CONDITION ASSESSMENT

SIXTH AND CHERRY PARKING STRUCTURE

COLUMBIA, MISSOURI

Prepared for:
CITY OF COLUMBIA

WRC PROJECT NO. 31-7734.00
SEPTEMBER 2014

WALKER
RESTORATION CONSULTANTS

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505 Davis Road
Elgin, IL 60123

Voice: 847.697.2640
Fax: 847.697.7439

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EXECUTIVE SUMMARY

This report contains the results of Walker's Condition Assessment of the Sixth and Cherry Parking Structure owned by the City of Columbia in Columbia, Missouri. The objectives of the condition assessment were to evaluate the existing condition of the parking structure, develop repair and maintenance recommendations for the structure based on observed deterioration, and provide an opinion of probable cost for the recommended repair items.

This seventeen year-old cast-in-place post-tensioned parking structure is in relatively good condition. The identified deterioration included very minor concrete deterioration with a few isolated spalls at the walls, columns, and floors, as well as several deteriorated waterproofing elements at the façade and Roof Level. Additionally, a few minor aesthetic items such as minor surface corrosion at the stairs and other miscellaneous metal elements were noted.

We recommend performing the following repairs in order of importance:

1. Repair of delaminated concrete at floor surfaces, walls, and columns.
2. Replacement of deteriorated expansion joints.
3. Removal and replacement of all the façade joint sealant.
4. Replacement of failed cove joint sealants and vertical sealants at the Roof Level stub columns.
5. Repair of spalled thin overlay concrete used to mitigate ponding.
6. Application of a penetrating concrete sealer on the supported floor surfaces.
7. Painting of traffic markings where the sealer is being applied. The original stripes will be partially removed when preparing the surface for the sealer application.
8. Replacement of failed sealants at the window perimeters.
9. Replacement of spalled bricks on the façade.

Our opinion of probable construction cost for the maintenance and recommended repairs is $185,000. Please see Table 1 in the Recommendations section for a breakdown of the individual repair and maintenance cost items.

Please see the attached discussion for a detailed report of our investigation.

September 15, 2014
Diego Romero, Ph.D., EIT. Date
Restoration Engineer

September 15, 2014
Laurence C. Susmarski Date
Project Manager

INTRODUCTION

Walker Restoration Consultants performed a Condition Assessment of the Sixth and Cherry Parking Structure in Columbia, Missouri, in accordance with our proposal dated May 12, 2014.

The assessment was performed by Restoration Engineer Diego Romero and Project Technician Jose Perez on August 19, 2014. The condition assessment included a visual review of readily accessible exposed structural members, supported floor surfaces, wall surfaces, exterior façade, stair towers, and floor drainage systems. Chain dragging and hammer sounding of representative elements was conducted to identify typical subsurface concrete delaminations.

OBJECTIVES

The objectives of the condition assessment was to evaluate the existing condition of the parking structure, develop repair and maintenance recommendations based on observed deterioration, and provide an opinion of probable cost for the recommended repair items.

PARKING STRUCTURE DESCRIPTION

The Sixth and Cherry Parking Structure is a 4-level (1 level-on-grade and 3 supported levels), 2-bay wide, cast-in-place, post-tensioned parking structure. Constructed in 1997, the structure provides parking for approximately 370 vehicles and has overall plan dimensions of approximately 290 feet in the north-south direction and approximately 126 feet in the east-west direction.

Pedestrian access is provided to the supported levels via stair/elevator tower located on the northeast and southeast corners of the structure. Vehicular entrance is through the 2nd Level of the structure on the east elevation. The vehicular exit is on the Ground Level of the structure on the south elevation. The structural framing consists of post-tensioned concrete slabs and beams supported by conventionally reinforced concrete columns. The stair towers in the structure consist of cast-in-place metal pan treads. The structure's façade is composed of concrete walls clad with brick masonry veneer.

RECOMMENDATIONS

The parking structure is currently in good condition. The observed deterioration is fairly common for similar post-tensioned concrete parking structures with brick veneer façade of this age.

