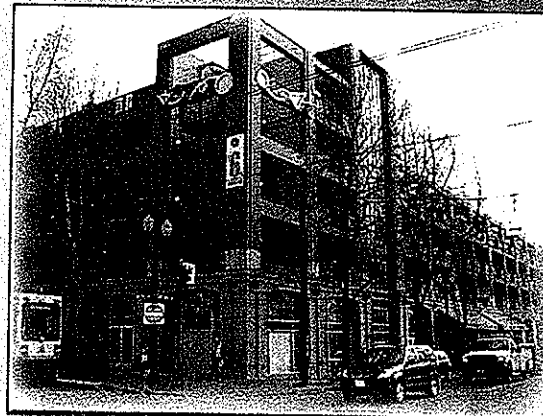
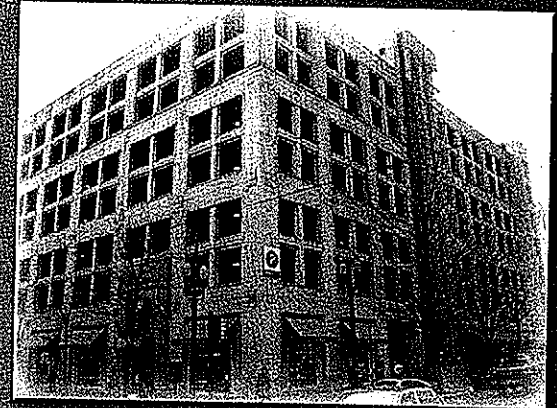
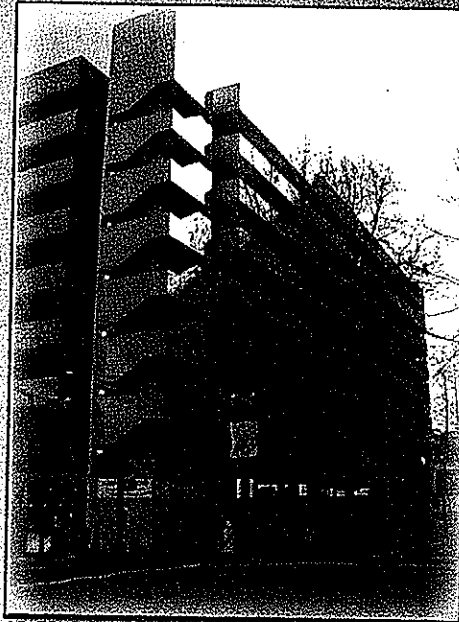


Consultant Services



City of Portland Office of Management and Finance
Structural Condition Assessment Report of Four Smart Park Garages,
Portland, Oregon

Submitted by

BERGER/ABAM
ENGINEERS INC.

BERGER/ABAM ENGINEERS INC.
700 NE Multnomah Street - Suite 900
Portland, Oregon 97232-4169
503/872-4100 • FAX 503/872-4101
www.abam.com



PLANNING
ENGINEERING
ENVIRONMENTAL
PROGRAM MANAGEMENT

29 May 2008

Ms. Johnson, LEED AP
City of Portland, OMF Facilities Services
1120 SW Fifth Avenue
Portland, OR 97204-1985

Subject: Structural Condition Assessment Report of Four Smart Park Garages – Contract #34813

Dear Ms. Johnson:

We are pleased to present the attached final Structural Condition Assessment Report of the four Smart Park Garages located at SW 3rd and Alder, SW 4th and Yamhill, NW Naito Parkway and Davis St., and SW 1st and Jefferson in downtown Portland, Oregon. Comments have been incorporated into the report as well as rehabilitation cost estimates. Furthermore, an additional appendix has been added for detailed descriptions on the rehabilitation costs for each parking garage.

Please do not hesitate to call if you have any questions regarding the document.

Sincerely,

A handwritten signature in black ink, appearing to read 'Howard A. Wells', is written over a horizontal line.

Howard A. Wells, PE
Senior Project Engineer

HAW:llt
Attachment
Structural Condition Assessment Report

**Structural Condition
Assessment Report**

**Four Smart Park Garages
Portland, Oregon**

Submitted to

**City of Portland Office of Mangement and Finance
Portland, Oregon**

29 May 2008



Submitted by

**BERGER/ABAM Engineers Inc.
700 NE Multnomah Street, Suite 900
Portland, Oregon 97232-4189**

Job No. PAPOR-04-112, Task 800

STRUCTURAL CONDITION ASSESSMENT REPORT

Four Smart Park Garages Portland, Oregon

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- Appendix A Photographs of Third and Alder Smart Park**
- Appendix B Photographs of Fourth and Yamhill Smart Park**
- Appendix C Photographs of First and Jefferson Smart Park**
- Appendix D Photographs of Naito and Davis Smart Park**
- Appendix E Rehabilitation Cost Estimates**

STRUCTURAL CONDITION ASSESSMENT REPORT FOUR SMART PARK GARAGES

EXECUTIVE SUMMARY

Objectives

The objective of this report is to evaluate the existing conditions of the four Smart Park garages located at SW Third Avenue and SW Alder Street, SW Fourth Avenue and SW Yamhill Street, SW First Avenue and SW Jefferson Street, and NW Naito Parkway and NW Davis Street in Portland, Oregon. This report will identify current structural deficiencies, addressing primarily long-term durability issues through visual investigations. BERGER/ABAM Engineers, Inc. has been authorized to do this work under Contract No. 34813 with the City of Portland Office of Management and Finance.

Description

The Third and Alder Smart Park garage is a ten-story building built in 1978. The first level comprises retail spaces and the remaining levels are for parking. All floors consist of concrete framing. The Fourth and Yamhill Smart Park garage is an eight-story building (excluding two underground levels) built in 1989. Similar to the Third and Alder Smart Park garage, retail spaces are located on the first level and the upper levels are for parking. The two lower, underground levels of parking are available for mall parking. The garage is composed of concrete and masonry. The First and Jefferson Smart Park garage is a ten-story building built in 1970 and engineered much like Third and Alder Smart Park garage. Retail spaces are located on the first level and the remaining levels are for parking. All floors consist of concrete framing. Lastly, the Northwest Naito Parkway and Davis Street Smart Park garage is a five-story building built in 1989 that includes a heliport on the top floor. Some retail spaces are located on the first floor and parking is located on the second to fourth floor. The garage consists of concrete, steel, and masonry framing.

Field Observations

Based on our visual observations of the structures, we observed the following structural deficiencies.

- Isolated stormwater ponding
- Concrete slab cracking with water intrusion
- Concrete deterioration with rebar exposure
- Concrete slab cracking and leakage due to negative bending moments
- Delamination of concrete
- Water intrusion at concrete slab closure pour strips with leakage underneath
- Water intrusion at beam-wall connection
- Concrete spalling at slab closure pour strips
- Structural steel deterioration

- Masonry cracking
- Concrete slab patches with leakage underneath
- Concrete top slab separation
- Concrete column/beam cracking
- Past concrete repairs with further deterioration
- Concrete joint sealant deterioration with leakage and leachate
- Indications of possible improper concrete workmanship/curing
- Brick veneer cracking
- Concrete stairway/sidewalk cracking
- Cable barrier wear
- Efflorescence mineral deposits on masonry

Conclusions and Recommendations

In order to address the long-term structural integrity of the buildings, the following is recommended.

