407.418.2218 main

July 30, 2021

Frank Woodard II
Project Coordinator
Contract Administration Department
City of Tampa
306 E. Jackson St.
Tampa, FL 33605

Re: Phase I - Condition Assessment
Kiley Garden Park Plaza Waterproofing Assessment
Tampa, FL
Walter P Moore Project No. D07.20021.00

Dear Frank:

We have completed the Phase I - Condition Assessment of the referenced Kiley Garden Park Plaza Waterproofing Assessment in accordance with our proposal 19-3035 dated January 22, 2020.

Included in our report are our visual observations, recommendations for remedial actions, conceptual repair recommendations, and preliminary opinion of probable construction costs.

We very much appreciate this opportunity to provide these services to you. Please do not hesitate to contact us if we can further assist you with the follow-up evaluation and development of repair documents for the distress conditions described in the following report.

Sincerely,

Walter P. Moore and Associates, Inc.
WPM Firm Certification of Authorization: 3818

Amaris Beza, P.E.
Graduate Engineer
Diagnostics Group

E. Webb Wright, P.E.
Senior Associate
Diagnostics Group

Cc: Randal M. Beard, Principal, Managing Director

Enclosure

E. WEBB WRIGHT LICENSE No. 57639 STATE OF FLORIDA PROFESSIONAL ENGINEER

Digitally signed by E. Webb Wright
DN: E=WWright@walterpmoore.com, CN=E. Webb Wright, O="Walter P. Moore and Associates, Inc.", L=Houston, S=Texas, C=US
Reason: Approved / Walter P Moore
Date: 2021.07.30 15:33:04-04'00'

300 South Orange Avenue, Suite 1200 · Orlando, Florida 32801

KILEY GARDEN PARK PLAZA WATERPROOFING ASSESSMENT

PHASE I - CONDITION ASSESSMENT

400 N. Ashley Drive
Tampa, FL 33602

Report Date	July 30, 2021
WPM Proposal No.	19-3035
WPM Project No.	D07.20021.00

EXECUTIVE SUMMARY

Walter P. Moore and Associates, Inc. has completed a Phase I condition assessment of the referenced plaza deck waterproofing system. Our assessment consisted of a walkthrough visual assessment of the plaza deck surface and the supporting parking structure structural system below to identify deteriorating conditions related to existing waterproofing and structural items in need of repair. Exploratory testing was also performed at 11 representative locations where overburden was excavated several feet in depth to expose the buried waterproofing membrane. VoltAir Consulting Engineers was retained by Walter P Moore as a subconsultant to review the existing drainage system for the plaza.

The plaza deck waterproofing system is currently exhibiting signs of deterioration and is considered to be in generally “Poor” condition overall with isolated elements in “Failed” condition. These conditions are critical to long-term service of the plaza and parking structure and require a repair program to return them to intended serviceability.

Significant entrapped water in the individual cells of the structural up-turned beams of the supporting structural system is the primary factor in the observed distress conditions. The up-turned beams create a “waffle-type” configuration of planter cells that has been retaining water within each of the cells. Typical distress items identified in this report include waterproofing membrane with entrapped water below the membrane and delaminated waterproofing membrane on the topping slab surfaces and structural slab. Water is leaking throughout the structural system from cracks with breached membrane and at previous mechanical penetrations that are not waterproofed. The cells in the structural system are not drained at the structural slab level and, therefore, the cells hold water except at locations of cracks and penetrations where water leaks from the cells and into the parking garage. Currently, the lowest point of each depression is lower than the existing stormwater drainage system and cannot be effectively drained without a major renovation of the stormwater drainage system.

Significant additional distress conditions, caused by the leaking locations, are post tensioned tendons in beams, corroding mild steel reinforcement, mechanical piping along with electrical equipment within the parking structure. These conditions are negatively impacting the current serviceability of the plaza level and parking garage structural system below.

Conceptual repair recommendations are provided to address the waterproofing distress items throughout Kiley Gardens Park. The following specific conditions were identified during our review, and are further discussed in the analysis section:

- **Widespread Waterproofing Membrane Deterioration and Water Infiltration**

Base Repair Recommendations:

Further Evaluation Required

1. Retain a qualified mechanical plumbing engineer to conduct a feasibility study to investigate retrofit of existing stormwater drainage system/installation of a new stormwater drainage system to accommodate installation of new drains inside planter cells at structural slab areas so that each individual cell can be properly drained from the bottom of the cell.
2. Assessment of post-tensioned distress conditions followed by repair program.

Waterproofing Repairs

1. Remove plaza overburden including concrete, stone pavers, soil and tile throughout plaza including amphitheater and at lower level pedestrian walkway area along North Ashley Drive.
2. Remove existing buried concrete topping slab throughout the planter cells.
3. Remove all existing waterproofing membrane on structural slab, upturned girders and beams.
4. Survey exposed concrete surfaces at top side of plaza structure framing and perform repairs of concrete spalls, delaminations and abandoned penetrations observed.
5. Epoxy inject structural cracks in cells, girders and upturned beams.
6. Install new drains at planter cells at structural slab level (lowest point) to connect with stormwater drainage system. Note: A new stormwater drainage system or major retrofit of the existing stormwater drainage system will be required based on further evaluation by mechanical plumbing engineer.
7. Properly seal all drain penetrations throughout the planter cells with a full link-seal pipe sleeve system.
8. Properly seal all other penetrations through the structural slab, including abandoned penetrations, with a non-shrink water-stop cementitious grout and detail with HRA waterproofing membrane system.
9. Install new hot-applied rubberized asphalt (HRA) waterproofing membrane system including drainage mat, protection board, specified detailing of penetrations and cracks, and new expansion joints throughout plaza deck. Include cants between vertical and horizontal transitions and corners. New waterproofing shall be a high-performance, 215 dry mil reinforced system.
10. Install new foam/lightweight fill overburden across the plaza in planter cells, along with new finishes of concrete, localized sod, paver and tile systems including area of the amphitheater and at the lower level pedestrian walkway area along North Ashley Drive.
11. Perform chemical injection of cracks and penetrations at east and north foundation walls.

Our opinion of probable construction cost for implementation of the Base Repair Recommendations is $9,000,000 to $11,000,000. *This range of cost does not include the cost for either retrofit of the existing stormwater drainage system or installation of a new stormwater drainage system so that the abandoned planter cells can be drained at the structural slab level.*

INTRODUCTION

Purpose

Walter P Moore was retained by the City of Tampa to perform a condition assessment of the buried waterproofing system at the Kiley Gardens Park Plaza, located at 400 N. Ashley Drive in Tampa, Florida, directly above the Rivergate Tower parking garage. The purpose of this assessment was to identify existing distress conditions related to the waterproofing system and to provide conceptual repair recommendations.

Background Information

The plaza was originally constructed in 1985 as the Nations Bank Plaza, a landscaped park designed by renowned landscape architect Dan Kiley. The plaza was built above the basement level parking garage adjacent to the 33-story Rivergate Tower office building, which was constructed at the same time. Originally, planter cells were formed in the garage upper level slab structure to accommodate the installation of approximately 800 crepe myrtle trees throughout the plaza level (Figures 1 and 2). The Kiley Gardens Park Plaza has since had a history of water infiltration into the Rivergate Tower parking garage below the plaza.

Between 2006 and 2008, the plaza was renovated to address the existing water infiltration, including the removal of existing fountains and trees from the plaza. During this renovation, the abandoned planter cells underwent structural and waterproofing repairs. The existing waterproofing membrane at the structural slab, though breached at cracks and penetrations remained in place, while the new waterproofing membrane over upturned beams was replaced, and a new waterproofing membrane was installed over a newly installed topping slab placed over foam fill within the previously abandoned planter cells. Walter P Moore was the structural engineer for this renovation project, and addressed structural repairs related to concrete deterioration. Reynolds, Smith and Hills (RS&H) was the architect, whose scope of work included design of waterproofing and drainage system repairs.

