CONDITION ASSESSMENT REPORT

of the

WEST GENERAL ROBINSON STREET PARKING GARAGE

Pittsburgh, Pennsylvania

Submitted to:

STADIUM AUTHORITY OF THE CITY OF PITTSBURGH

Attention:

Taylor Blice
Facilities Director
Stadium Authority of the City of Pittsburgh
171 10th Street, 2nd Floor
Pittsburgh, PA 15222

August 7, 2017

Submitted by:

O&S ASSOCIATES

Parking Consultants
Structural Engineers
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August 7, 2017

Taylor Blice
Facilities Director
STADIUM AUTHORITY
OF THE CITY OF PITTSBURGH
171 10th Street, 2nd Floor
Pittsburgh, PA 15222

Re: **STADIUM AUTHORITY OF THE CITY OF PITTSBURGH, PITTSBURGH, PENNSYLVANIA**
West General Robinson Street Parking Garage Condition Assessment Report

Dear Mr. Blice,

At your request, we have performed a Condition Survey of the West General Robinson Street Parking Garage located at 668 West General Robinson Street in Pittsburgh, Pennsylvania. This is the first of three surveys to be performed on a "biennial" basis over the next 5 years. The purpose of this condition survey is to provide an assessment of the current condition of the parking garage and to recommend repair measures to repair existing deterioration, as well as recommend preventive maintenance and waterproofing measures to extend the life of the garage to the greatest extent.

The inspection was performed on May 1st & 2nd, 2017 and consisted primarily of visual inspection of the parking garage. Observations were noted and photographically documented. The only testing performed as part of the inspection was limited hammer-tap sounding of selected areas of the structural framing and floor slabs. Original design drawings were made available for our review.

This report includes our observations, conclusions and repair recommendations per our survey and can be found in the following sections.

INTRODUCTION

The West General Robinson Street Parking Garage is located at the intersection of West General Robinson Street and Tony Dorsett Drive in Pittsburgh, Pennsylvania. It is a self-park facility with ten levels of parking, with one on-grade parking level and nine supported parking levels above. The parking garage has an approximate capacity of 1,160 cars. The parking facility is a two bay, threaded helix design with two way traffic circulation and ninety degree parking. The garage was constructed around 2005. A subway station is located under part of the first floor of the parking garage, which was reported to us to have been constructed after the original construction of the parking garage.

The parking garage is constructed using a pre-stressed, precast concrete framing system. The structural floor slabs consist of a 4" thick precast, pre-topped double tee slabs and cast-in-place concrete pour strips at girders and curbs. The double tees are supported by precast spandrel beams or inverted tee beams, and precast light walls. The precast beams frame into precast columns.

The parking garage façade generally consists of precast concrete facade panels. There is also a sizable glass curtain wall at the main stair and elevator tower, as well as decorative metal architectural screen in some areas.

OBSERVATIONS AND RECOMMENDATIONS

The following section includes an outline of the conditions we observed in the garage, as well as recommendations for repair and preventive maintenance. Representative photos of each condition has also been provided.

CRACKING, SPALLING, AND DEBONDING AT POUR STRIPS

OBSERVATIONS:

The CIP pour strips are deteriorating, including cracking, debonding of the pour strip from the underlying precast girder/double tee slab, spalling and scaling. The pour strips tie individual structural precast elements together while providing a suitable driving surface.

RECOMMENDATIONS:

We recommend patch repairs and/or removal and replacement of the deteriorated sections of pour strips (Line Item #4), with provisions for new control joints above the precast beam-tee/tee-tee joints. Cracks at locations of sound concrete should be routed and sealed (Line Item #10). The pour strips should then be shot blast cleaned and protected with a traffic bearing waterproofing membrane (Line Item #12) to reduce the rate of scaling and structural deterioration; and reduce water leakage and seepage below the pour strips.

GIRDER LEDGE SPALL AT SLAB CROSS-OVER – LEVEL SEVEN

OBSERVATIONS:

A large spall has developed along the girder bearing ledge under the intermediate crossover at the 7th level of the parking garage. Failed sealants and leakage through the CIP pour strip at the floor slab appears to have caused the damage to the inverted tee girder. Over time, the spall may continue to deteriorate and loss of bearing capacity of the double tee may occur.