- Flushing and cleaning of storm drains and weep holes
- Epoxy resin chemical grout injection to rebond the concrete slab and post-tensioning closure pour strips
- Epoxy bonded replacement concrete or mortar where delamination is present
- Injection of a two-component epoxy resin and polyurethane resin at "live" concrete cracks to structurally bond concrete while preventing water leaks
- Reconstruction of concrete slab at isolated ponding locations
- Reconstruction of deteriorated concrete with epoxy-bonded dry pack mortar
- Removal of rust and an application of epoxy paint on steel members
- Pressure injection of epoxy into cracks
- Resealing concrete joints with a polyurethane resin
- Installation and tightening of cable barriers
- Removal of efflorescence mineral deposits from brick walls

Detailed quantity take-offs were obtained and a summary is shown as follows. Unit costs for these work items are based on our experience and the experience of Leewens Corporation, as well as on cost data obtained from RS Means Building Construction Cost Data 2008. Dollar figures have been rounded to the nearest \$10,000.

Third and Alder	Fourth and Yamhill	First and Jefferson	Naito and Davis
\$960,000	\$910,000	\$390,000	\$590,000

These costs do not include final engineering services or other consultant services related to preparation of bidding documents, nor do they include the City's cost to administer the project. Further, these costs do not include estimates for lead paint abatement, or necessary work, such as cleaning of the drainage system.

STRUCTURAL CONDITION

ASSESSMENT REPORT FOUR SMART PARK GARAGES

INTRODUCTION

This report documents the key findings of the visual structural evaluation of the Third and Alder, Fourth and Yamhill, First and Jefferson, and Northwest Naito Parkway and Davis Street Smart Park parking garages located in Portland, Oregon. BERGER/ABAM Engineers Inc. has been contracted by the City of Portland Office of Management and Finance through Contract No. 34813. The purpose of this evaluation is to identify structural deficiencies in the buildings and provide recommendations to repair the buildings. BERGER/ABAM will address primarily the long-term structural integrity issues.

The scope of work included visits to the sites to observe the current conditions of the structures and to perform a visual assessment of each building's structural framework. The assessment does not include concrete core sampling, steel strength testing, or any other material testing and cannot guarantee that all structural deficiencies are included.

The four Smart Park garages are located in downtown Portland. All of the garages are composed of concrete slabs on reinforced concrete beams. The Naito and Davis Smart Park garage also includes steel girders on the parking levels. The Fourth and Yamhill and Naito and Davis Smart Park garages include masonry.

PROJECT DESCRIPTION

Description of Work

Structural condition visual observations were completed by BERGER/ABAM on 11 and 12 March 2008, to provide an assessment of each Smart Park parking garage's structural integrity. Each floor was visually investigated to determine the extent of structural deficiencies. Notes were obtained and photos were taken for report documentation. The photos are included in Appendices A through D. Further visual observations were completed by BERGER/ABAM on 15 and 16 May 2008, to provide a rehabilitation cost estimate for each Smart Park parking garage. The cost estimates for rehabilitation of each parking garage is included in Appendix E.

Description of Structures

The four Smart Park garages are located throughout downtown Portland. All of the garages contain some retail spaces on the first floor of their respective structure. The garages contain five to eleven levels and are predominantly constructed of concrete slabs, beams, and columns.

The following final report discusses the visual observations of the existing structural conditions of the buildings for an assessment of the predominant structural deficiencies or areas of concern

at each location. The inspections are limited to the elements that are directly observable to the human eye.

OBSERVATIONS FROM VISUAL INSPECTION

The overall condition of the structures is fair for the structures' respective ages. Most of the structural deficiencies that were observed were due to aging, structural movements, and/or environmental conditions, mainly water intrusion. The following list provides the existing, predominant structural deficiencies or areas of concern found through the visual inspection at each location, a summary of suspected causes of these conditions, and suggested maintenance or repair (in decreasing order of severity).

■ Isolated stormwater ponding

Building -	Thrd and Alder	Fourth and Yamhill	First and Jefferson	Naito and Davis
Floor Number -	2, 4, 8, 9, 10	3, 4, 5, 6, 7	2, 8, 9	2, 3, 4
Photo Number -	3	16, 17	23	57

Suspected Cause - Largely due to clogged storm drains. However, a few areas of ponding have developed due to slight depressions in the concrete floor slab.

Repair - Ponding found in these structures can be dramatically reduced by the flushing and cleaning of the storm drains and weep holes (Fourth and Yamhill). Cleaning storm drains and weep holes yearly will limit delamination of concrete and rebar corrosion in future years and greatly reduce the cost of repairs. Reconstruction to repair slab slope can be a severe cost. Areas of ponding due to slight depressions in the concrete slab can be repaired by grinding the concrete and replacing areas greater than one square foot and six inches of depth. A second option would be to grind channels in the concrete toward drainage structures to direct stormwater flow. The aesthetic appeal in this construction alternative is very limited and exposure of reinforcement in certain areas is probable and therefore may not be a viable option.

■ Concrete slab cracking with water intrusion

Building -	Thrd and Alder	Fourth and Yamhill	First and Jefferson	Naito and Davis
Floor Number -	2, 3, 5, 6, 8, 9	5, 7	All Floors	2, 3, 4
Photo Number -	4, 5, 8	21	26, 27, 31	43, 44, 45

Suspected Cause - Aging and structural movements due to expansion and contraction are the possible causes for the cracks. Typical cracking of this nature can lead to water intrusion and moisture contacting the reinforcement. This can further lead to rebar corrosion and the beginning of concrete spalling.

Repair - Epoxy resin or chemical grout injection is a viable option in this situation to prevent further cracking and aid in structural rebonding. Cracks larger than 1/32 inch are recommended to be repaired. Cracks less than 1/32 inch are difficult to properly inject; therefore, a surface sealant should be applied to these. Areas with substantial amounts of water present can be coated with a two-component polyurethane resin system. This system utilizes an epoxy resin for structural bonding and a polyurethane resin for water resistance.

■ Concrete deterioration with rebar exposure

Building -	Third and Alder	Fourth and Yamhill	First and Jefferson	Naito and Davis
Floor Number -	2, 3, 6, 8, 10, 11	6, 8	3, 4, 7	2, 4
Photo Number -	1, 2	13	32, 33, 34	50, 54, 55

Suspected Cause - The cause of this type of concrete defect is often due to the method of construction of the concrete. It may also be caused by water intrusion into cracks, leading to corrosion reinforcement, or a localized weak bond between the aggregate and the cement paste and air voids remaining in the concrete after curing. Additionally, shallow concrete cover over rebar has been observed at some locations resulting in rebar exposure after concrete deterioration. Rebar that has been exposed because of these defects are corroding from oxidation and exposure to water.

Repair - Rebar that has corrosion must be cleaned to remove all loose rust that would interfere with the bond to the repair material. Afterwards, an epoxy paint should be applied to coat the rebar. Rebar that has been reduced to half of its original cross-section due to corrosion should be completely removed and replaced. Concrete then should be repaired with an epoxy-bonded dry pack. Placement of epoxy in the concrete void area followed by dry pack mortar can be a suitable option. The dry pack mortar can either be pumped into form or trowel applied.

■ Concrete slab cracking and leakage due to negative bending moments

Building -	Third and Alder	Fourth and Yamhill	First and Jefferson	Naito and Davis
Floor Number -	-	5, 6, 7	All Floors	2
Photo Number -	-	18, 19	24, 25	48, 49

Suspected Cause - Predominantly due to the negative bending moment over the concrete beams. Typical cracking of this nature can lead to water intrusion and moisture contacting the reinforcement. This can further lead to rebar corrosion and the onset of concrete spalling.

Repair - Epoxy resin injection should be used to structurally rebond the concrete. Because water damage is prevalent in a substantial portion of the structure, a two-component polyurethane resin system could be used that consists of an epoxy resin and polyurethane resin for water resistance.

■ **Delamination of concrete**

Building -	Third and Alder	Fourth and Yamhill	First and Jefferson	Naito and Davis
Floor Number -	5, 8, 9, 10	-	3	-
Photo Number -	3, 9	-	35	-

Suspected Cause - Corrosion of rebar in the concrete slab due to stormwater intrusion, as well as the expansion of the post-tensioned slabs. Delamination of concrete slabs at columns can extend up to five feet from the column and will increase the susceptibility of rebar corrosion. As rebar corrodes, the likelihood of further delamination increases. Delamination has also been found at the intersection of the floor slab and entrance and exit ramps at the Third and Alder Smart Park garage. This deterioration is predominantly due to traffic wear and should be inspected yearly for further concrete delamination.

