.1.2 Water stains at the masonry are the result of moisture collection and saturation on the masonry. The saturation has resulted in isolated masonry damage at mortar joints at select areas.

4.2 Siding

4.2.1 The panel and lap siding installed at the library is in good condition. Periodic maintenance is required to extend of the life of the installed materials, which has been executed recently with siding replacement.

4.3 Sealants

4.3.1 Joint sealants are installed at façade penetrations and joints of dissimilar materials, as well as expansion joints. Joint sealants allow building materials to move differentially while maintaining an exterior seal. Joint sealants provide primary protection at the building façade and, when failed, will not accommodate movement and can lead to moisture intrusion. The existing joint sealants are in poor to fair condition as a result of age-related deterioration. Joint sealants will typically have an expected useful life of 10-15 years.

4.3.2 The heads of windows were typically sealed with no drainage path or weep mechanism (see photo 25). The termination of any façade element such as siding, metal, or brick, where it meets a window or penetration, should have a means to drain water to the exterior.

4.4 Windows

4.4.1 The windows appear to be in fair condition and no issues were typically observed with the window units. Adjacent sealants should be repaired and are addressed in the previous section.

4.4.2 The roof skylights are not currently exhibiting any leaks, although they have leaked in the past. No leaks were detected with water testing that was conducted, but signs of water intrusion were noted around the skylights. Deficiencies at the window and adjacent brick flashings may be contributing to moisture intrusion. Monitoring of the skylights may assist to confirm the presence of leak issues.

4.4.3 The sealants at the skylight frames and flashings are at or near the end of their useful life.

4.5 Roof

4.5.1 The roofing at the building is generally in fair condition, with localized areas of failure due to wear or material degradation. The expected service life of typical membrane roofing can be expected to be between 20 to 25 years.

5.0 RECOMMENDATIONS

The following repairs are recommended at the library:

5.1 Front Windows

5.1.1 In order to allow the wall assembly to drain properly above the window, revise the window head configuration to weep/drain at the window head (see Figure 1). This will require disassembly and modification of the sheet metal coverings and framing above the windows. The sheet metal assembly may also be modified to conceal the exposed sealant joints to extend their lifespan and improve performance.

5.1.2 Replace all joint sealant at the windows. Remove all existing joint sealants and install new joint sealants.

5.2 Office Window

5.2.1 Disassemble the exterior frame around the operable window units and remove the operable units. Repair the frame seals and zone dams around the operable window units. Repair any flashings around the operable unit framing to seal the window frame and reassemble the window.

5.3 Ceiling Leak

5.3.1 No leaks were detected during testing and no repairs can be recommended at this time.

5.4 Skylights

5.4.1 Replace all joint sealant at the skylight frames and adjacent flashings.

5.4.2 Remove the existing wall/head metal flashing at the skylights. If through wall flashing is present, inspect it for deficiencies and install flashing to lap under it and over the skylight heads. If through wall flashing is not present, install it into the masonry wall and over the skylights.

5.4.3 Monitor the skylights for any leaks until repairs can be completed and evaluate them immediately if leaks occur.

5.5 Masonry

5.5.1 Remove the existing concrete caps and remove the existing flashings. Install new membrane flashing with a stainless steel, hemmed drip edge at both sides that drains water off the masonry wall. Reinstall the caps and seal the panel joints with sealant and weep ropes.

5.5.2 Use a masonry cleaner, power washing, hot water washing, or other means necessary to clean the stained masonry below the concrete wall caps.

5.5.3 Install water repellents at the concrete caps and north masonry walls.

5.5.4 Perform localized tuckpointing at cracked or damaged locations, estimated to be less than 5% of the façade.

5.6 Sealants

5.6.1 Remove and replace all existing exterior joint sealants at the windows, doors, masonry joints, and wall penetrations. Provide drainage and/or weep mechanisms at façade material transitions as applicable.

5.7 Roof

5.7.1 Roofing replacement should be considered within the next 5 years.



Photograph 1 – The east (front) elevation of the library building.



Photograph 2 – The west elevation of the library building.



Photograph 3 – The north elevation of the library building.



Photograph 4 – Bumpout window assembly near the main entrance.



Photograph 5 – Joint above window head, note failed sealant, testing location is noted by arrow.



Photograph 6 – Failed sealant at joints in the bumpout window overhang assembly.



Photograph 7 – Office window with leaks reported at the interior jamb.



Photograph 8 – Leak location at the office window.



Photograph 9 – Reported leak location at the ceiling near the east entry doors.



Photograph 10 – Water testing location at the skylights.



Photograph 11 – Typical masonry conditions at the north elevation.



Photograph 12 – Typical lintel details at masonry window fenestrations.



Photograph 13 – Water-stained masonry wall (north facing).



Photograph 14 – Water-stained masonry with cracking at bed joint. Moss formation is also noted.