The most widely observed form of deterioration occurred at the façade panel joints where the sealant had failed at almost all locations. When water is allowed into the joints it can corrode the panel connections or shift individual bricks on the façade. This can ultimately create a potential for the panel failure or force bricks to spall. We recommend total removal and replacement of all the façade sealants. In addition, we recommend that the remaining repairs be completed during the next repair cycle to reduce the potential for additional deterioration.

We recommend performing the following repairs in order of importance:

1. Repair of delaminated concrete at floor surfaces, walls, and columns.
2. Replacement of deteriorated expansion joints.
3. Removal and replacement of all the façade joint sealant.
4. Replacement of failed cove joint sealants and vertical sealants at the Roof Level stub columns.
5. Repair of spalled thin overlay concrete used to mitigate ponding.
6. Application of a penetrating concrete sealer on the supported floor surfaces.
7. Painting of traffic markings where the sealer is being applied. The original stripes will be partially removed when preparing the surface for the sealer application.
8. Replacement of failed sealants at the window perimeters.
9. Replacement of spalled bricks on the façade.

The recommended repairs are tabulated in Table 1 along with the opinion of probable cost. Our opinion of probable cost for the repairs is $185,000.

OPINION OF PROBABLE REPAIR COST

Our opinion of probable repair costs for the recommended actions, including a recommended construction contingency and estimated engineering fees is summarized in the following table:

Table 1 – Opinion of Probable Repair Costs for the Recommended Repairs & Maintenance

ITEM	DESCRIPTION	EXTENSION
1	General Requirements	$ 11,000
2	Floor Repair	$ 1,000
3	Column Repair	$ 500
4	Wall Repair	$ 1,000
5	Expansion Joint	$ 31,000
6	Control Joint Sealant	$ 3,000
7	Column Joint Sealant	$ 2,000
8	Cove Sealant	$ 1,000
9	Isolation Joint Sealant	$ 13,000
10	Overlay	$ 4,000
11	Concrete Sealer	$ 43,000
12	Paint Traffic Markings	$ 4,000
13	Clean and Paint Stair Tower Handrails and Miscellaneous Steel	$ 7,000
14	Face Brick Repair	$ 1,000
15	Clean Façade	$ 10,000
16	Window Frame Perimeter Sealant	$ 13,000
	SUBTOTAL	$ 145,500
	Contingency	$ 22,000
	CONSTRUCTION SUBTOTAL	$ 167,500
	Estimated Engineering and Testing	$ 17,500
	TOTAL	$ 185,000

Notes for Table

1. Estimated costs are in 2014 U.S. dollars and are based on the repairs being completed in one construction season.
2. Estimated costs are based on historical records of similar types of work.
3. Costs may vary due to local economy, time of year, phasing, or other factors.
4. The repairs presented in this table should have a minimal service life of 5 to 8 years.

IMPLEMENTATION

The repair program outlined in Table 1 can be competitively bid and executed by experienced restoration contractors. The first step in this process is to obtain a quality set of bidding documents prepared by an experienced restoration engineer. This will allow for appropriately designed repairs and estimated quantities, so the project can be competitively bid by restoration contractors. A quality set of bidding documents will also provide assurance that the competing contractors are bidding on an appropriate identical repair program – providing for a fair comparison between bids. It also provides some quality standards in terms of repair approaches and materials that can be referenced during construction.

We recommend that the construction be scheduled in moderate weather due to weather sensitive repair procedures. Implementation of the repairs during winter months are possible but at increased costs and with some technical difficulties.

The construction time for the recommended repairs will be approximately 1 to 2 months. This will vary depending upon the amount of space that is made available for the Contractor to perform the repairs; especially during application of the concrete sealer which requires large open areas for a more efficient workflow. The concrete sealing process takes approximately 2 to 3 days to complete (per level) and could potentially be performed on the weekends. The fastest way to complete this portion of the work would be to close the parking structure completely. However, it is possible to keep a portion of the parking structure open while the repairs are underway. Barriers will be required separating the work areas from the areas available for parking. The remaining repairs should not significantly disturb the parking operations.