Scope of Work

Walter P Moore performed a visual assessment of the plaza deck waterproofing system at exploratory excavation openings and reviewed the underside of the plaza deck structure from within the Rivergate Tower parking garage to identify areas of leakage and to develop conceptual repair recommendations for addressing the water infiltration. The following services were provided:

- Review of original construction documents to understand design concept of the structure
- Review of plaza renovation drawings to understand design of waterproofing repairs performed between 2006 and 2008
- Site visits to view the structure for areas of waterproofing deterioration and to identify visible potential or suspected waterproofing problem areas
- Assessment of two stormwater pipes that penetrate the plaza deck slab at the west side of the garage
- Field testing and exploratory excavation openings to expose the existing plaza waterproofing system and to document as-built conditions of the plaza waterproofing system
- Preparation of report of findings, including preliminary opinion of probable construction costs for recommended waterproofing repairs

Exploratory excavation openings through the plaza deck system to expose the buried waterproofing were performed with the assistance of Restocon Corporation, a specialty restoration contractor retained by Walter P Moore. The assessment of two pipe penetrations through the plaza that exhibit signs of past water infiltration and a review of the existing drainage system for the plaza was conducted by VoltAir Consulting Engineers, Inc., a mechanical plumbing engineering consultant retained by Walter P Moore.

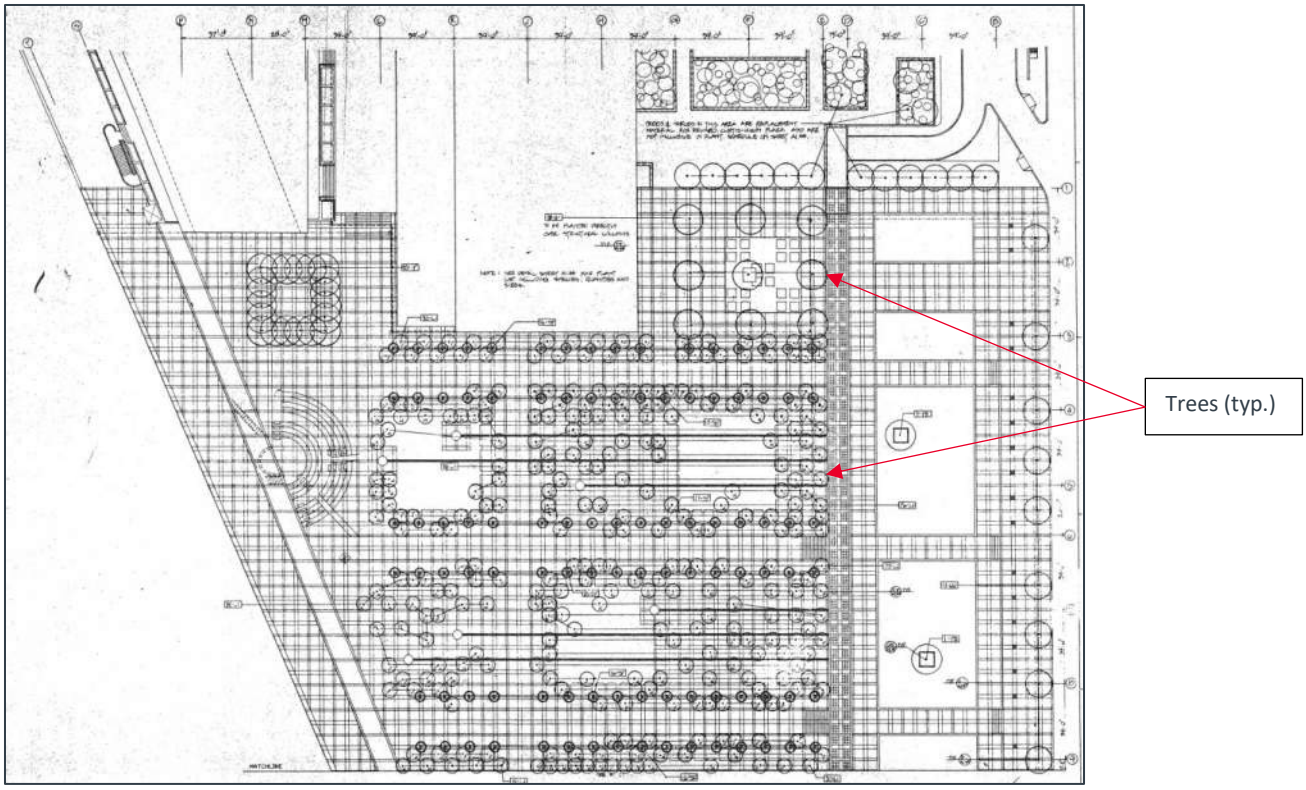


Figure 1: Original architectural plan showing location of trees throughout plaza level

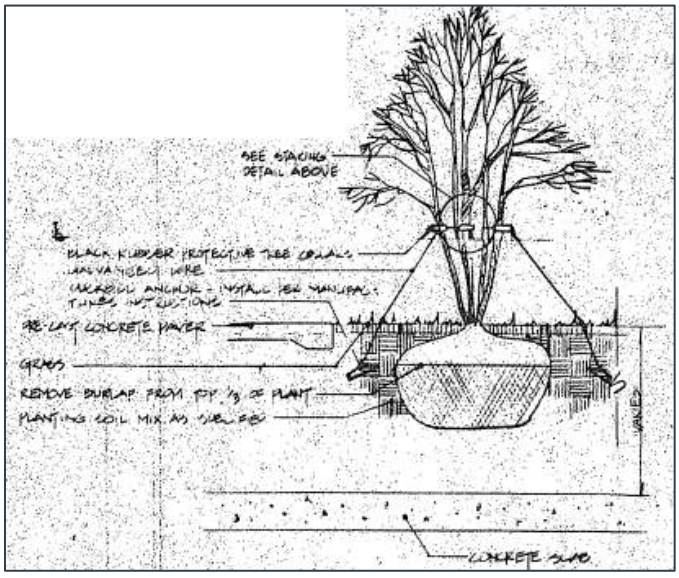


Figure 2: Original section detail of crepe myrtle installed within concrete planter cell

DESCRIPTION OF STRUCTURE

Brief Description of Plaza

The structural system of the Plaza Level is predominantly composed of mild reinforced cast-in-place concrete slabs and upturned beams supported by concrete columns. The 12-inch x 48-inch beams span 39 feet to concrete girders. The girders span between 26 feet and 39 feet to the round or square concrete columns. The structural slab in the plaza area is either flush with the bottom of the beams (in planter cell areas) or spans across the top of the beams (in pedestrian walkway areas). Figure 3 below shows an overall plan of the Kiley Gardens plaza that is located above the Rivergate Tower parking garage, which consists of a main landscaped/hardscaped plaza area (Area A), a lower level pedestrian walkway on the east side (Area B), and an amphitheater located at the northwest corner of the Plaza Level (Area C). In 2008, new sloped concrete topping slabs placed on foam fill were installed within the previously abandoned planter cells (Figure 4). The new topping slab is a 3-inch thick concrete slab reinforced with welded wire reinforcement. New engineered soil was used to backfill the areas above the topping slab where repairs were performed, which was then surfaced with sod and concrete pavers. The plaza has a footprint of approximately 4.5 acres. Refer to Photos No. 1 - 7 for overall views of Areas A, B and C.

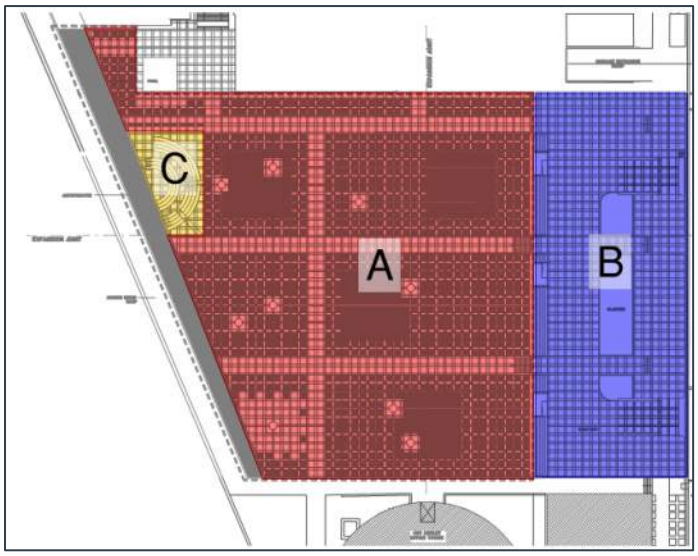


Figure 3: Overall plan of existing Kiley Gardens Plaza above the Rivergate Tower Parking Garage