Photograph 15 – Wall cap details showing flashing conditions.



Photograph 16 – Brick crack around through wall flashing details.



Photograph 17 – Water stains at a wood soffit.



Photograph 18 – Cracking sealant at a window assembly.



Photograph 19 – Skylight assembly at the roof.



Photograph 20 – Interior view of skylight assemblies.



Photograph 21 – Failed sealant joints at the skylight wall flashing, no through wall detail is visible with existing wall flashing.



Photograph 22 – Repairs at the skylight joints.



Photograph 23 – Water stains at the wood beam beneath the skylight.



Photograph 24 – Failed sealant at a windowsill joint.



Photograph 25 – Sealant installed at window head/base of siding, with failures observed.



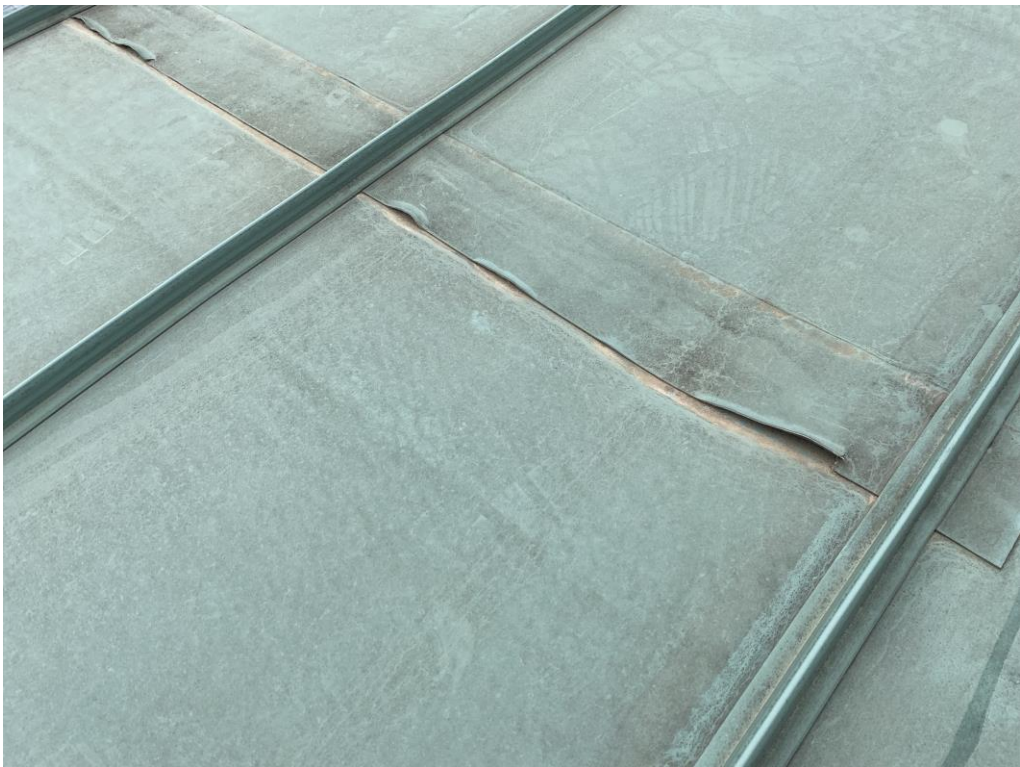
Photograph 26 – Sealant at masonry joints.



Photograph 27 – Failed sealants at metal flashings.



Photograph 28 – Roofing at the south roof elevation.



Photograph 29 – Deteriorated roofing seam location.



Photograph 30 – Roofing at the north roof elevation, with peeled terminations at the corner.