SERVICE LIFE OF PARKING STRUCTURES

The service life of today's designed parking structure ranges from 40 to 50 years, but this can be extended based upon the level of corrective and preventive maintenance done to the structure. Parking structures experience exposure to unusually harsh conditions compared to most buildings. Temperature extremes, dynamic loads, and de-icing agents are potentially destructive to all parking structures. Premature deterioration, such as scaling, spalling, cracking and leaking can reduce the integrity of the entire structure. Timely corrective and preventive maintenance can and will reduce the deterioration mechanism on the structure and is less disruptive to operations. The repairs outlined in this report will restore the intended integrity of the structure; however, some minor maintenance will be needed on a yearly or bi-yearly basis to maintain the repairs recommended in this report and additional items that may come up in the future.

DISCUSSION

Overall, the structure is in good condition with the need for a few routine maintenance repairs. The sections that follow discuss each type of observed deterioration in conjunction with the recommended repair and maintenance activities necessary to address the items noted and to properly maintain the structure. A list of detailed observations (including photo references) is included under the heading Observations and Findings.

CONCRETE STRUCTURE

The parking structure utilizes post-tensioning as the main structural reinforcement for both the concrete beams and floor slabs. This system consists of high strength seven wire steel strands that are encased in a plastic sheathing, embedded in the concrete and anchored at each end of the member. During the initial stages of construction, these strands or tendons are stressed to provide uplift and compression in the structural members. This method of construction counteracts the effects of a portion of the dead load and allows for longer spans and more slender members than a conventionally reinforced concrete member.

Chain dragging and sounding of the supported floor surfaces did not reveal any widespread deterioration. However, we did observe three isolated locations (one observation per elevated level) where the concrete had either delaminated or spalled. This condition was isolated and was not representative of the overall condition of the floors throughout the parking structure. Additionally, no signs of corrosion related deterioration were observed at these locations.

We also noted some minor wall spalls at grade level, some spalls at the façade panel grill connections (the grills are partially loose), and an isolated spall at a column-to-façade panel connection on the west elevation Ground Level ramp. We recommend performing partial depth repairs at these locations to restore the integrity of these members and mitigate additional deterioration. Additionally, we observed a cracked and spalled thin concrete overlay near the east entrance of the structure. The overlay appears to have been installed to mitigate water ponding but without the proper surface preparation. To address this, we recommend removing the current overlay and installing a new thin concrete overlay using latex-modified concrete. The properties of latex-modified concrete allow for better bonding to the existing floor surface. Additionally, a properly prepared substrate will allow for greater durability at this high traffic region.

WATERPROOFING

The waterproofing sealants on the façade panels as well as the roof-level stub columns have totally failed and are exhibiting alligator cracking. Water is allowed through these joints and can lead to corrosion of the embedded connections which hold the façade panels to the structure. Failure of the embedded connections can lead to the panel falling off the structure. These failed sealants may be allowing water to enter behind the brick veneer which can ultimately lead to spalling bricks. Also, we noted alligator cracking at the window perimeter

joint sealants. Failure at these joints allows water to potentially enter the stair/elevator towers. We recommend replacing all these sealants.

The expansion joints used at the stair towers are compression-type joints. We noted adhesion failures at several locations throughout the expansion joints. At some locations, daylight can be seen from underneath. Failure at these expansion joints allows water to pass through to the lower levels. During the winter season, this water may freeze on the floor surfaces and can potentially create a slipping hazard. To address these issues, we recommend replacing the existing expansion joints with a wide silicone seal protected by a cover plate. Silicone seals are more durable and are capable of accommodating greater expansions. However, they require a cover plate for ADA compatibility. Their overall cost of the recommended system is comparable to that of a compression expansion joint.

In addition to the measures above, we recommend application of a clear concrete silane sealer to minimize moisture infiltration into the post-tensioned floor surface. A silane sealer will help minimize chloride ingress from de-icing salts into the concrete and slow the potential rate of corrosion. Application of the sealer involves shot blasting the concrete surface, which also removes much of the striping paint. For this reason, we have included costs for restriping the supported tiers within the structure in our opinion of probable repair costs. Concrete sealers typically have an effective life of 3 to 5 years, after which time a reapplication is necessary to maintain their effectiveness.