Repair - Rebar that has corrosion must be cleaned to remove all loose rust and corrosion that would interfere with the bond to the repair material. Afterwards, an epoxy paint should be applied to coat the rebar. Rebar that has been reduced to half of its original cross-section due to corrosion should be completely removed and replaced. Careful repair must be performed to prevent failure of bonding to the existing concrete. Therefore, an epoxy-bonded replacement concrete or epoxy-bonded mortar should be used to replace the delaminated concrete. Furthermore, a roller applied silane sealer can be applied after the concrete has cured to prevent future water intrusion.

■ **Water intrusion at concrete slab closure pour strips with leakage underneath**

Building -	Third and Alder	Fourth and Yamhill	First and Jefferson	Naito and Davis
Floor Number -	-	5, 6, 7	All Floors	2, 3, 4
Photo Number -	-	20	28, 29	37

Suspected Cause - The concrete slabs were poured in sections. After the slabs had time to cure, the rebar was stressed for post-tensioning at each of the closure pour locations. Water has been intruding into the slab joints over time and corroding the reinforcement because of the deterioration of joint sealant and the expansion and contraction of the concrete slab from loading.

Repair - Epoxy resin injection should be used to structurally rebond the concrete slab and closure pour strips to prevent water intrusion. Further preventative measures, such as an Alkyl-Alkoxy Siloxane sealing compound, are suggested for use over the entire concrete pour area to lengthen the service life of the slab.

■ Water intrusion at beam-wall connection

Building -	Thlrd and Alder	Fourth and Yamhill	First and Jefferson	Nalto and Davis
Floor Number -	-	-	-	2, 4
Photo Number -	-	-	-	46, 47

Suspected Cause - Water intrusion from upper floor through slab cracks due to shrinkage and restraint.

Repair - Further damage of this type may be prevented by removing any isolated ponding areas from the floor above. Afterwards, any rebar exposure should be inspected for corrosion. If the rebar is significantly damaged, it should be replaced. A pressure injection procedure involving pumping epoxy into all cracks followed by covering the crack with a thixotropic epoxy or hydraulic cement should be used to prevent further damage.

■ Concrete spalling at slab closure pour strips

Building -	Thlrd and Alder	Fourth and Yamhill	First and Jefferson	Nalto and Davis
Floor Number -	3	-	2, 7, 8	2, 3, 4
Photo Number -	11	-	29, 30	37, 53

Suspected Cause - Probable cause is due to the expansion and contraction of the concrete slab at the joint, as well as vehicle exposure to a poorly finished concrete surface.

Repair - Repair of concrete surface spalling requires the removal of the weakened area. The surface for repair should be cleaned and roughened via a high-pressure wash and replaced with an epoxy-bonded shotcrete patch. In cases where water is being absorbed, apply an alkyl-alkoxy siloxane sealing compound over spalling areas to prevent moisture from entering the concrete.

■ Structural steel deterioration

Building -	Thlrd and Alder	Fourth and Yamhill	First and Jefferson	Nalto and Davis
Floor Number -	-	-	-	3, 4
Photo Number -	-	-	-	38

Suspected Cause - Environmental conditions, aging, and less than ideal maintenance.

Repair - Affected steel components should be sandblasted and cleaned to remove rust and coated with an epoxy paint. Yearly maintenance of steel components should be performed afterwards to prevent the structure from becoming dilapidated and structurally deficient.

■ **Masonry cracking**

Building -	Third and Alder	Fourth and Yamhill	First and Jefferson	Naito and Davis
Floor Number -	-	-	-	1, 2
Photo Number -	-	-	-	40, 41, 42

Suspected Cause - The probable causes of masonry cracking are structure settlement, temperature movement, and water intrusion from upper floors.

Repair - Before the masonry is repaired, all potential water leaks surrounding the masonry should be sealed. Afterwards, the masonry can be repaired by applying an epoxy mortar with a trowel. If the cracks reappear or are still "active," the masonry should be repaired by stabilizing the expansion and contraction in the wall. These cracks can be stabilized by inserting small diameter reinforcing bars in the bed joints and applying masonry grout behind the mortar to envelop the steel.

■ **Brick veneer cracking**

Building -	Third and Alder	Fourth and Yamhill	First and Jefferson	Naito and Davis
Floor Number -	-	-	-	4
Photo Number -	-	-	-	58

Suspected Cause - The probable causes of brick veneer cracking are structure settlement and exposure to environmental conditions over time.

Repair - Chip out any crumbling mortar to a depth of ½-inch and remove all brick that is damaged. Use a weather resistant mortar to bond the replacement bricks to the existing and repair any other cracks in the existing mortar. Match the finish of the mortar joints to the existing joints to reduce new points of wear. Keep the mortar joints moist for four days to ensure the mortar cures properly and does not crack.

- Concrete slab patches with leakage underneath

Building -	Third and Alder	Fourth and Yamhill	First and Jefferson	Naito and Davis
Floor Number -	-	2, 4	4	-
Photo Number -	-	22	24	-

Suspected Cause - Concrete slab patches are a result of the construction method used for this garage (concrete pump access to upper floors) or from the reconstruction of poorly cured concrete slab sections.

Repair - Patches that exhibit water intrusion should be repaired with an epoxy resin injection to structurally rebond the concrete slab. Areas with substantial amounts of water present can be coated with a two-component polyurethane resin system. This system utilizes an epoxy resin for structural bonding and a polyurethane resin for water resistance.

- Concrete top slab separation

Building -	Third and Alder	Fourth and Yamhill	First and Jefferson	Naito and Davis
Floor Number -	-	-	-	2
Photo Number -	-	-	-	51

Suspected Cause - Predominantly due to the settlement of the vertical wall.

Repair - The repair should consist of thoroughly cleaning and roughening the area through high pressure washing. A pressure injection procedure involving pumping epoxy into all cracks followed by an epoxy-bonded shotcrete patch should be performed. In cases where water is being absorbed, apply an alkyl-alkoxy siloxane sealing compound over spalling areas to prevent moisture from entering the concrete.

- Concrete column/beam cracking

Building -	Third and Alder	Fourth and Yamhill	First and Jefferson	Naito and Davis
Floor Number -	5, 7	-	-	4
Photo Number -	6	-	-	39

Suspected Cause - Aging and structural movements due to expansion and contraction are the possible causes for the cracks. These cracks are predominantly due to the service life and repeating loads on the structure.

Repair - Epoxy resin injection is a viable option in this situation to prevent further cracking and aid in structural rebonding.

■ Past concrete repairs with further deterioration

Building -	Thlrd and Alder	Fourth and Yamhill	First and Jefferson	Nalto and Davis
Floor Number -	2, 5	-	-	-
Photo Number -	10	-	-	-

Suspected Cause - Likely due to a poor concrete batch at the time of construction, with weak bonding between the aggregate and cement.

Repair - Epoxy resin injection can be used to further enhance the bond between the cement and aggregate as the past repairs have done. An additional preventive measure that can be taken is to use an epoxy-bonded dry pack or mortar around and in the area of deterioration to further limit deterioration.

■ Concrete joint sealant deterioration with leakage

Building -	Thlrd and Alder	Fourth and Yamhill	First and Jefferson	Nalto and Davis
Floor Number -	-	5, 7	-	-
Photo Number -	-	15	-	-

Suspected Cause - Structural age and deterioration of joint sealant.