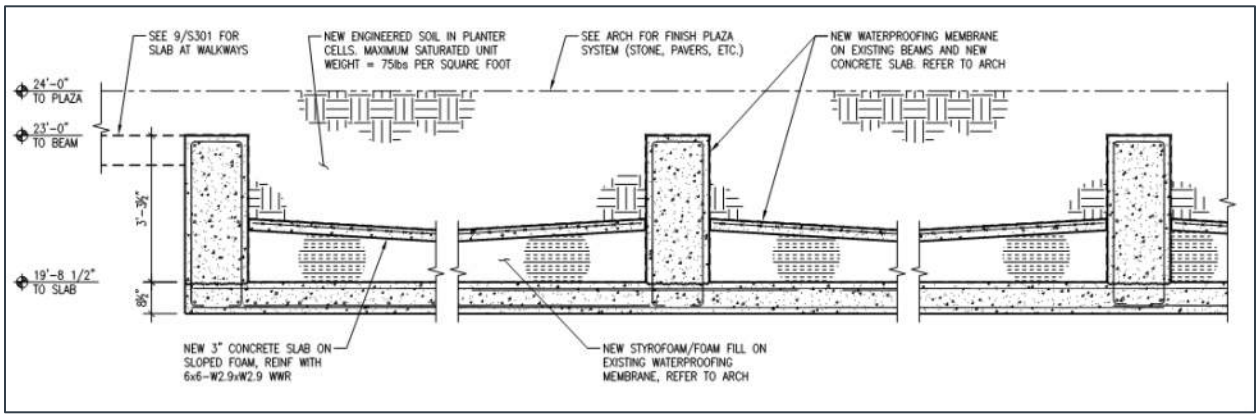


Figure 4: Detail showing topping slab on foam fill installed in abandoned planter cells during 2008 renovation

Brief Description of Parking Garage Structure

The structural system of Level B1 in the parking garage below the plaza level is a two-way flat plate post-tensioned concrete slab with drop panels. The unbonded post-tensioning systems consists of tendons with ½-inch diameter low-relaxation strands wrapped in greased sheathing. Drop panels at columns are typically 13-feet x 13-feet square. The parking garage consists of two basement levels, with approximately 735 spaces and a footprint of 153,000 square feet. The ground level consists of a concrete slab-on-grade.

DOCUMENT REVIEW

The following documents were reviewed for general understanding of the plaza construction:

- Record structural drawings for NCNB Headquarters by King/Gunn Associates, dated December 2, 1985.
- Record architectural drawings for NCNB Headquarters by Odell Associates, dated October 21, 1986.
- Kiley Park Structural Repairs and Waterproofing by Walter P Moore (Structural), dated January 15, 2008.
- Kiley Park Waterproofing and Structural Improvements by RS&H (Architectural), dated December 2007.

OBSERVATIONS

Our observations consisted of a walk-through visual review of the plaza surface and the underside of the Plaza Level framing from inside the parking garage structure to identify items of distress in the structural and waterproofing components. Exploratory excavation openings at the Plaza Level were performed at eleven (11) locations with the assistance of Restocon Corporation to expose the buried waterproofing system. Locations for exploratory openings were selected at representative existing details in the upper Plaza Level framing/buried waterproofing system, and are shown in Figure 1. Samples of the existing waterproofing membrane encountered onsite were taken for additional observation.

Our observations are as follows:

Photo	**PLAZA SURFACE**
8	Pavers on the Plaza Level walking surfaces were vertically displaced and settling at several locations. This condition creates trip hazards.
9	Cracked pavers were observed at multiple locations.
	Standing water was observed adjacent to the amphitheater indicating inadequate drainage below.
	Failed joint sealants were observed at the perimeter wall at the west side of the plaza.
Photo	**WATERPROOFING: EXPLORATORY EXCAVATION OPENINGS**
10, 11	<u>Exploratory Opening #1:</u> Girder-to-topping slab transition
12	• A blister filled with water, measuring approximately 6-inches x 6-inches, was observed in the sheet waterproofing membrane on the top, horizontal surface of the upturned girder.
	• Sheet waterproofing membrane on the topping slab appeared to be well-bonded at the area observed.
13	• A sample of the sheet waterproofing membrane measuring approximately 3-inches by 3-inches was taken. The membrane was observed to be brittle.
14	<u>Exploratory Opening #2:</u> Expansion joint, girder-to-topping slab transition, foam fill, and structural slab surface
15	• No distress was observed at the existing expansion joint material.
	• The sheet waterproofing membrane on the topping slab and girder appeared to be well-bonded at surface area observed.
16	• Water stains were observed on the foam fill below the topping slab.
17, 18	• Approximately 4 inches of standing water were observed on the structural slab, at the bottom of the foam fill. This observation was reported by the Contractor.
	• An apparent asphaltic waterproofing membrane was observed on the surface of the structural slab. The membrane appeared to be well-bonded at the area observed.
19, 20	<u>Exploratory Opening #3:</u> Beam-to-topping slab transition
	• Sheet waterproofing membrane on the topping slab appeared to be well-bonded at most of the area observed.
21, 22	• Small blisters filled with water were observed on the vertical face of the upturned beam.
23, 24	<u>Exploratory Opening #4:</u> Topping slab surface, foam fill, and structural slab surface
25	• Sheet waterproofing membrane on the topping slab was de-bonded throughout the area observed, though no apparent breaches in the membrane were observed.
	• No water staining or visible signs of distress were observed on the foam fill.

	• The apparent asphaltic waterproofing membrane on the surface of the structural slab was wet to the touch, though no standing water was observed or reported by the Contractor upon removal of foam fill. • The apparent asphaltic waterproofing membrane on the surface of the structural slab appeared to be well-bonded at the area observed.
26, 27	Exploratory Opening #5: Girder-to-topping slab corner transition
	• The sheet waterproofing membrane on the topping slab and girder appeared to be well-bonded at the area observed. • Moisture was observed under the membrane at several locations where the sheet membrane was punctured with a knife.
28, 29	Exploratory Opening #6: Beam-to-topping slab transition adjacent to walkway and expansion joint
30	• A concrete section not detailed on the original structural drawings was observed above the beam adjacent to a pipe. • A blister filled with water was observed in the sheet waterproofing membrane at the corner transition between the beam and the referenced concrete section. • The sheet waterproofing membrane on the topping slab appeared to be well-bonded at area observed.
31, 33	Exploratory Opening #7: Perimeter wall beam-to-topping slab transition.
33, 34	• A crack in the sheet waterproofing membrane was observed at the transition between the vertical face of the beam and the topping slab. Water was observed leaching out through the crack. • Upon puncturing the sheet waterproofing membrane on the vertical wall surface with a knife, moisture was observed below the membrane.
35, 36	Exploratory Opening #8: Amphitheater wall-to-topping slab transition.
	• Sheet waterproofing membrane on the topping slab and wall appeared to be well-bonded at the area observed.
37, 38	Exploratory Opening #9: Expansion joint, top of girder.
	• No visible distress was observed at the existing expansion joint. • The sheet waterproofing membrane on the top side of the girder appeared to be well-bonded at the area observed.
39, 40	Exploratory Opening #10: Stair wall-to-topping slab transition.
41, 42	• The sheet waterproofing membrane on the vertical wall surface terminated below the paver level. • Moisture was observed within the gap between the concrete beam and paver setting bed. • Upon puncturing the sheet waterproofing membrane on the topping slab/vertical wall surface with a knife, moisture was observed below the membrane.
43, 44	Exploratory Opening #11: Topping slab surface.
	• The sheet waterproofing membrane on the topping slab appeared to be well-bonded at the area observed.
Photo	**WATERPROOFING: UNDERSIDE OF PLAZA**
	The underside of the plaza level structure framing was observed from inside the parking garage for indications of water infiltration.

45	Concrete cracks were observed at the underside of slabs with efflorescence staining at multiple locations.
	Water stains were observed at construction joints in the overhead planter cell walls at multiple locations.
	Active water infiltration was observed at expansion joints at multiple locations.
47	Supplemental, retrofit gutters comprised of a flexible sheet membrane were observed under expansion joints.
48	Retrofit drip pans were installed at the underside of the Plaza Level slab at multiple locations throughout the garage under slab penetrations, cracks and joints that exhibited evidence of past water infiltration.
49, 50	Active water infiltration was observed at existing and abandoned penetrations through the plaza slab at multiple locations.
	Injection ports remaining from past epoxy or chemical injection work were observed at the underside of the slab in an area below the lower Plaza Level.
51	Water stains were observed at penetrations of polyvinyl chloride (PVC) lateral drain pipes through planter cell walls at multiple locations.
52, 53	Water stains and active water infiltration at the east and north foundation walls were observed at wall cracks and wall penetrations.
Photo	**STRUCTURAL: UNDERSIDE OF PLAZA**
	The underside of the Plaza Level structure framing was observed from inside the parking garage for indications of structural damage related to water infiltration.
54	Failed post-tensioned tendons were observed at the plaza level structural slab from inside the parking garage at Level B1 below Area B.
	Isolated concrete spalling was observed at the underside of the Plaza Level slab from inside the parking garage.
	Isolated concrete repairs were observed at the underside of the Plaza Level slab.