MISCELLANEOUS

We did note minor surface corrosion at the base plates and handrails of the stairs. Currently this is not a structural problem, but more of an aesthetic concern. This condition was also observed at the Roof Level snow-chute gate and at the east elevation Ground Level handrails. We recommend cleaning and painting these locations to restore them to their original condition. Additionally, the exterior façade panels have a build-up of embedded dirt and soot on them around the entire structure. While this is more of an aesthetic concern, we recommend pressure washing these locations. Lastly, we observed a few isolated bricks that have spalled throughout the building's façade. At one location a brick was hanging loose and is about to fall (northwest corner of the structure, west elevation). We recommend removing this isolated brick as soon as possible.

The plumbing and electrical systems appeared to be in relatively good condition without any significant deterioration. No visible problems were noted.

SUMMARY

On Tuesday, August 19 2014 Walker Restoration Consultants performed a Condition Assessment of the Sixth and Cherry Parking Structure. The assessment consisted of a visual review of readily accessible exposed structural (columns, beams, walls, floor slabs and precast tees), waterproofing (sealants and expansion joints) elements, and chain dragging and hammer sounding of representative areas to identify concrete delaminations and possible corrosion of the embedded steel reinforcement

The following conditions were noted; representative photos may be found in Appendix A.

OBSERVATIONS AND FINDINGS

CONCRETE STRUCTURE

1. Chain dragging of the supported floor surfaces revealed a few minor isolated floor spalls throughout the parking structure. No signs of corrosion at these locations were observed (Photo 4).
2. Some minor concrete wall spalls were noted at a few decorative façade grill connections throughout the structure (Photo 5).
3. An isolated spall was observed at a column-to-façade panel connection on the west bay, Ground Level ramp (Photo 6).
4. Spalled concrete was observed at a thin concrete overlay at the east entrance of the structure (Photo 7).

WATERPROOFING

1. The expansion joints at the north and south stair towers are exhibiting adhesion failures at all levels. Daylight can be seen from underneath and are leaking (Photos 8 and 9).
2. Moisture and grease stains were observed at the underside of the control joint sealants throughout the parking structure. The sealants appear to be in fair condition with some alligator cracking observed at the ends (Photos 10 and 11).
3. The Roof Level stub column vertical sealants and isolated Roof Level cove sealant have failed (Photos 12 and 13).
4. Most of the exterior façade sealants on the exterior have failed. Cracking was observed on most vertical sealants on the precast façade panels, isolation joints, and window perimeter joints (Photos 14 through 19).

MISCELLANEOUS & FAÇADE

1. The façade panels have a build-up of embedded dirt and soot on them around the entire structure (Photo 20).

2. A few isolated brick spalls were observed throughout the façade. At one location, a brick was loosely hanging from the façade (Photos 21 and 22).
3. Surface corrosion observed at the metal base plates and handrails of the stairs. Additional surface corrosion was observed at the Roof Level snow-chute gate and at the east elevation handrails (Photos 23 and 24).

LIMITATIONS

This report contains the professional opinions of Walker Restoration Consultants based on the conditions observed as of the date of our site visit and documents made available to us by our the City of Columbia (CLIENT). This report is believed to be accurate within the limitations of the stated methods for obtaining information.

We have provided our opinion of probable costs from visual observations, limited testing, and field survey work. The opinion of probable repair costs is based on available information at the time of our assessment and from our experience with similar projects. There is no warranty to the accuracy of such cost opinions as compared to bids or actual costs. This condition appraisal and the recommendations therein are to be used by our CLIENT with additional fiscal and technical judgment.

It should be noted that our renovation recommendations are conceptual in nature and do not represent changes to the original design intent of the structure. As a result, this report does not provide specific repair details or methods, construction contract documents, material specifications, or details to develop the construction cost from a contractor.

Based on the agreed scope of services, the assessment was based on certain assumptions made on the existing conditions. Some of these assumptions cannot be verified without expanding the scope of services or performing more invasive procedures on the structure. More detailed and invasive testing may be provided by Walker Restoration Consultants as an additional service upon written request from our CLIENT.

The recommended repair concepts outlined represents current generally accepted technology. This report does not provide any kind of guarantee or warranty on our findings and recommendations. Our assessment was based on and limited to the agreed scope of work. We do not intend to suggest or imply that our observation has discovered or disclosed latent conditions or has considered all possible improvement or repair concepts.

A review of the facility for Building Code compliance and compliance with the Americans with Disabilities Act (ADA) requirements was not part of the scope of this project. However, it should be noted that whenever significant repair, rehabilitation or restoration is undertaken in an existing structure, ADA design requirements may become applicable if there are currently unmet ADA requirements.