RECOMMENDATIONS:

We recommend the girder ledge be patch repaired, which would include cleaning and protecting the corroded steel reinforcement in the beam ledge (Line Item #5). The tee stems will need to be temporarily shored during the repair. The pour strip above the spall should be sounded for delaminations, and be patch repaired as needed (Line Item #4); followed by sealant replacement (Line Item #9) and application of a waterproofing membrane (Line Item #12) to prevent leakage through the slab.

FAILED SEALANT, UNPROTECTED CONCRETE AND WATER ACCUMULATION ALONG JOINT BETWEEN POUR STRIP AND PRECAST SLAB

OBSERVATIONS:

The existing drainage along the slab surface accumulates water along the joint between the pour strip and the precast topping slab. Failed sealants along the joint and lack of waterproofing is permitting water seepage into and under the pour strips. Efflorescence has developed under almost all of the cast in place pour strips (second photo) throughout the parking garage, due to the leakage through the unprotected & cracked slabs and failed sealants above. Over time, the moisture seepage will lead to extensive debonding of the pour strips from the structural Tee flange, as well as corrosion of structural steel connections and reinforcement.

RECOMMENDATIONS:

We recommend replacement of all of the sealants at the pour strips (Line Item #9), followed by application of a waterproofing membrane (Alternate A1). If a reduced cost option is desired, the curb pour strips may be sealed with a water repellant sealer (Line Item #16), however the product offers a reduced level of protection. We recommend that traffic bearing membrane be provided at the pout strips over the inverted tee girders at the turning bays (Line Item #12), at a minimum, due to the more deteriorated conditions that are occurring in these areas.

FAÇADE PANEL SPALL AT CONNECTION

OBSERVATIONS:

Several spalls have developed at the wall panel joints around the roof level of the garage, indicating some corrosion of the underlying connection has developed. The spall leads to cracking which allows moisture penetration and increased the rate of corrosion.

RECOMMENDATIONS:

We recommend providing concrete patch repair at the spalled concrete (Line Item #6), including cleaning and painting underlying steel connection with protective, rust inhibitive coating. The patch should be coated with a façade waterproofing coating (included in cost for line item #6) to help protect the underlying connections.

AGED AND DEBONDED TEE JOINT SEALANT

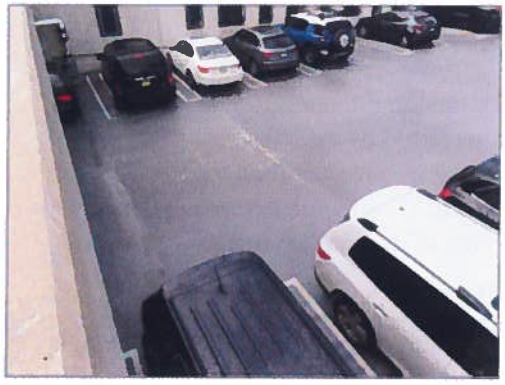
OBSERVATIONS:

The tee-tee joint sealants are near the end of their useful service life. The sealants were beginning to debond and leak, especially at the locations of the tee-tee shear connectors. Leakage through the slab causes the embedded connectors to corrode, and deterioration of the concrete tee flange edges.

RECOMMENDATIONS:

We recommend complete replacement of all of the floor slab sealants throughout the garage (Line Item #9/#14). This can be done on a scheduled basis over a few years to reduce annual budget impacts if needed.

WORN MEMBRANE ALONG TEE JOINTS AND DRIVE LANES



OBSERVATIONS:

The existing traffic bearing waterproofing membrane at the roof level is showing signs of wear, especially along tee joints and in the drive aisle. In some areas, the membrane has worn to bare concrete and the slabs and joints are vulnerable to water absorption and leakage.

RECOMMENDATIONS:

We recommended the existing waterproofing membrane at the roof level be rehabilitated with a new waterproofing wear course, including a new reinforced detail base coat along the tee-tee joints (Line Item #11).

THRU SLAB LEAKAGE ALONG TEE JOINTS

OBSERVATIONS:

Leakage at the tee-tee joints has occurred due to failed sealants & worn waterproofing. Leakage through the slab causes the embedded connectors to corrode, and deterioration of the concrete tee flange edges.

RECOMMENDATIONS:

We recommend removal and replacement of the tee-tee joint sealants (Line Item #9/#14). Sealant replacement at the roof level will require replacement of traffic bearing membrane in strips along the tee joints and the new sealants as part of the work, as the existing membrane will be damaged upon removal of the existing sealants.