Figure 5: Locations of exploratory openings performed at plaza level (Area A)

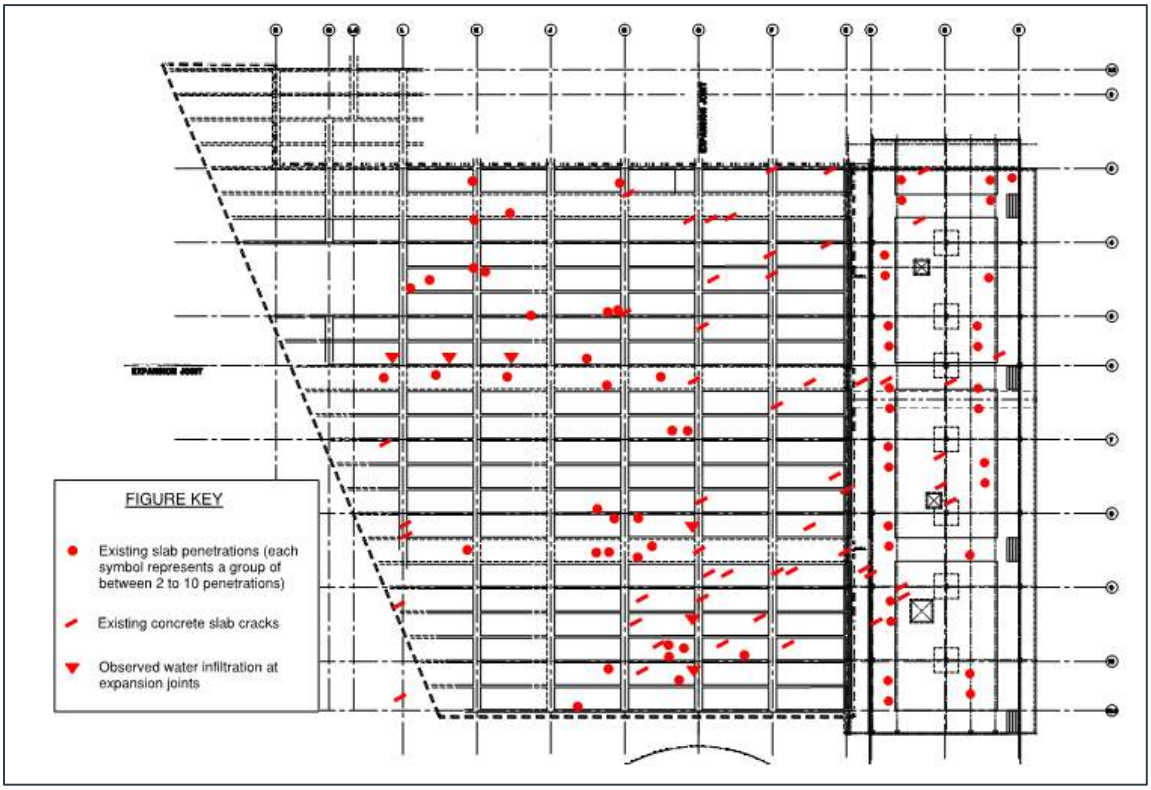
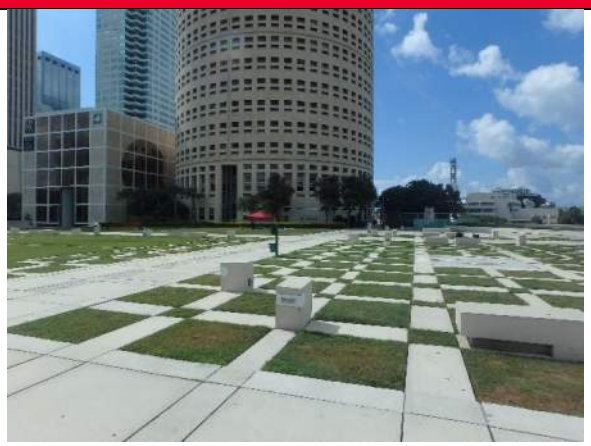
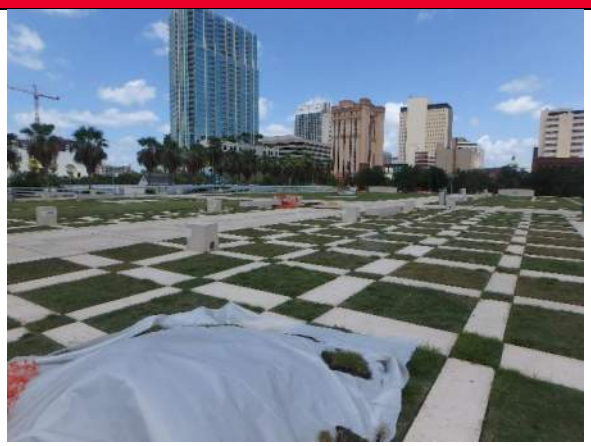


Figure 6: Observations of water infiltration at slab underside from parking garage Level B1