Similarly, we have not reviewed or evaluated the presence of, or the subsequent mitigation of, hazardous materials including, but not limited to, asbestos and PCB.

This report was created for the use of our CLIENT and may not be assigned without written consent from Walker Restoration Consultants. Use of this report by others is at their own risk. Failure to make repairs recommended in this report in a timely manner using appropriate measures for safety of workers and persons using the facility could increase the risks to users of the facility. CLIENT assumes all liability for personal injury and property damage caused by current conditions in the facility or by construction, means, methods and safety measures implemented during facility repairs. CLIENT shall indemnify or hold Walker Restoration Consultants harmless from liability and expense including reasonable attorney's fees, incurred by Walker Restoration Consultants as a result of CLIENT's failure to implement repairs or to conduct repairs in a safe and prudent manner.

APPENDIX A
PHOTO LOG

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Photo 1 – North and East elevation of the parking structure.

Photo 2 – South and East elevation of the parking structure.

Photo 3 – West elevation of the parking structure.

Photo 4 – Isolated area of deteriorated concrete at floor surface, Roof Level.

Photo 5 – Spalled façade panel concrete at grill connection.

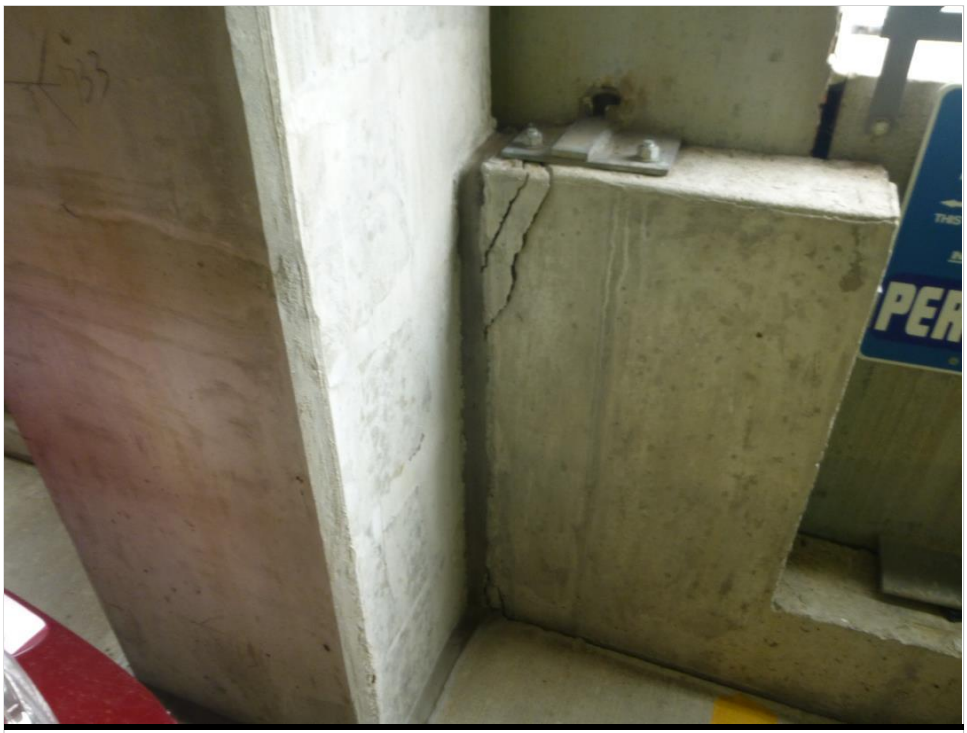

Photo 6 – Cracked and spalled concrete at column-façade panel connection.

Photo 7 – Spalled and delaminated thin overlay concrete to mitigate water ponding, east elevation entrance.

Photo 8 – Adhesion failure observed at Roof Level compression expansion joint.