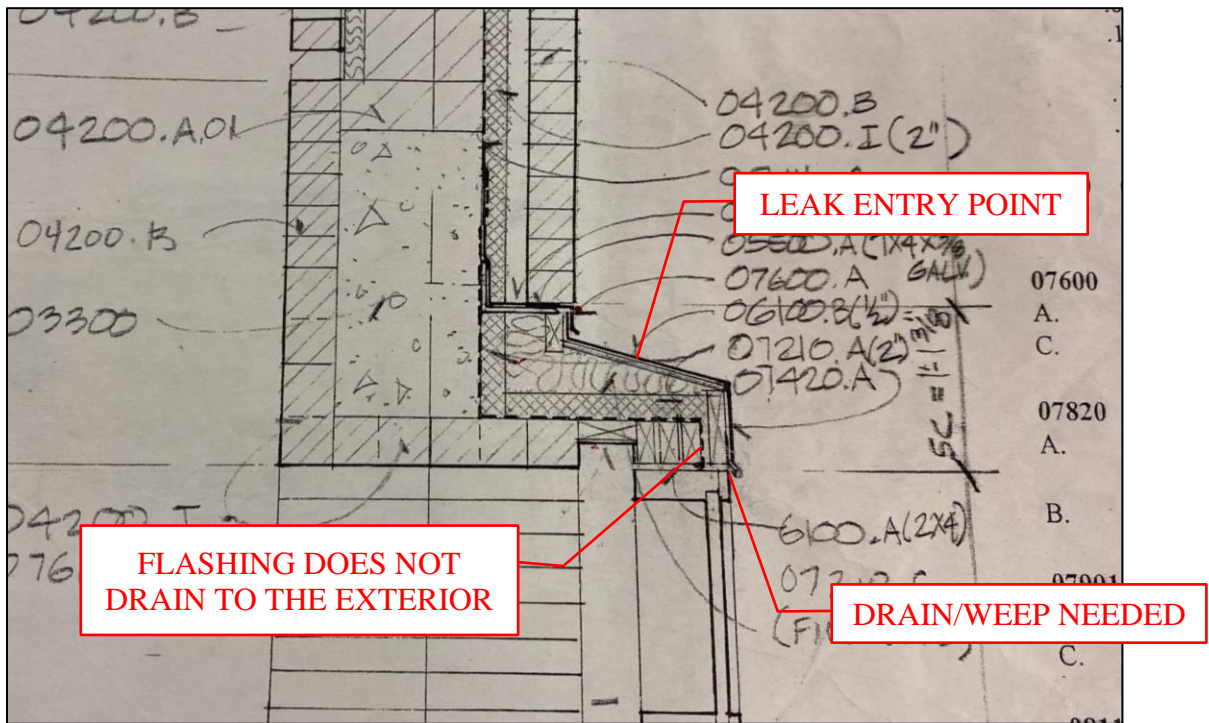


Figure 1 – Original detail at the head of the bumpout windows.

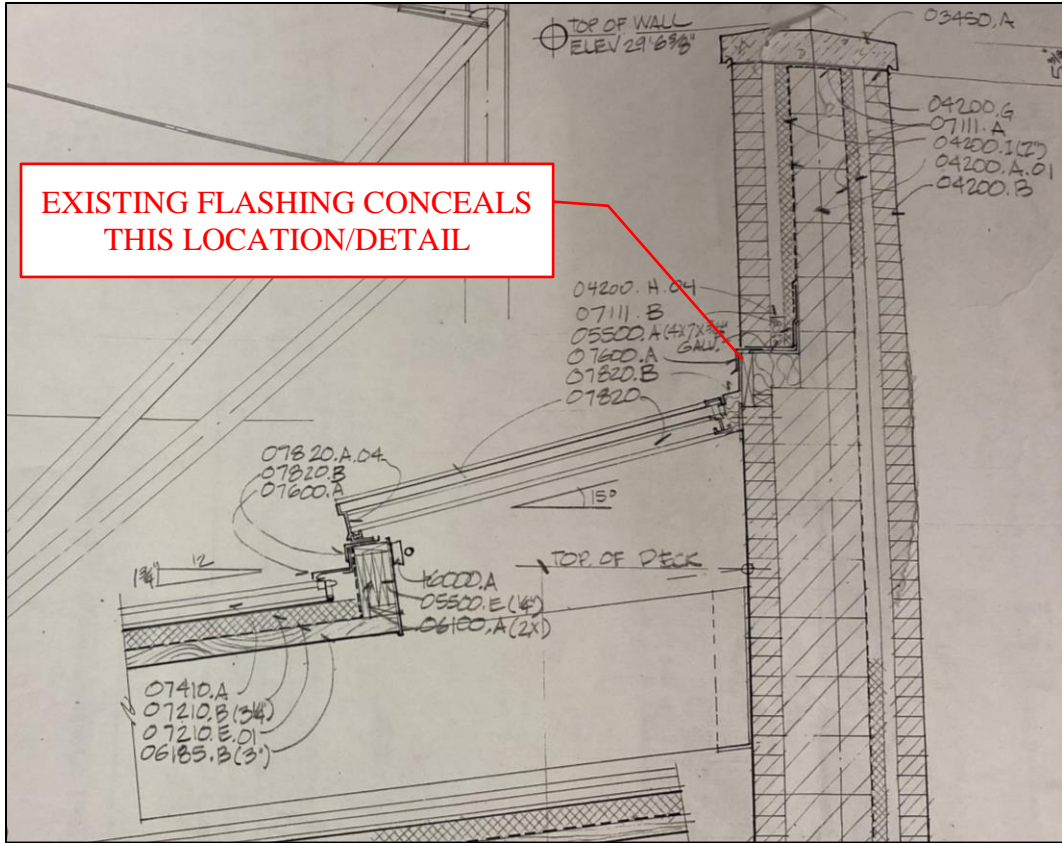


Figure 2 – Original detail at the skylights.