PHOTOS



1 General view of plaza looking south



2 General view of plaza looking northeast

3 General view of plaza looking east

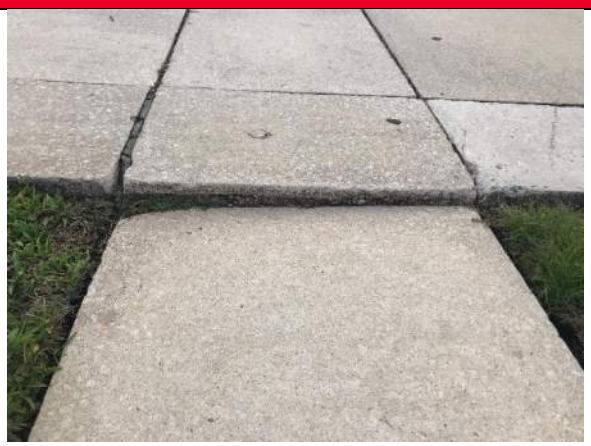
4 Looking along west perimeter wall

5 General view of amphitheater

6 General view, interior of amphitheater

PHOTOS

7 Partial view of walkway adjacent to N. Ashley



8 Concrete paver settlement

9 Concrete paver cracks

10 Exploratory Opening #1

11 Exploratory Opening #1

12 Water under membrane at blister

PHOTOS

13 Sample of sheet waterproofing membrane

14 Exploratory Opening #2

15 Water proofing membrane over expansion joint

16 Water stains on foam fill under topping slab

17 Standing water on structural slab

18 Standing water on structural slab

PHOTOS

19 Exploratory Opening #3

20 Exploratory Opening #3

21 Water found behind membrane

22 Water found behind membrane

23 Exploratory opening #4

24 Exploratory Opening #4

PHOTOS

25 Waterproofing membrane de-bonded at topping slab

26 Exploratory Opening #5

27 Exploratory Opening #5

28 Exploratory Opening #6

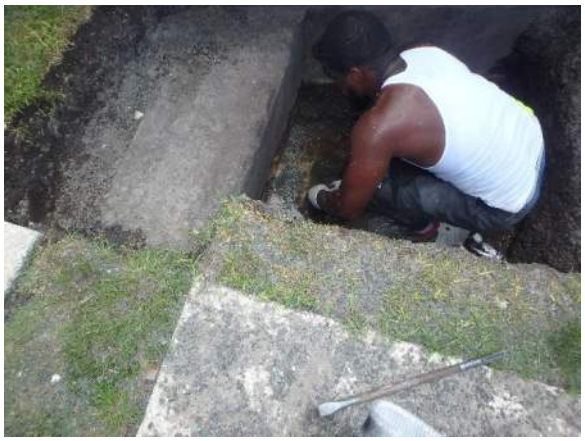
29 Exploratory Opening #6

30 Water observed behind waterproofing membrane

PHOTOS

31 Exploratory Opening #7

32 Exploratory Opening #7



33 Removing sample of waterproofing membrane

34 Water found under membrane at sample removal location

35 Exploratory Opening #8

36 Exploratory Opening #8

PHOTOS

37 Exploratory Opening #9

38 Waterproofing membrane covering expansion joint

39 Exploratory Opening #10

40 Exploratory Opening #10

41 Exploratory Opening #10 (circle identifies location of Photo 42)

42 Water observed behind membrane at puncture

PHOTOS

43 Exploratory Opening #11

44 Exploratory Opening #11

45 Crack with water staining at underside of Plaza Deck

46 Water stains, underside of Plaza Deck

47 Remedial gutter below Plaza Deck expansion joint

48 Drip pan below Plaza Deck

PHOTOS

49 Group of abandoned penetrations through Plaza Deck slab

50 Water stains at abandoned penetration

51 Water stains at pipe penetration through abandoned planter cell

52 Water infiltration at north foundation wall (see following photo)

53 Water infiltration at north foundation wall

54 Failed post-tensioned tendons at Plaza Deck slab

ANALYSIS

EXISTING WATERPROOFING MATERIALS

The type of waterproofing membrane on the topping slab differed from the waterproofing material called out on the structural drawings issued for the Plaza Level renovation in 2008. The structural renovation drawings called out "Carlisle CCW-500," a hot-applied rubberized asphalt waterproofing membrane, to be installed over the new topping slab and on the vertical and horizontal surfaces of the upturned beams and girders. During our assessment, we observed that a sheet waterproofing product was installed at these locations instead. Sheet waterproofing products are inherently more susceptible to deficiencies originating during installation and are less durable than a hot-applied rubberized asphalt waterproofing membrane. Defects at laps in sheet waterproofing membranes are common problems with these systems that lead water ingress through the membrane.

Samples of the existing sheet waterproofing were taken on-site during exploratory work, and the material was observed to be brittle. A waterproofing membrane should be flexible in order to accommodate movement of the concrete structure due to thermal changes, loading, etc. *The joint between the 3-inch topping slabs installed during the 2008 renovation project and adjoining beams and girders is particularly susceptible to movement and tearing of the waterproofing membrane which has occurred throughout the plaza.* A brittle material has an increased potential to crack and allow water infiltration below the membrane. Since drains are only installed at the topping slab level within the abandoned planter cells, it is imperative that the waterproofing membrane that is installed on the topping slab be watertight.

Hot-applied rubberized asphalt waterproofing systems achieve uniform adhesion to the substrate, tend to be more flexible, and typically have a longer service life than sheet membrane systems. Another advantage of these systems over sheet membrane systems is that they are seamless and can be applied with uniform thickness and evenness at transitions, changes in plane, irregularities in the substrate and penetrations. Hot-applied rubberized asphalt waterproofing systems have the ability to self-heal to an extent if impacted from construction and can better handle intermittent conditions of ponding water than do sheet membrane waterproofing systems. For these reasons, we recommend heavy-duty hot-applied rubberized asphalt waterproofing systems for plaza deck systems but only at the structural slab (lowest point) level. Installation at the level of the current topping slab limits the serviceability of the HRA system to perform long-term as joints in the topping slab, settlement of the overburden and long-term collection of water are not conditions that can be effectively detailed and allow the HRA system to perform properly.

During our review of the drawings for the renovation project in 2008, we also noted a discrepancy between the architectural and structural drawings. The architectural drawings in 2007 noted that the existing waterproofing membrane on the structural slab was to be removed and replaced, while the structural drawings in 2008 noted that the waterproofing membrane on the structural slab was to remain. Our field observations at exploratory excavation openings showed that a waterproofing membrane is present at the structural slab level, however conditions indicate the original system has been breached in the significant past.

The waterproofing membrane on the structural slab was observed to be an aged asphaltic membrane, which did not appear to have been replaced during the renovation work in 2008, but possibly dates back to 1985, the original year of construction. If this waterproofing membrane is from the original construction, then the age of the waterproofing is approximately 35 years old, which is well past the typical useful service life of 25 years for buried waterproofing systems. Current practice for application thickness of hot-applied rubberized asphalt waterproofing membranes for plaza deck systems generally starts at 120 dry mil thickness and can be typically as high as 215 dry mil thickness for high performance systems. Reinforcing fabrics are generally included with these high performance systems to aid in bridging cracks and joints. Today's hot-applied rubberized asphalt waterproofing membranes are generally a high cost, high performance waterproofing system with high durability and require no maintenance with well over 25 years of expected service life before experiencing expected repairs at penetrations and moving cracks. Lower cost bonded waterproofing systems are available but are far less durable.

WATERPROOFING FAILURE

Area A:

The existing waterproofing membranes on the Plaza Level topping slab, girders, beams, and structural slab were observed to be failing at several of the exploratory openings conducted during our investigation. Blisters with trapped water beneath the waterproofing membrane were observed at multiple locations, which indicates that water is bypassing the installed waterproofing assembly in various areas. Obvious signs of defects in the waterproofing membrane, such as punctures, de-bonded flashing strips, and other breaches, were not typically observed within the small areas of waterproofing exposed onsite.

The prevalence of entrapped water behind the membrane that was encountered onsite demonstrates that this is likely a widespread issue, where water entering the system through the Plaza Level surface infiltrates at multiple breaches within the waterproofing membrane at the topping slab and girder/beam level and at expansion joints, and then travels below the membrane throughout the Plaza Level and eventually into the parking garage below causing further distress conditions to structural, mechanical, and electrical systems.

Drains within the abandoned planter cells are currently only located at the level of the topping slabs installed in 2008. There are no drains at the structural slab level below. The water that breaches and passes through the waterproofing at membrane defects collects at the bottom of the cells (see Figure 7 below). This was evidenced by the observation of water-stained foam fill below the topping slab, and standing water on top of the lower structural slab within the planter cells. With no drains at the structural slab level, the water which collects at the bottom of the cells will infiltrate slab cracks, construction joints, transition joints, and penetrations in the structural slab over time and pass into the parking garage below.

Water stains and active water infiltration were observed at the underside of the structural slab at cracks, construction joints, and penetrations from inside parking Level B1. Additionally, water infiltration through the structural slab has resulted in several locations of failed post-tensioned tendons, which has adversely affected the overall integrity of the parking garage structure. (A more detailed assessment of the failed post-tensioned tendons and associated repair recommendations is provided in our condition assessment report of the Rivergate Tower Parking Garage, dated August 18, 2017).

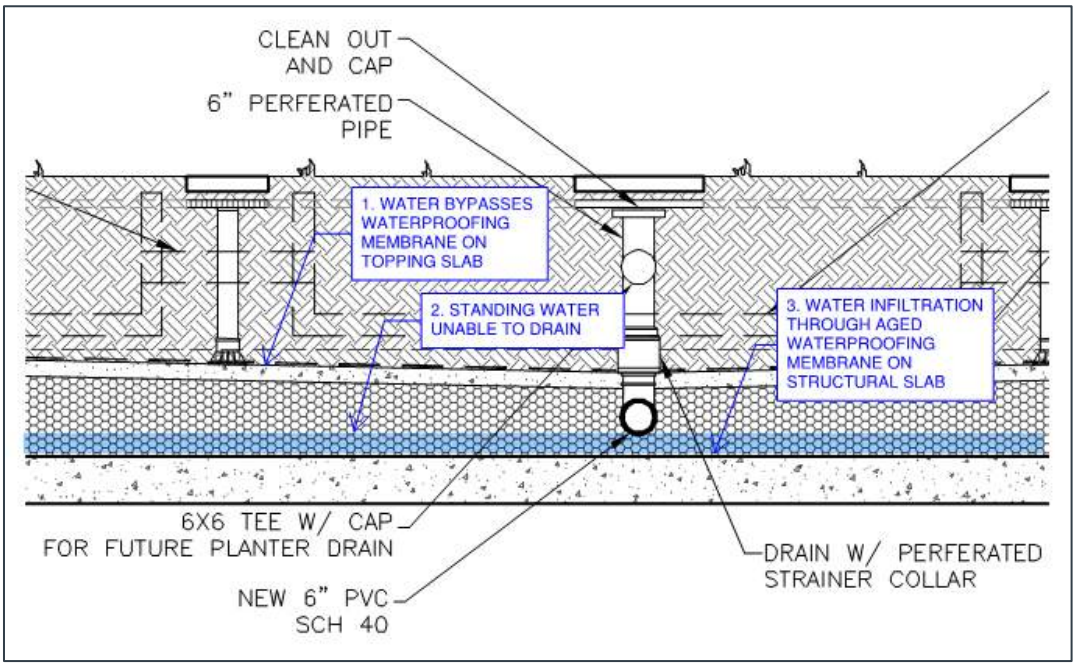


Figure 7: Current condition – inadequate drainage within planter cells at Plaza Level above parking garage

Area B and C:

At the amphitheater, at stairs, and at the lower level walkway area, evidence of widespread water infiltration into the parking structure below was also observed. Though no exploratory openings were performed in these areas, it is our opinion that the waterproofing systems at these areas are similarly failing, based on a review of the original structural drawings, our previous experience with similar structures and the water infiltration observed below these areas from within the parking garage. We understand that repairs to the waterproofing components in these areas were not performed during the 2008 renovation. Due to the widespread nature of the observed water infiltration below Area B and C, we recommend the removal and replacement of the existing waterproofing system at the plaza level at these locations as well.