FLOOR SLAB CRACKING

OBSERVATIONS:

Several floor slab cracks were observed throughout the garage. Slab cracks are conduits for water seepage into the slab, which can lead to corrosion of reinforcing steel and subsequent concrete delaminations and spalls.

RECOMMENDATIONS:

We recommend routing and sealing the floor slab cracks (Line Item #10) with new polyurethane sealant to prevent the ingress of moisture into the cracks.

SLAB DEFLECTION AT SUPPORTED TO SOG TRANSITION

OBSERVATIONS:

Floor slab deflections and audible noise was reported and noted as vehicles passed over the last double tee flange at transition between supported slab to slab-on-grade. There were no visible flange supports along the edge of the double tee.

RECOMMENDATIONS:

We recommend providing new supplemental steel supports between the underside of the tee flange and foundation wall (Line Item #20). These will firmly support the tee flange and reduce deflections and associated noise.

SCALING (FREEZE-THAW) DAMAGE AT SLAB-ON-GRADE

OBSERVATIONS:

Moderate scaling was observed at the SOG slab, especially at the vehicle entrance/exit. Although not a structural concern at this time, the scaling damage will eventually unravel the concrete and it will need to be repaired or replaced.

RECOMMENDATIONS:

We recommend shotblast cleaning the slab and sealing it with a water repellant penetrating surface sealer (Line Item #16). The sealer will reduce the amount of moisture absorption into the slab, protecting it from freeze-thaw damage & weathering.

WORN WATERPROOFING MEMBRANE WEAR COURSE – ROOF LEVEL

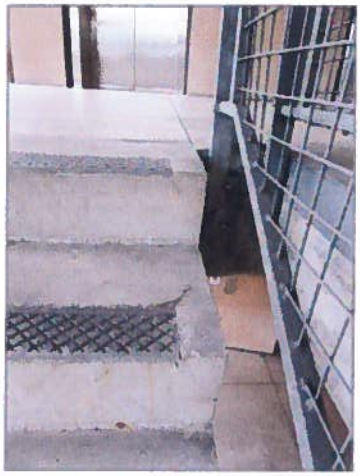
OBSERVATIONS:

The traffic bearing waterproofing membrane wearing course is showing signs of moderate wear, including loss of some of the embedded aggregate.

RECOMMENDATIONS:

We recommend resurfacing the roof level membrane with a new waterproofing wear course sometime within the next 1 to 3 years (Line Item #11). At the tee joints, we recommend providing a new reinforced detail base coat.

STAIR TREAD EDGE SPALLS



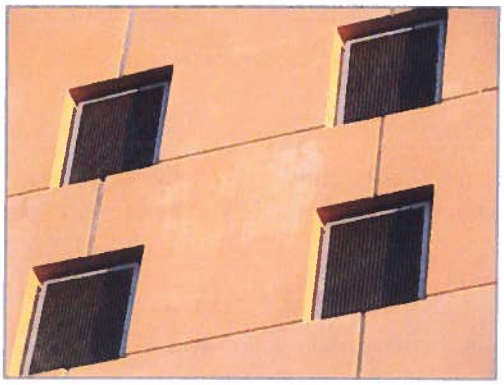
OBSERVATIONS:

Crack and spalled tread edges were observed at most of the stairs. These spalls may eventually come loose and become a tripping hazard, as well as be unsightly.

RECOMMENDATIONS:

We recommend that the spalled edges be patch repaired (Line Item #7).

CRACKING/SPALLING AT PRECAST CONCRETE FAÇADE PANEL



OBSERVATIONS:

A few cracks, previous patches, and potentially new spalls have developed at the precast façade panels. The condition appeared to be limited to the top row of precast concrete panels.

RECOMMENDATIONS:

Cracks and spalls appeared to be minimal at this time, and should be monitored for development of loose & spalled concrete.

WET/SATURATED FAÇADE

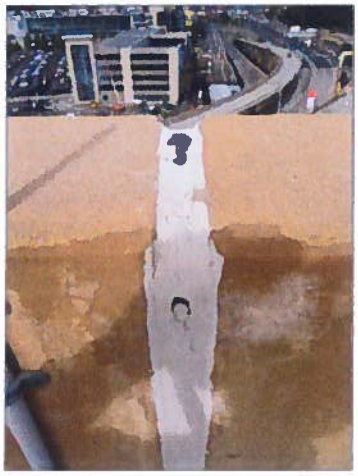
OBSERVATIONS:

Water absorption into the façade panels was occurring at the time of our visit, indicating that a serviceable waterproofing sealer is not currently protecting the façade panels.