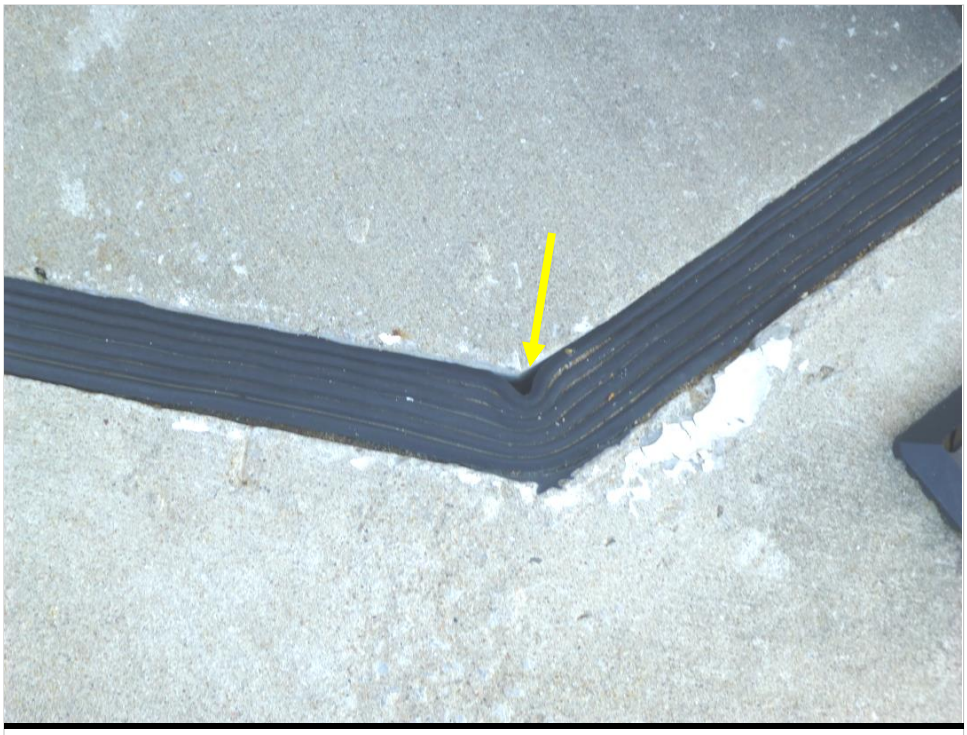

Photo 9 – Opening at compression joint seal.

Photo 10 – Alligator cracking observed at control joint.

Photo 11 – Water/grease stains on ceiling below control joints.

Photo 12 – View of Roof Level stub columns and failed vertical sealant.

Photo 13 – Failed vertical joint sealant at stub column.

Photo 14 – View of typical vertical isolation joint installed throughout façade.