PLAZA LEVEL DRAINAGE

Existing Drainage System Assessment

VoltAir Consulting Engineers was retained to review the existing drainage system for the plaza. Their scope of work specifically included review of two leaking storm drain pipes that penetrate the Plaza Level structure, as well as to provide recommendations for improving the Plaza drainage system. Their report is attached as Appendix A. Recommendations provided by Voltair focus on updating seals and penetrations and making improvements to the existing planter drainage systems through the plaza level to prevent water from standing against, and degrading the pipe seals at penetrations.

Recommendations for improvements to the existing planter drainage system included installing a bed of gravel at the planter drains to facilitate drainage and minimize the amount of soil packing against the drains, installing a swept fitting at vertical to horizontal drain pipe transitions within the planter cells, and maintaining a minimum slope of 1/8 inch per foot for the PVC lateral drainage lines. Additionally, Voltair recommends two improvement options to incorporate at the drain penetrations through the concrete structure to mitigate leakage from the Plaza Level into the garage. One option was to install full link-seal pipe sleeves around the drain penetrations. Although this would require core drilling around the pipes, this is a viable long-term solution for preventing leaks. The second option is a field-fabricated system installed around drain pipe penetrations which would include backing rod and sealant. This option would be a less durable repair solution than full link-seal pipe sleeves and would require removal and replacement periodically.

The recommendations provided by VoltAir for improvements to the existing plaza drainage system are viable repair options that can be implemented during the full replacement of the plaza waterproofing system. Installation of a full link-seal pipe sleeve system will provide the best protection against any incidental water that reaches the drain pipe penetrations. It is of note, however, that these repair options are applicable only at the drain penetration locations, and would not address water infiltration that occurs at other penetrations, abandoned penetrations, concrete cracks or construction joints through the structural slab in the field of the abandoned planter cells.

Structural Slab Level Drainage at Area A (Planter Cells):

Additional measures are required to effectively address the waterproofing failures and water infiltration that is occurring through the structural slab at the bottom of the abandoned planter cells and into the parking garage. As previously discussed, water has passed through the waterproofing membrane on the topping slab, through defects within the membrane and at expansion joints, and is trapped inside the cells because deck drains are not located at the structural slab level (refer to Figure 7). This was evidenced by the observation of wet insulation and standing water at the structural slab level during exploratory excavation openings performed during our field assessment. Drains must be installed at the lowest point where water may collect within a plaza system.

However, the layout of the existing stormwater drainage system presents challenges with installation of deck drains at the structural slab level inside the cells. The invert elevations of the existing cast iron main stormwater lines that the PVC lateral drainage lines feed to are located above the bottom of the structural slab. Therefore, new deck drains installed at the structural slab level inside the abandoned planter cells would be unable to gravity feed to the existing cast iron main stormwater lines. Thus, the installation of a new drainage system or a major retrofit of the existing drainage system would be necessary to provide proper drainage of water that infiltrates to the bottom of the abandoned planter cells. A new drainage system would potentially include new deck drains inside planter cells, lateral drainage pipes to convey stormwater from the planter cells, new vertical drainage leaders and new main stormwater lines below the parking garage slab-on-grade. Design of a new drainage system must also take into consideration existing structure constraints such as maintenance of a minimum overhead clearance for vehicles using the garage.

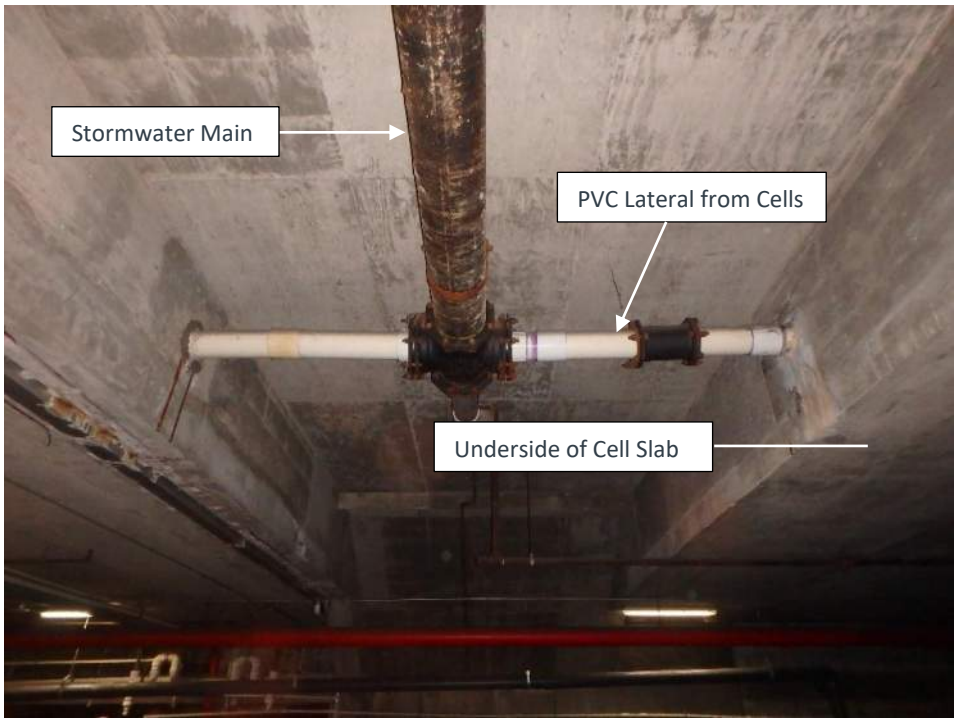


Figure 8: Typical cast iron east/west oriented stormwater main below Plaza Level

The existing cast iron main stormwater drain lines that currently collect water that drains from planter cells at the upper level of the parking garage extend in an east-west orientation and are located under the concrete walkways on the upper plaza surface. These stormwater mains gravity feed to cast iron stormwater lines located at the west side of the garage and that extend generally in a north-south orientation. *The invert elevations of these stormwater lines at the west side of the garage are above the elevation of the garage slab-on-grade. This presents a major challenge for design of a new stormwater drainage system because new stormwater lines that collect water from the drainage laterals coming from the planter cells and that are routed below the existing slab-on-grade cannot gravity feed to these existing east-west stormwater mains.*

Walter P Moore and Voltair discussed the possibility of installing a system of pumps that could pump water from new drainage laterals connected to new deck drains installed at the structural slab level up to the existing cast iron stormwater mains that extend in an east-west orientation and convey water to the cast-iron stormwater mains on the west side the garage. Such a system is not recommended because, in the experience of both Walter P Moore and Voltair, maintenance and long-term successful operation of such systems is extensive in cost and manpower.

We recommend that a qualified mechanical plumbing engineer be retained to perform a detailed feasibility study to evaluate options to investigate installation of a new stormwater drainage system or potential major retrofit of the existing stormwater drainage system to accommodate installation of new drains inside planter cells at the level of the structural slab so that cells can be properly drained, minimizing the potential for water infiltration into the garage from the Plaza Level.