Repair - Severe mineral buildup at these locations can lead to rigorous rebar corrosion in the concrete slab. Inspection and maintenance should be preformed yearly to check and reseal concrete joints. All mineral deposits should be thoroughly flushed from the joint and the joint should be repaired with a polyurethane resin to seal and eliminate further leakage into the joints.

■ Improper concrete workmanship/curing

Building -	Thlrd and Alder	Fourth and Yamhill	First and Jefferson	Nalto and Davis
Floor Number -	7	-	-	-
Photo Number -	7	-	-	-

Suspected Cause - Insufficient time allowed for concrete to cure.

Repair - Although areas of this nature are not necessarily structurally deficient, they are aesthetically displeasing and over time could possibly lead to concrete cracking and spalling. Concrete in these areas must be replaced by grinding and removing the existing concrete surface so a new concrete surface can be applied.

■ Concrete stairway/sidewalk cracking

Building -	Thlrd and Alder	Fourth and Yamhill	First and Jefferson	Nalto and Davis
Floor Number -	-	-	1	1
Photo Number -	-	-	36	52

Suspected Cause - Concrete stairway cracking is predominantly from wear and structural aging.

Repair - Epoxy resin injection can be used to further increase the bond between the cement and aggregate. Where cracking is severe, the entire area should be removed and an epoxy-bonded dry pack or mortar should be trowel applied.

■ Cable barrier wear

Building -	Thlrd and Alder	Fourth and Yamhill	First and Jefferson	Nalto and Davis
Floor Number -	-	8	-	4
Photo Number -	-	12, 17	-	56

Suspected Cause - Age and cable stretching over time.

Repair - Current building codes require barrier cables to be installed 4-inches center-to-center. These cables have been either stretched or loosened. Tightening and/or installing additional cables is recommended to bring the barrier up to current code.

■ Efflorescence mineral deposits on masonry

Building -	Thlrd and Alder	Fourth and Yamhill	First and Jefferson	Nalto and Davis
Floor Number -	-	5, 7	-	-
Photo Number -	-	14, 15, 17	-	-

Suspected Cause - From water accumulation containing salts (likely from the mortar and concrete) entering into the masonry.

Repair - This is mainly an aesthetic repair. Remove lime deposits from the brick walls with an efflorescence remover. Afterwards, use a sealer and lacquer to prevent future lime buildup.

ASSESSMENT OF EXISTING CONDITIONS

Through the visual investigation, BERGER/ABAM found that the majority of the structural deterioration is due to the intrusion of rainwater through the concrete from isolated concrete slab low spots and clogged storm sewer systems or minor structural cracks. The extensive amount of time the rainwater has had to intrude into the concrete members of the structures led to the current situation of suggested maintenance. While some degree of concrete cracking and deterioration, as well as structural steel member degradation is expected over time, the damage observed characterizes less than ideal maintenance practices to uphold the structural integrity of these aging structures. As deterioration progresses in time, the rate of deterioration increases exponentially leading to increases in repair costs and decreases in repair effectiveness. From the investigation, these structures are not in an immediate state of failure. However, continued future use and exposure to rain events with little or no maintenance will ultimately lead to costly reconstruction of concrete members. BERGER/ABAM suggests maintenance repairs to minimize water intrusion into the concrete members and corrosion of the steel members be conducted in the near future. These repairs will involve the cleaning and flushing of storm drain systems, replacement of delaminated concrete, sealing of joints and cracks in concrete members and slabs, and the removal of rust and repainting the steel members of the structure.

CONCLUSIONS AND RECOMMENDATIONS

In order to improve the service life of these buildings, the following repairs should be performed.

- Cleaning and flushing of all storm sewer drains.
- Deteriorated concrete should be repaired with an epoxy-bonded dry pack.
- Exposed rebar that has corrosion should be cleaned and painted with an epoxy coating before the replacement of concrete.
- Concrete slab closure pours should be cleaned and injected with epoxy resin to structurally rebond the concrete slab and concrete closure pour strips and prevent water intrusion. Waterproofing this entire area with a sealing compound is recommended for additional protection.
- Delamination of concrete around steel columns should be replaced with an epoxy-bonded replacement concrete or epoxy-bonded mortar after the rebar has been cleaned and painted with an epoxy coating to prevent further corrosion.
- Concrete slab cracks with water intrusion should be structurally rebonded with an epoxy resin injection, as well as a polyurethane resin for water resistance.

- Isolated ponding of stormwater should be prevented by concrete replacement to a correct slope for water runoff or, at the very least, installing a channel through concrete grinding to route water to drainages.
- Steel structural deterioration (rust) on framing should be removed by sandblasting and repainted with an epoxy paint.
- Concrete joint sealant deterioration should be inspected and replaced at locations where there is leaking. Polyurethane resin should be used to seal the joint and to prevent water from leaking to the lower floor.
- Brick veneer cracking should be repaired by replacing all cracked bricks and replacing with new brick and mortar. All cracking mortar between the brick should be replaced with a weather resistant mortar.

Further repairs that are suggested but are not of an immediate concern are the following.

- Cracks in concrete columns and beams should be injected with an epoxy resin to prevent further cracking in the future and structural rebonding.
- Cable barrier wear should be brought up to building code standards by the tightening of cables and the installation of new cables so they do not exceed the gap of 4 inches center-to-center.
- Efflorescence mineral deposits on brick walls can be addressed by removing lime deposits from the brick walls with an efflorescence remover. Afterwards, use a sealer and lacquer to prevent future lime build-up.

CONCLUSIONS AND RECOMMENDATIONS

BERGER/ABAM and Leewens Corporation, a specialty concrete repair contractor, performed walk-throughs on 15 and 16 May 2008. Detailed quantity take-offs were obtained and are shown in Appendix E. Unit costs for these work items are based on our experience and the experience of Leewens Corporation, as well as on cost data obtained from RS Means Building Construction Cost Data 2008.

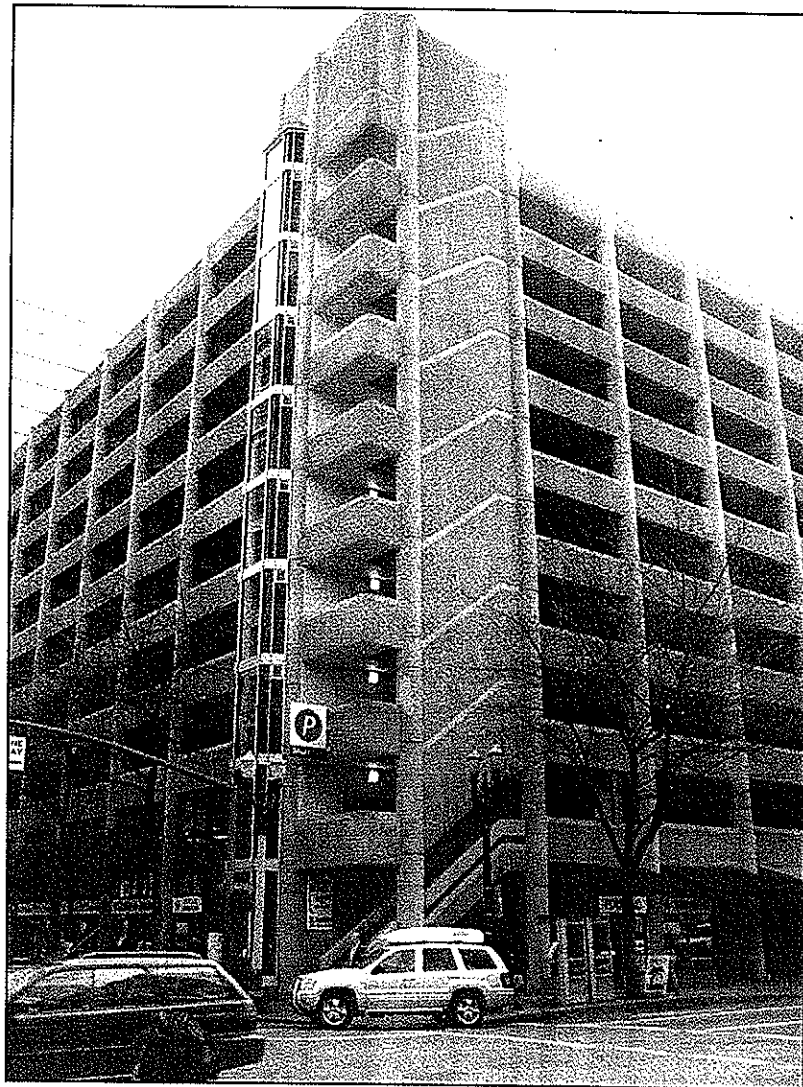
The estimated cost for rehabilitation of the parking garages is as follows. Dollar figures have been rounded to the nearest \$10,000.