RECOMMENDATIONS:

We recommend the façade be powerwash cleaned and sealed with a protective water repellant sealer (Line Item #17).

CRACKED AND DEBONDED SEALANT AT FAÇADE PANELS



OBSERVATIONS:

Some of the façade sealant has debonded and failed. The open joints allow water to seep into the joints causing corrosion of embedded steel connections and concrete delaminations around panel connections.

RECOMMENDATIONS:

This condition is relatively sporadic at this time, however is an indication that the façade sealant is nearing the end of its useful service life. We recommend removal and replacement of the façade sealants sometime in the next 1 to 3 years (Line Item #15).

FOUNDATION WALL CRACKS

OBSERVATIONS:

Several foundation wall cracks were observed, a few of which appear to have been previously routed but were never sealed.

RECOMMENDATIONS:

We recommend routing and sealing the cracks at the exposed portion of the foundation wall (Line Item #10).

CLOGGED DRAIN/WATER PONDING

OBSERVATIONS:

We observed at least one area of water accumulation/ponding due to a clogged drain.

RECOMMENDATIONS:

We recommend inspecting and clean out the drainage system as needed (Line Item #19).

LEAKAGE BELOW SELECTED WALL OPENING, LEVEL 3 NEAR CL 3.

OBSERVATIONS:

We observed water accumulation between the slab and a wall opening. The water was leaking between the slab joint with the façade an running down the foundation wall.

RECOMMENDATIONS:

Parge and flash the wall opening to drain water away from the floor slab (Line Item #18).

FAILED SEALANTS AT STAIRS

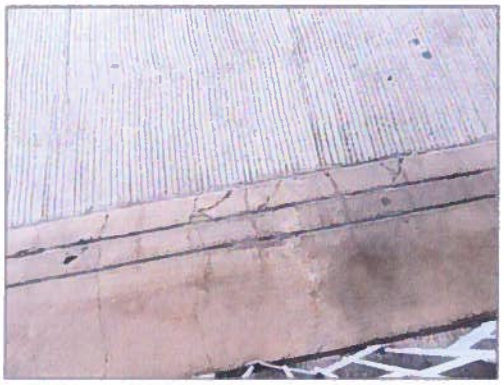
OBSERVATIONS:

The existing sealants at the stairs have failed allowing water into the joints between the sections of the precast stairs; leading to corrosion damage of the structural precast connections.

RECOMMENDATIONS:

Remove and replace the caulk sealants (Line Item #9/#14) to protect the precast connections.

CRACKING OF TOPPING AT SPEED RAMP TO GARAGE POUR STRIP



OBSERVATIONS:

The cast-in-place concrete pour strip between the floor slab and exterior speed ramp has cracked and may have spalled (direct access was not available to the ramp at the time of our survey).

RECOMMENDATIONS:

We recommend sounding and providing patch repairs (Line Item #4) as needed. Rout and seal cracks (Line Item #10) at the pour strips and coat with a new waterproofing membrane.

In summary, we recommend a comprehensive parking garage repair and preventive maintenance program be implemented at this time. The repair program will be designed to repair the observed deterioration and provide the recommended preventive maintenance and waterproofing items to extend the life of the parking garage. On the following pages is our recommended repair program for restoration of the garage. Also included is our recommended 2017, Phase 1 repair project that was developed ahead of this report and sent under separate cover. It has been provided here for reference and convenience. Future phases can be developed at request, based on the attached comprehensive program. The comprehensive, prioritized recommended repair program for all work still includes the work that is proposed for the 2017 repair phase.

We hope that the above is sufficiently responsive to your needs. Please do not hesitate to contact us if you need further information or assistance.

Very Truly Yours,
O&S ASSOCIATES, INC.

Phillip Haley
Project Manager

RECOMMENDED REPAIR PROGRAM

PRIORITIZED, RECOMMENDED REPAIR & PREVENTIVE MAINTENANCE PROGRAM & BUDGET COST ESTIMATE
WEST GENERAL ROBINSON STREET PARKING GARAGE
SPORTS & EXHIBITION AUTHORITY OF THE CITY OF PITTSBURGH