MISCELLANEOUS CONDITIONS

The Americans with Disabilities Act (ADA) standards state that that "changes in level of ¼-inch high maximum shall be permitted to be vertical." The vertically displaced pavers observed at the plaza level have created sudden changes in elevation of more than ½-inch at several locations. These conditions represent potential trip hazards for pedestrians using the park facilities. We recommend that these pavers be re-leveled or replaced in order to restore the walking surface to be ADA-compliant.

SUMMARY OF ANALYSIS

The waterproofing failures within the plaza deck assembly at Kiley Gardens Park are widespread and contributing to deterioration of the structural and operational systems of the parking garage structure below, it is our opinion that the best course of action to effectively address the current conditions of water infiltration into the parking structure is to remove and replace all existing waterproofing materials at Areas A, B, and C, and to install new drains at the structural slab level within the planter cells.

While deteriorated waterproofing systems are generally not regarded as high priority repair items, failure to address the root cause of the plaza leaks will result in continued deterioration of the Plaza Level structural components, mechanical and electrical systems and continued leaking of water onto cars using the parking garage which can result in damage to vehicle finishes due to the effects of mineral leachate from the overburden soils and concrete structure above. Repairs to the plaza waterproofing and drainage systems at all locations directly above the parking structure is therefore recommended as a high priority repair item.

A more detailed discussion of our base conceptual repair recommendations, as well as alternative repair options that can be considered, is presented in the following section of this report.

RECOMMENDATIONS

The parking garage is experiencing water infiltration due to widespread failures of the buried waterproofing membrane and lack of drainage at the structural slab level of the abandoned planter cells. Our recommendations for a future course of action to address water infiltration into the parking garage from the Plaza Level include further evaluation of the existing plaza drainage system.

FURTHER EVALUATION

1. Retain a qualified plumbing engineer to investigate feasible options and associated probable construction costs for a new drainage system for the planter cells in which drains are provided at the lowest point of the planter cells (structural slab level).
2. Complete predesign and repair of the failed post-tensioned slab indicated in previous condition assessment reports.

Our base repair recommendations for addressing the waterproofing failures, as well as alternative repair options for consideration, are presented below.

BASE REPAIR RECOMMENDATIONS

Based on our visual observations and analysis, we recommend the following repairs be performed to address the waterproofing failures observed at the Kiley Garden Park Plaza:

We strongly recommend that the installation of a proper drainage system for the planter cells be implemented in order to effectively mitigate the potential for continued water infiltration into the existing parking garage and for additional structural distress to the post-tensioned concrete slab related to water infiltration.

Once a new drainage system is installed, we recommend the following conceptual repair approach for replacement of the existing plaza waterproofing system:

1. Remove overburden including concrete and stone pavers and tile throughout plaza including amphitheater and at lower level pedestrian walkway area along North Ashley Drive.
2. Remove existing concrete topping slab in planter cells.
3. Remove all existing fill material, foam material, waterproofing membrane on structural slab and upturned girders and beams.
4. Survey exposed concrete surfaces at top side of plaza structure framing and perform repairs of concrete spalls and delaminations observed. Epoxy inject select cracks in the structural slabs, girders and beams.
5. Install new drains at planter cells at structural slab level to connect to stormwater drainage system. Note: A new stormwater drainage system or major retrofit of the existing stormwater drainage system will be required based on further evaluation by plumbing engineer.
6. Properly seal all drain penetrations through the planter cells with a full link-seal pipe sleeve system.
7. Properly seal all penetrations through the structural slab, including abandoned penetrations, with a non-shrink grout.
8. Install new hot-applied rubberized asphalt waterproofing membrane system including drainage mat, protection board and new expansion joints throughout plaza deck. Include cants between vertical and horizontal transitions at corners. New waterproofing shall be a high-performance, 215 dry mil reinforced system.
9. Put back overburden of foam/lightweight fill material across the plaza, at planter cells and new finish pavers and tile including at amphitheater and at the lower level pedestrian walkway area along North Ashley Drive.

10. Perform chemical injection of cracks and penetrations at east and north foundation walls.

The following recommended repairs are related to current miscellaneous conditions observed at the plaza:

1. Re-level concrete pavers so that there are no sudden differences in elevation greater than ¼-inch vertical.
2. Replace cracked concrete pavers.
3. Replace joint sealants and re-point mortar joints at site walls such as the west perimeter wall and the stairwell walls.
4. Install area drains to alleviate standing water adjacent to the amphitheater.

ALTERNATIVE REPAIR OPTIONS

Other repair options for Area A (planter cells), in addition to our base repair recommendation, were also extensively considered and evaluated internally as part of our assessment. The following repair options are presented for the Client's consideration, but note that our base recommendation as stated above is, in our opinion, the most effective repair solution for the observed plaza deck waterproofing issues long-term.

Option 1: *Waterproofing Membrane Replacement with Limited Drainage System Improvements.* One alternative repair option is to replace the waterproofing membrane at the existing topping slab level in Area A and at the structural slab in Areas B and C; repair cracks and abandoned and existing penetrations in the structural slab at Area A from inside the parking garage; and perform limited improvements to the existing plaza drainage system.

The main problem with this repair approach is that it does not provide for drainage at the structural slab level of the abandoned planter cells within Area A as does the Base Repair Recommendation. Water that passes through the new waterproofing membrane will collect at the bottom of the cells (ref. Figure 7) and may eventually infiltrate through the structural slab and into the parking garage below. Perfect workmanship during installation of a new waterproofing membrane system is an unrealistic expectation. Rather, it should be anticipated that some water infiltration will occur through the waterproofing membrane at the level of the existing topping slabs and collect at the bottom of the planter cells.

Another problem with this repair approach is that chemical injection of cracks in the Area A structural slab from inside the garage will be difficult for the repair contractor to control because the cracks cannot be sealed on the backside. Thus, material injected into the cracks will tend to flow into the planter cells above and the volume of material required to seal the cracks hard to control. In addition, crack repairs by chemical injection are expected to require periodic re-injection of the cracks to maintain a seal due to structure movement. Repairs to seal penetrations through the structural slab with a non-shrink hydraulic water-stop grout will also require periodic repairs.

Option 2: *Lightweight Concrete Addition*. The addition of lightweight concrete on as an infill installation on top of the structural concrete slab can serve as a method to raise the low point within the planter cells to the level of the existing installed drains (at the level of the existing topping slabs within the abandoned planter cells). With this alternative repair approach, the self-weight of the lightweight concrete would need to be considered as an additional dead load on the structural slab. Lightweight concrete has a typical unit weight of approximately 100 to 125 pounds per cubic foot. The original structural concrete slab was designed for carrying the dead load of soil with a saturated unit weight of 75 pounds per square foot, up to a depth of approximately 4 feet (approximately 300 pounds per cubic foot). Thus, we do not expect that the additional loading of lightweight concrete would be a structural concern. However, waterproofing membranes historically do not bond well long term to lightweight concrete substrates. They will fail in bond and eventually deteriorate and breach. This could ultimately lead to the same issues that are currently occurring at the plaza deck with water bypassing the waterproofing membrane on the topping slab over insulated foam, and ponding on the structural slab with no method for drainage.

<u>Reason Option 2 is not recommended</u>: Waterproofing membranes do not bond well to lightweight concrete substrates, which will likely result in de-bonding of the waterproofing membrane over time and water bypassing the membrane, infiltrating through the porous lightweight concrete and ultimately through the structural concrete slab into the garage interior.

Option 3: *Pumps Addition.* Due to the existing location of main drain lines in the parking garage, the addition of pumps to the current drainage system as a potential repair option was discussed with VoltAir. With this repair method, drains would be installed at the low point of the planter cells at the structural slab, and hydraulic pumps would be added to feed water "up" to the main drain lines, which are located above the bottom of the structural slabs. However, in our opinion, the addition of pumps to the drainage system would be problematic, as well as expensive.

<u>Reason Option 3 is not recommended:</u> As discussed in the Analysis section above, the addition of pumps to move water from new drainage laterals connected to new deck drains installed at the structural slab level up to the existing cast iron stormwater mains that extend in an east-west orientation would be problematic, and in our experience, would require extensive, regular maintenance. As such this repair approach is not recommended.

OPINION OF PROBABLE CONSTRUCTION COST

Based on our site observations and review of owner-provided documents, we have prepared an opinion of probable construction cost for implementation of the Base Repair Recommendations for repair of the Plaza Level waterproofing system. The repair general consists of removal of the existing waterproofing system throughout the Plaza Level, installation of a new heavy-duty, hot-applied rubberized asphalt waterproofing membrane system throughout the Plaza Level and reinstallation of overburden and new tile pavers in Areas B and C. The opinion of probable construction cost can be used by the City for budgetary planning purposes.