Third and Alder	Fourth and Yamhill	First and Jefferson	Naito and Davis
\$960,000	\$910,000	\$390,000	\$590,000

These costs do not include final engineering services or other consultant services related to preparation of bidding documents, nor do they include the City's cost to administer the project. Further, these costs do not include estimates for lead paint abatement, or necessary work, such as cleaning of the drainage system, which we assume will be performed by City maintenance staff.

**Structural Condition Final Assessment Report
Four Smart Park Garages
Portland, Oregon**

**Appendix A
Photographs of Third and Alder Smart Park**



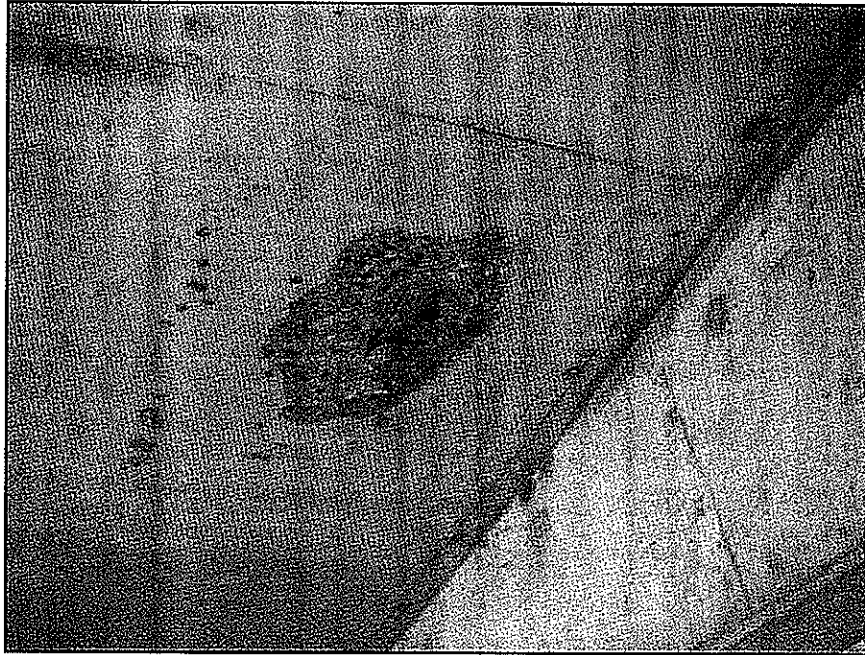


Photo 1 - Concrete deterioration and rebar exposure