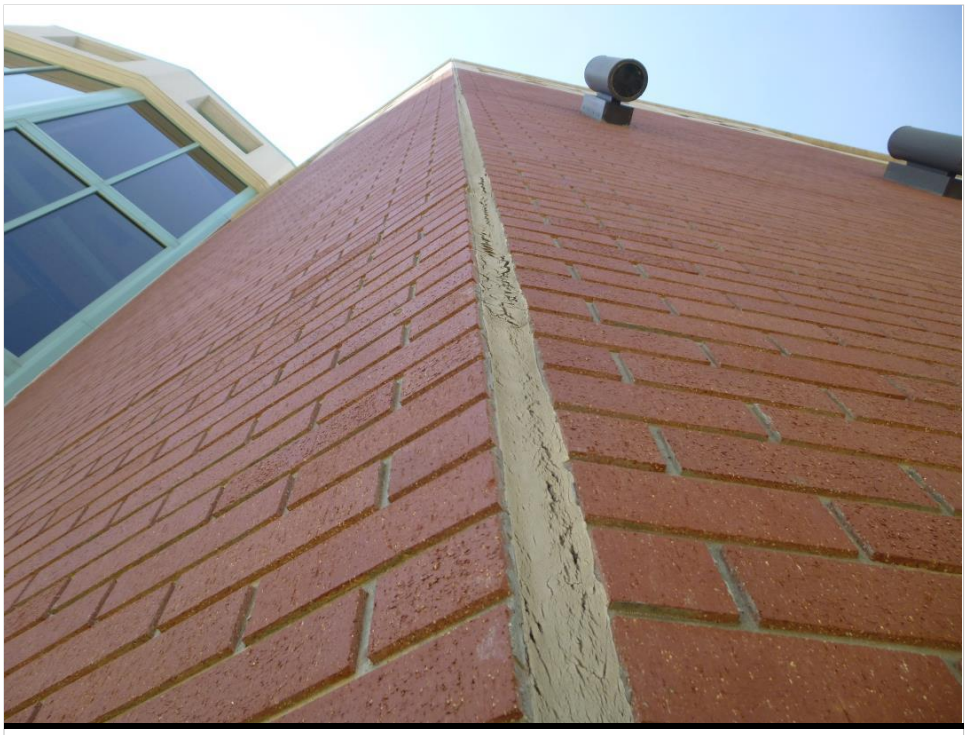

Photo 15 – Close-up of failed sealant at façade isolation joint.

Photo 16 – View of façade panel and failed vertical sealant.

Photo 17 – Close-up of failed sealant between façade panel and brick veneer.

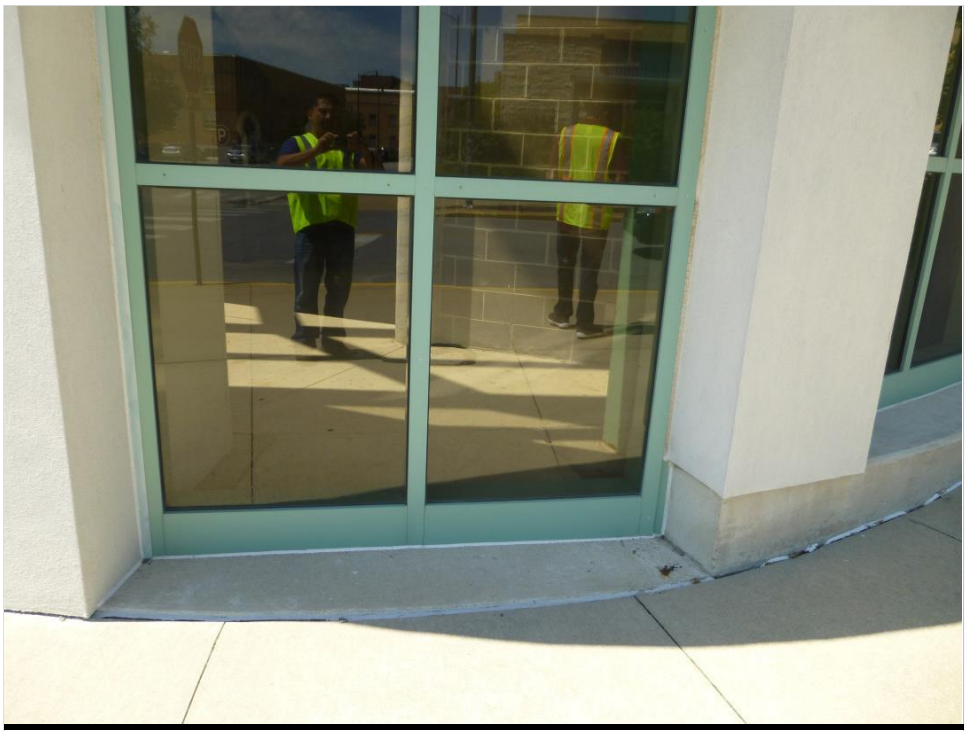

Photo 18 – View of storefront windows at stair towers.

Photo 19 – Failed sealant at window perimeter joints.

Photo 20 – View of concrete façade panel with embedded dirt and soot.