In summary, the opinion of probable construction cost for the Base Repair Recommendations is $9,000,000 to $11,000,000. *This cost estimate does not include retrofit of the existing stormwater drainage system or installation of a new stormwater drainage system so that the abandoned planter cells can be drained at the structural slab level as recommended.*

These estimated costs are based on historic records of similar plaza restoration work. Costs are in 2021 dollars and are based on one construction season and estimated quantities. Cost may vary due to time of year, local economy, or other factors. Cost is based on normal workweek and night hours. Testing is not included in the opinion of probable construction costs. Typical restoration design, engineering, construction administration and quality testing fees are not included in the cost estimate.

The opinion of probable construction cost is for budgetary purposes only and not for actual construction. Since this is an opinion of cost, Walter P Moore does not have control over the cost or availability of labor, equipment or materials, or over market conditions or the contractor's method of pricing. In addition, the opinion of probable construction cost is made on the basis of our professional judgment and experience. Furthermore, the Walter P Moore makes no warranty, expressed or implied, that the bids or the negotiated cost of the work will not vary from the engineer's opinion of probable construction cost.

LIMITATIONS

The recommendations presented represent current technology for plaza and parking structure renovation and maintenance. We have assumed the facility will continue in its present use and will require appropriate repairs and periodic maintenance for this use. Structures undergo harsh exposure to various environmental elements and further deterioration will take place with continued service related exposure. Proper design and installation of effective repairs and maintenance can significantly reduce further deterioration and the associated repair costs.

This report is not a warranty or guarantee of the items noted. The extent of our evaluation was limited and cannot guarantee that the condition assessment discovered or disclosed all possible latent conditions. The evaluation required that certain assumptions be made regarding existing conditions and some of these conditions cannot be verified without expending additional sums of money, or destroying otherwise adequate or serviceable portions of the facility. In this study, we did not include review of the design, inspection of concealed conditions, or detailed analysis, to verify adequacy of the structure to carry the imposed loads and to check conformance to the applicable codes or for compliance with the American's with Disability Act (ADA) requirements. The assessment also does not provide specific repair details, construction contract documents, material specifications, details to develop construction cost, or information on means and methods of construction.

Any comment regarding concealed construction or subsurface conditions are our professional opinion, based on engineering experience and judgment, and derived in accordance with standard of care and professional practice.

This report has been prepared on behalf of and for the exclusive use of the City of Tampa. This report and the findings contained herein shall not, in whole or in part, be disseminated or conveyed to any other party or used or relied upon by any other party, in whole or in part, without our prior written consent.

GLOSSARY OF TERMS

The definitions of terms used in this report are given below. Note that when terms are applied to an overall system, certain portions of the system may be in a different condition.

GOOD: Component is in a "like new" condition requiring no rehabilitation and is performing its function as intended.

FAIR: Item is in sound condition and performing its function. The component is exhibiting some signs of normal wear and tear. Some incidental rehabilitation or maintenance work may be recommended.

POOR: Component is performing adequately at this time but the component's rate of deterioration has begun to accelerate. Repair or maintenance is strongly recommended to prevent further deterioration.

FAILED: Component cannot be relied upon to continue performing its original function. Item exhibits deferred maintenance and repair or replacement, or maintenance is required.

ABRASION RESISTANCE: Ability to resist being worn away by rubbing and friction.

ABRASIVE BLASTING: A system of cutting or abrading a surface, such as concrete or steel, by a stream of abrasive ejected from a nozzle at high speed by compressed air; often used for cleanup of corroded steel or for exposure of aggregate in architectural concrete.

CMU: Concrete Masonry Unit

CONCRETE: Mixture of Portland cement, fine aggregate, coarse aggregate, and water, with or without admixtures.

CORROSION: Disintegration or deterioration of steel or reinforcement by electrolysis or by chemical attack.

CRAZE CRACKS: Fine, random cracks, or fissures caused by shrinkage, which may appear in a surface of plaster, cement paste, mortar, or concrete.

DEFLECTION: A variation in position or shape of a structure or element due to effects of loads or volume change, usually measured as a linear deviation from an established plane.

DELAMINATION: In the case of a concrete slab, a delamination is the horizontal splitting, cracking, or separation of a slab in a plane roughly parallel to, and generally near, the upper surface. Delaminations are typically caused by corrosion of reinforcing steel or separation between concrete topping and underlying elements.

DETERIORATION: Disintegration or chemical decomposition of a material during service exposure.

DIAGONAL CRACK: An inclined crack caused by shear stress, usually at about 45 degrees to the neutral axis of a concrete member; or a crack in a slab, not parallel to the lateral or longitudinal dimensions.

EFFLORESCENCE: A deposit of mineral salts, usually white in color, formed on a concrete or masonry surface.

EPOXY CONCRETE: A mixture of epoxy resin, catalyst, fine aggregate, and coarse aggregate.

FAÇADE: The exterior finishes of a parking structure which may consist of various forms of concrete, brick, stone, metal panels, or other materials which are suitable for exterior exposure.

HAIRLINE CRACKING: Small cracks of random pattern in an exposed concrete surface.

JOINT SEALANT: Compressible material used to exclude water and solid foreign material from joints.

MAINTENANCE: Taking periodic actions that will either prevent or delay damage or deterioration or both

MICROCRACKS: Microscopic cracks within concrete.

OVERLAY: A layer of concrete or mortar, seldom thinner than 1 inch, placed on and usually bonded to the worn or cracked surface of a concrete slab to either restore or improve the function of the previous surface.

PATTERN CRACKING: Fine openings on concrete surfaces in the form of a pattern; resulting from a decrease in volume of the material near the surface, or increase in volume of the material below the surface, or both.

PEELING: A process in which thin flakes of mortar are broken away from a concrete surface, such as by deterioration or by adherence of surface mortar to forms as they are removed.

GLOSSARY OF TERMS *(CONTINUED)*

PRESTRESSED CONCRETE: Concrete in which stresses of such magnitude and distribution are introduced that the tensile stresses resulting from the service loads are counteracted to the desired degree.

Pretensioned concrete is prestressed concrete in which stressing tendons are tensioned before the concrete hardens.

Post-Tensioned concrete is prestressed concrete in which stressing tendons are tensioned after the concrete hardens.

REINFORCEMENT: Bars, (smooth or deformed), wires, strands, tendons and other elements that are embedded in concrete in such a manner that reinforcement and concrete act together to resist applied forces.

Conventional reinforcement is non-prestressed smooth or deformed bar or wire reinforcement with yield strengths in the 40,000-75,000 psi range.

Prestressed reinforcement is steel bars, wires or strands with ultimate strengths in the 250,000-270,000 psi range, strong enough to permit effective pre- or post-tensioning.

SCALING: Local flaking or peeling away of the near-surface portion of hardened concrete or mortar; also of a layer from metal. (Note: Light scaling of concrete does not expose coarse aggregate; medium scaling involves loss of surface mortar of 5-10 mm in depth and exposure of coarse aggregate; severe scaling involves loss of surface mortar of 5-10 mm in depth with some loss of mortar surrounding aggregate particles 10-20 mm in depth; very severe scaling involves loss of coarse aggregate particles as well as mortar generally to a depth greater than 20 mm.)

SERVICE LIFE: Estimated time until the on-set of deterioration which leads to distress (i.e. cracking, spalling/flaking, pitting, debonding, delaminations, section loss, and an eventual loss of integrity of an element.

SHRINKAGE CRACKING: Cracking of a structure or member due to failure in tension caused by external or internal restraints as reduction in moisture content develops, or as carbonation occurs, or both.

SOFFIT: The underside of a structural member typically observed overhead from the floor level below such as the bottom-face of a beam or the bottom of a floor slab.

SPALL: A dish-shaped cavity or void formed by the broken surface, edge, or corner of a larger mass such as a floor slab, beam, column, wall, etc. Spalls are usually the result of weathering, pressure, or volume change of the larger mass.

SPANDREL BEAM: A beam at the perimeter of a building spanning between columns and usually supporting floor or roof loads.

TENDON: A steel element such as a wire, cable, bar, rod, strand, or group of such elements used to impart prestress to concrete when the element is tensioned.

TRANSVERSE CRACKS: Cracks that develop at right angles to the long direction of a member.