Photo 2 - Concrete deterioration and rebar exposure

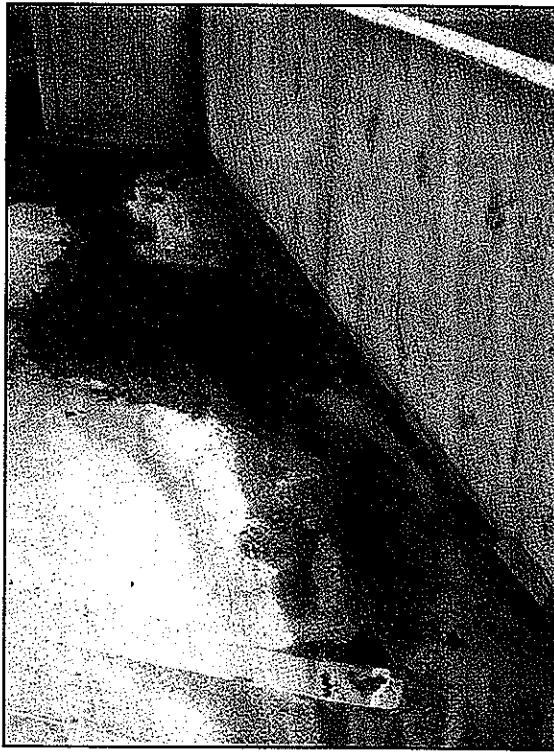


Photo 3 - Concrete delamination and ponding



Photo 4 - Concrete slab cracking

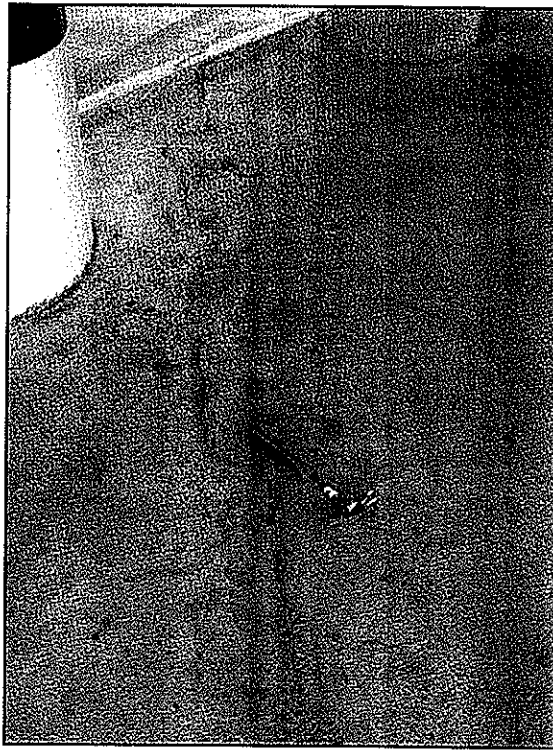


Photo 5 - Concrete slab cracking

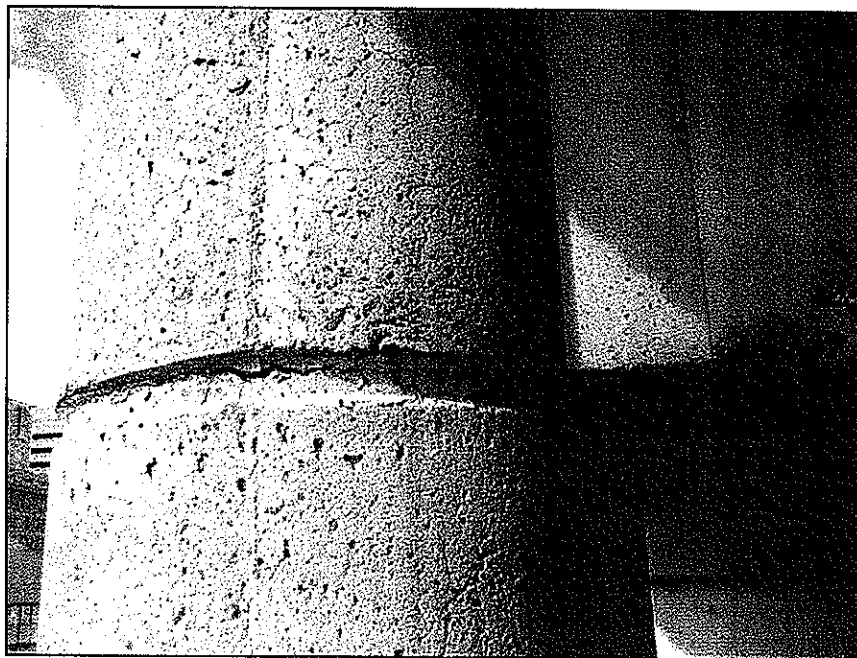


Photo 6 - Concrete column cracking

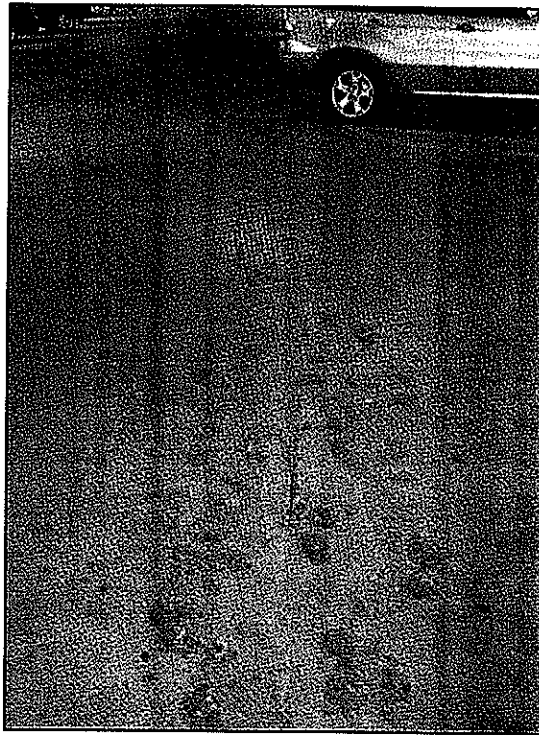


Photo 7 - Poor concrete construction

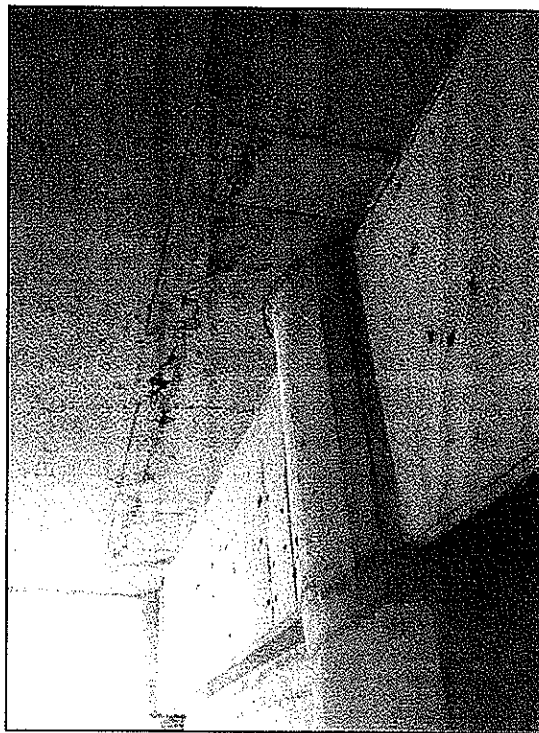


Photo 8 - Concrete cracking and water intrusion

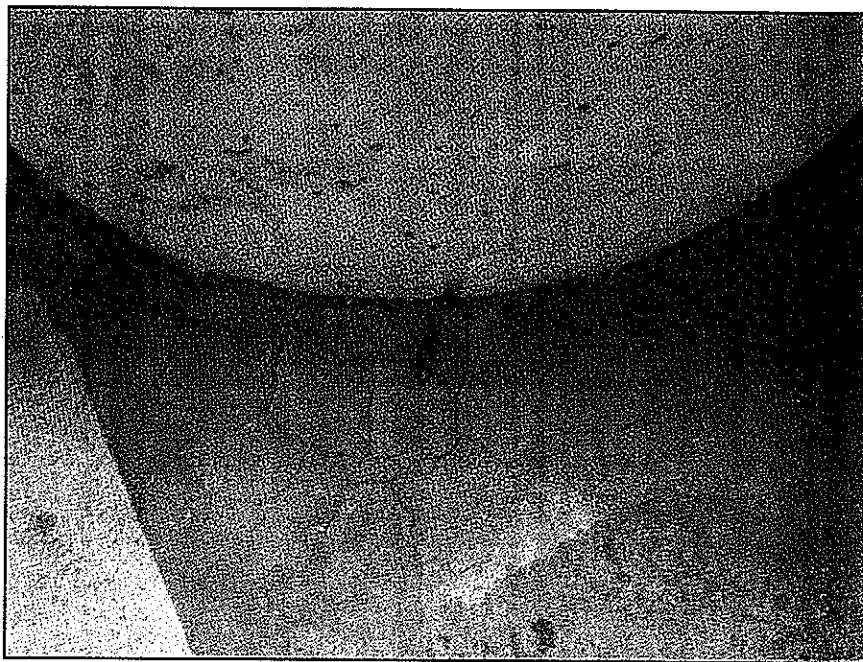


Photo 9 - Delamination of concrete slab

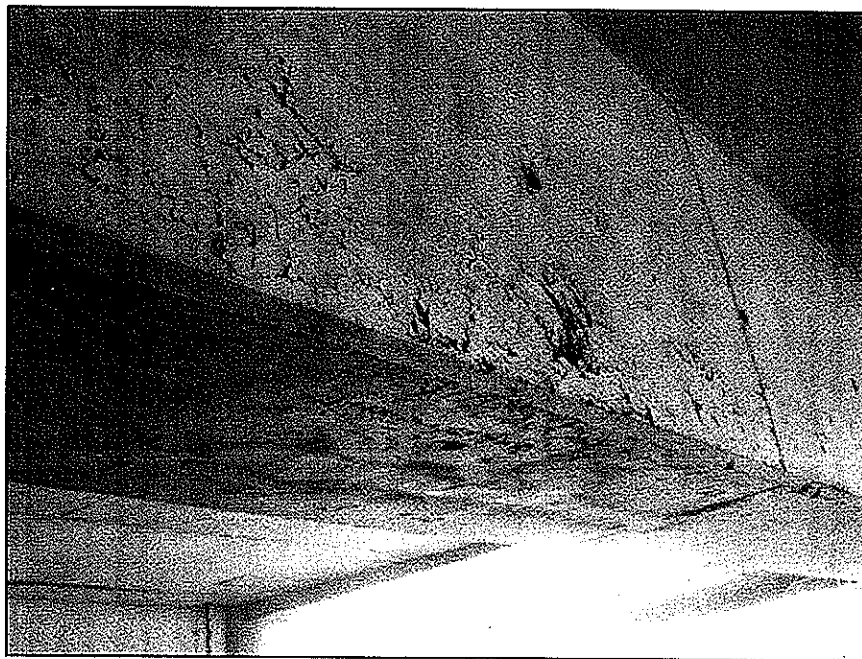


Photo 10 - Past concrete repair and further deterioration

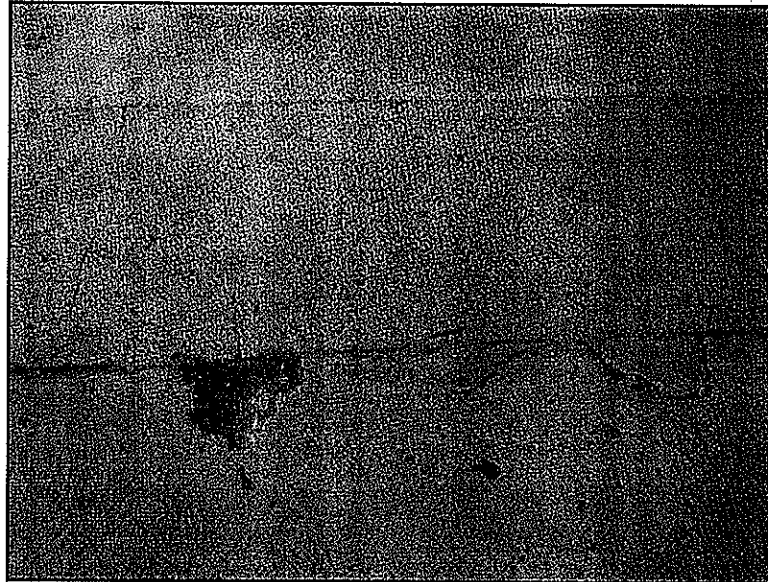
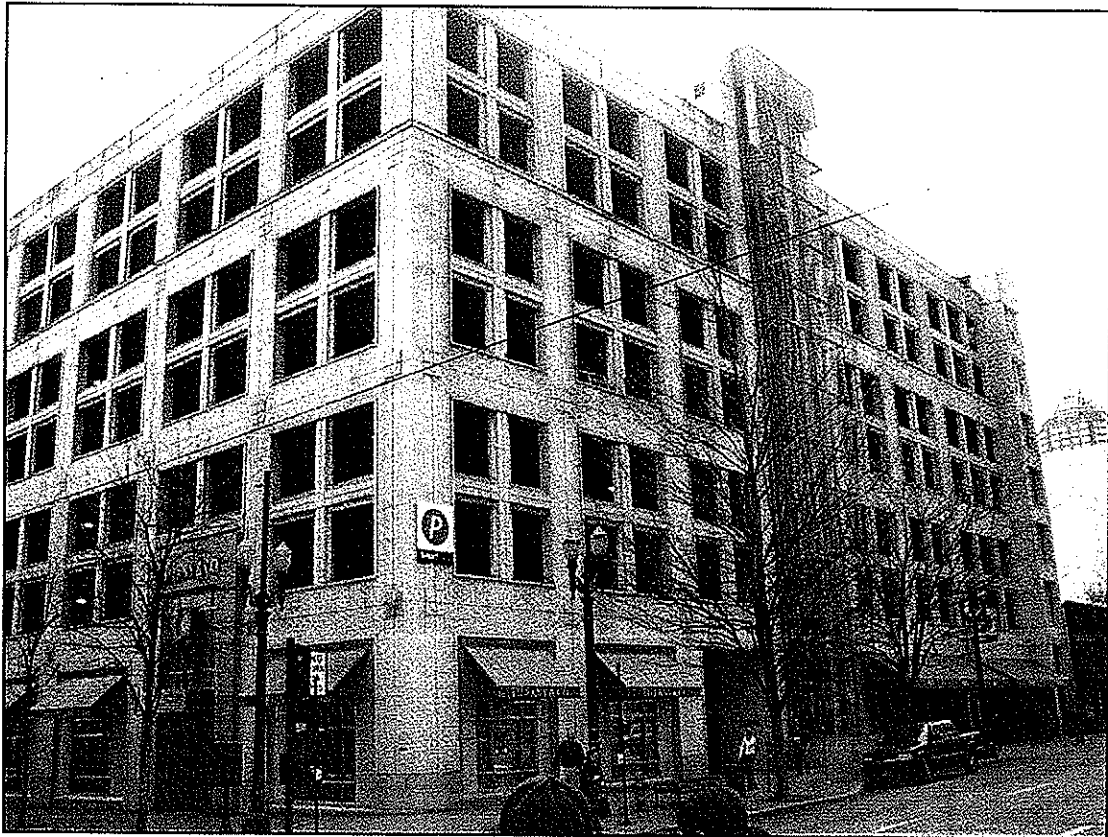