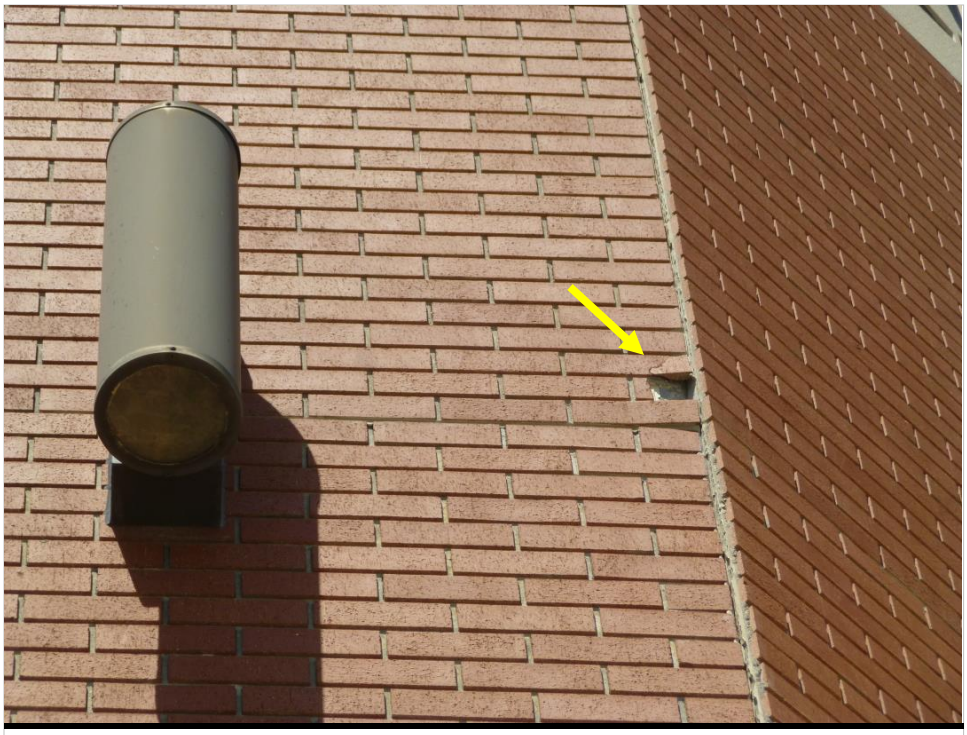

Photo 21 – Spalled brick at south elevation.

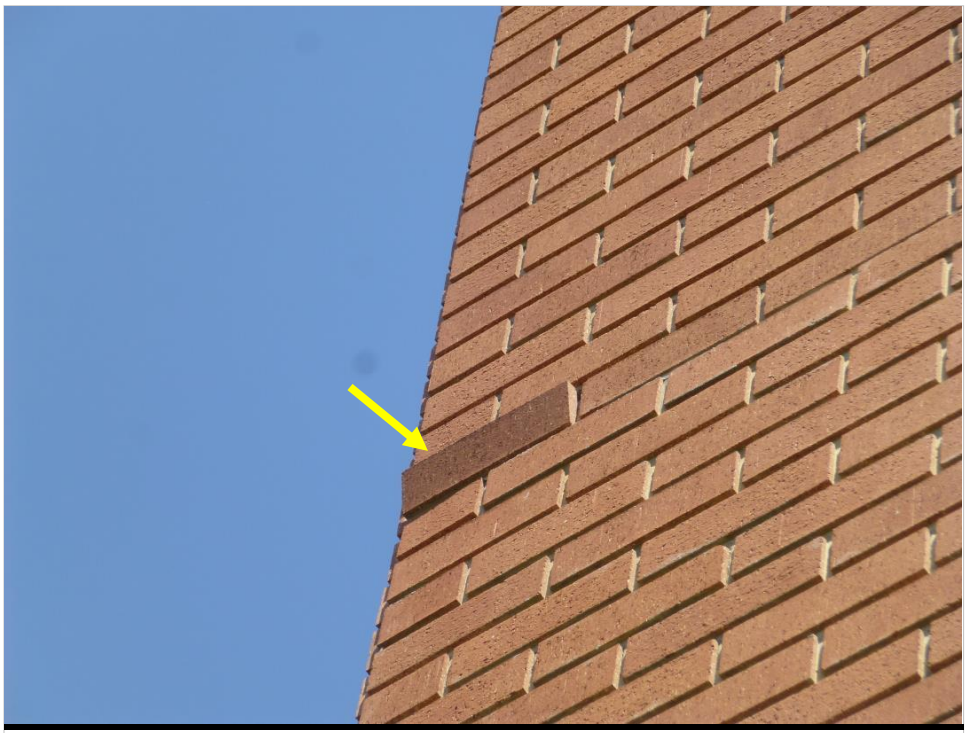

Photo 22 – Loose brick at west elevation, northwest corner of structure.

Photo 23 – Surface corrosion at stair handrails and base plate connections.

Photo 24 – Surface corrosion at snow-chute gate connection panel.

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