August 7, 2017

No.	DESCRIPTION	EST. COST	PRIORITY
GENERAL CONDITIONS			
1	Mobilization & Demobilization	$15,000	
2	Work Access (Swingstage, Scaffolding, Hydraulic Lifts), Temporary Protection, Etc.	$65,000	
3	General Conditions, Permits	$35,000	
	Subtotal General Conditions	*$115,000*	
STRUCTURAL & FAÇADE REPAIRS			
4	Replacement of debonded, spalled and heavily scaled sections of the CIP pour strips, primarily at the turning bays	$40,000	1 - Important
5	Overhead patch repairs at spalled and delaminated sections of slab soffits, beams, girders, etc. including girder ledge spall at level 7	$30,000	1 - Important
6	Allowance for vertical patch repairs at the precast façade panels	$19,000	2 - Short Term
7	Patch repairs of stair tread edge spalls	$19,000	3 - Programmed
8	Patch repair of selected sections of stair & elevator towers topping slab (Allowance, requires further investigation to determine actual extent of work required)	$45,000	3 - Programmed
	Subtotal Structural & Façade Repairs	*$153,000*	
PREVENTIVE MAINTENANCE AND RECOMMENDED WATERPROOFING			
9	Replace failed floor slab sealants at all of the pour strips and selected, leaking tee-tee joints. Includes provisions for new waterproofing membrane "strips" along tee-tee joints at the roof level	$255,000	1 - Important
10	Rout & Seal selected floor slab cracks	$40,000	1 - Important
11	Resurface roof level waterproofing membrane with a new traffic bearing wear course. Includes allowance for repair of worn base course, primarily along tee-tee joints as needed. Restripe same as existing.	$192,500	2 - Short Term
12	Provide new traffic bearing waterproofing membrane over the pour strips at the turning bays and crossovers	$120,000	2 - Short Term
13	Seal curb pour strips with water repellant surface sealer	$90,000	2 - Short Term
14	Remove and replace floor slab sealant not included in line item 9, including all tee-tee joint sealant, sealants at stairs and landings, etc.	$340,000	2 - Short Term
15	Replace façade sealants	$212,500	2 - Short Term
16	Powerwash and seal lower floor slabs (Level 1 to 8) with water repellant sealer	$351,000	3 - Programmed
17	Powerwash and seal precast concrete façade panels with water repellant sealer	$222,500	3 - Programmed
	Subtotal Preventive Maintenance And Recommended Waterproofing	*$1,823,500*	

CONTINUED ON NEXT PAGE.

RECOMMENDED REPAIR PROGRAM (CONT.)

CONTINUED FROM PREVIOUS PAGE.

PRIORITIZED, RECOMMENDED REPAIR & PREVENTIVE MAINTENANCE PROGRAM & BUDGET COST ESTIMATE (CONT.)
WEST GENERAL ROBINSON STREET PARKING GARAGE
SPORTS & EXHIBITION AUTHORITY OF PITTSBURGH
August 7, 2017

DRAINAGE, MISCELLANEOUS			
18	Provide new flashing at leaking facade wall opening at level 3	$1,500	1 - Important
19	Clean & unclog existing drains	$5,000	1 - Important
20	New tee flange support brackets at the SOG to Supported slab transition	$6,500	1 - Important
21	Rout & Seal foundation wall cracks along the base of the elevator tower	$2,000	1 - Important
Subtotal Drainage, Miscellaneous		*$15,000*	
SUB-TOTAL ESTIMATED CONSTRUCTION COSTS		$2,106,500	
a)	**Engineering Design, Repair Drawings & Specifications**	**$84,500**	
b)	**Estimated Contract Administration & Technical Supervision, including Site Visits**	**$45,000**	
GRAND TOTAL ESTIMATED CONSTRUCTION COSTS		$2,236,000	

WATERPROOFING MEMBRANE ADD ALTERNATES		
Add ALTERNATE #1 - NEW TRAFFIC BEARING WATERPROOFING MEMBRANE OVER THE CURB POUR STRIPS IN LIEU OF WATER REPELLANT SEALER		
A1	Shotblast clean floor slab and install new traffic bearing waterproofing membrane over the curb pour strips at the lower supported levels of the parking garage (Level 2 - 9)	$300,000
	Less cost for water repellant sealer	-$100,000
Total Add Alternate #1 - New Traffic Bearing Waterproofing Membrane Over The Curb Pour Strips In Lieu Of Water Repellant Sealer		*$200,000*

Priority Legend:

Priority 1 - Important : Work recommended within 1 year	**$427,000**
Priority 2 - Short Term : Work recommended within 1-3 years	**$1,093,500**
Priority 3 - Programmed : Work recommended within 3-5 years	**$715,500**