Photo 11 - Concrete spalling at slab closure pour strips

**Structural Condition Final Assessment Report
Four Smart Park Garages
Portland, Oregon**

**Appendix B
Photographs of Fourth and Yamhill Smart Park**



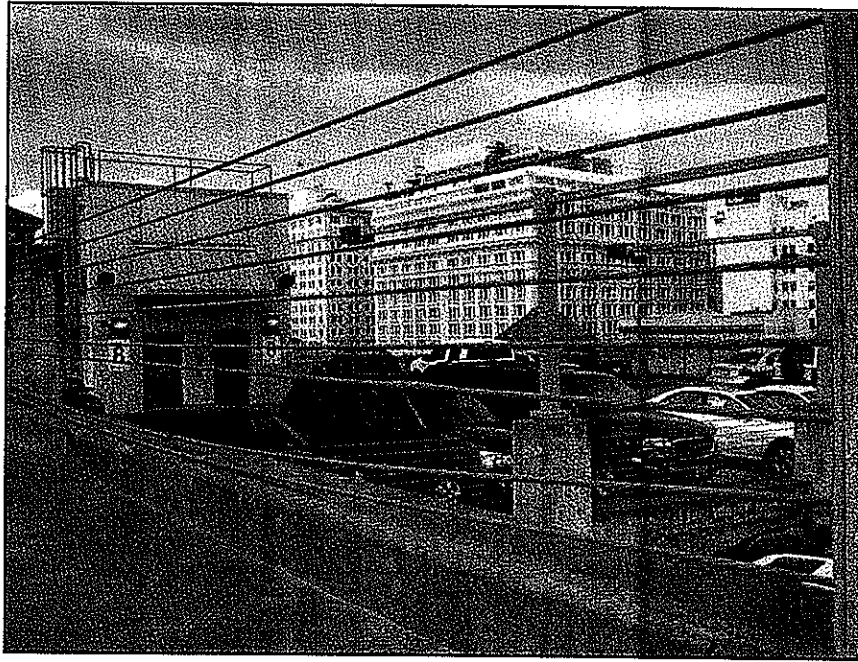


Photo 12 - Loose guard cables



Photo 13 - Rebar exposure

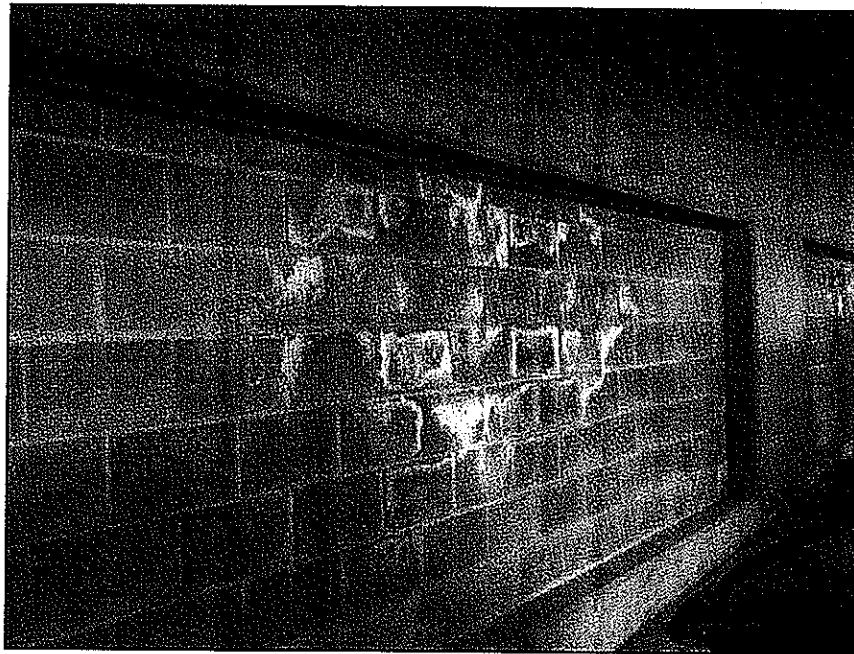


Photo 14 - Efflorescence mineral deposits



Photo 15 - Mineral buildup and leaking

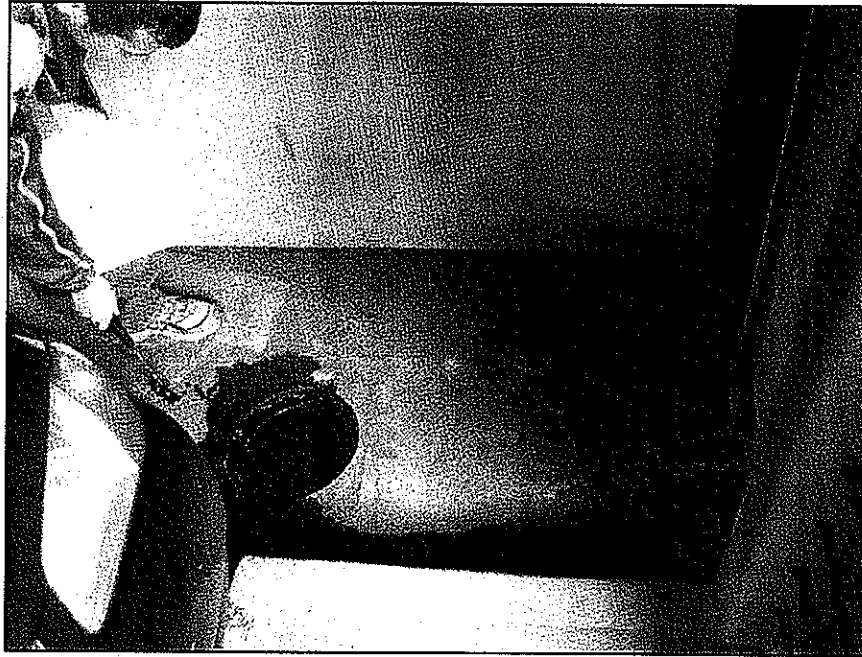


Photo 16 - Clogged storm drain

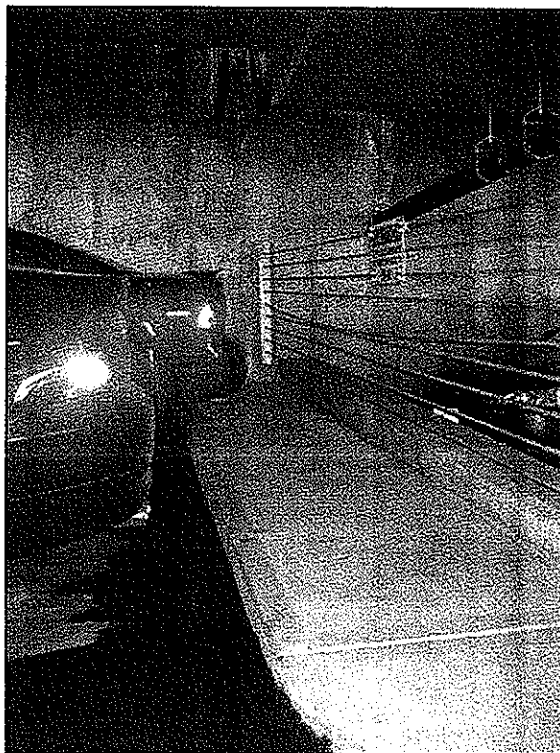


Photo 17 - Water ponding and intrusion; Loose guard cables

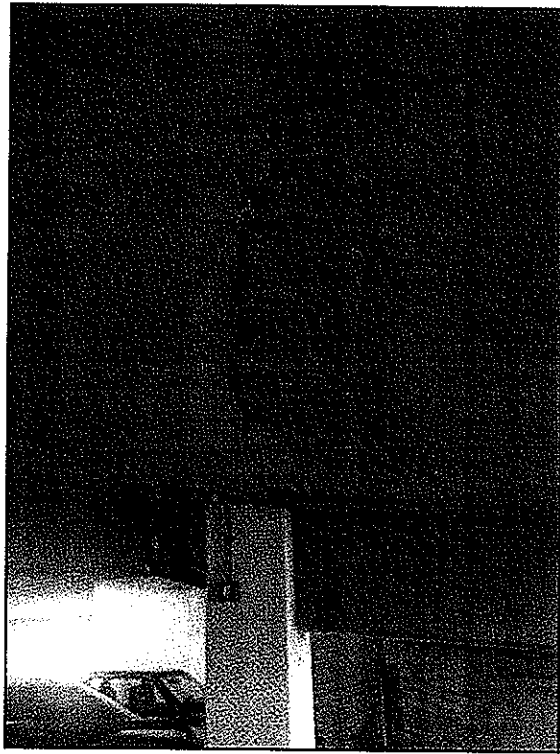


Photo 18 - Water Intrusion

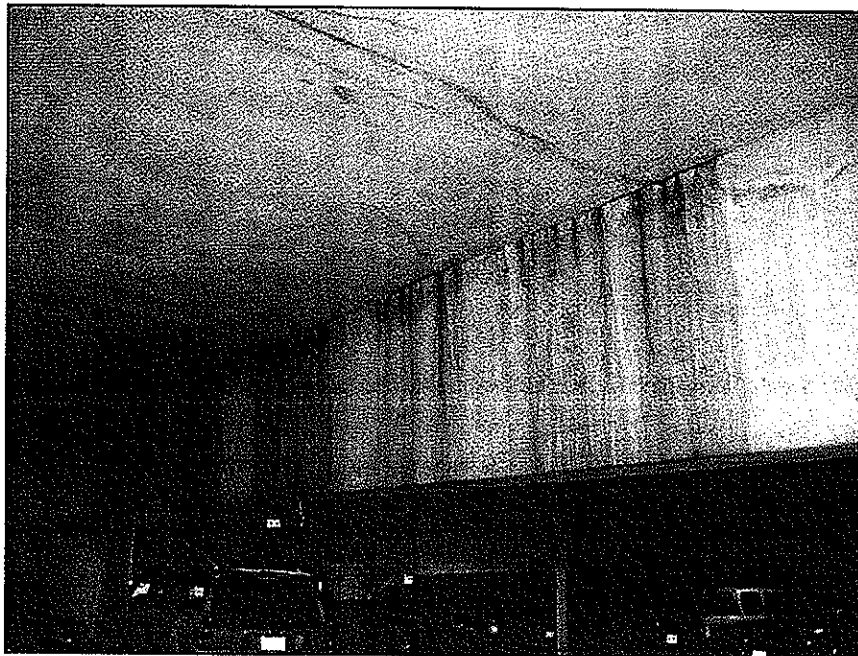


Photo 19 - Water Intrusion

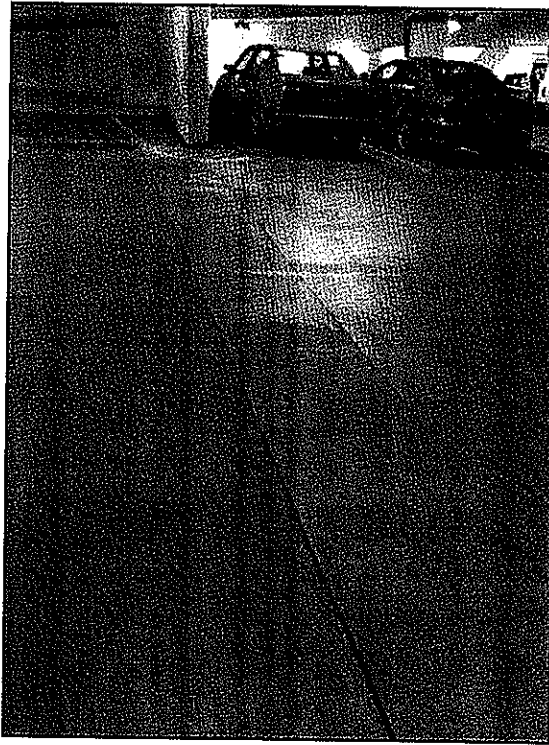


Photo 20 - Concrete slab closure pours

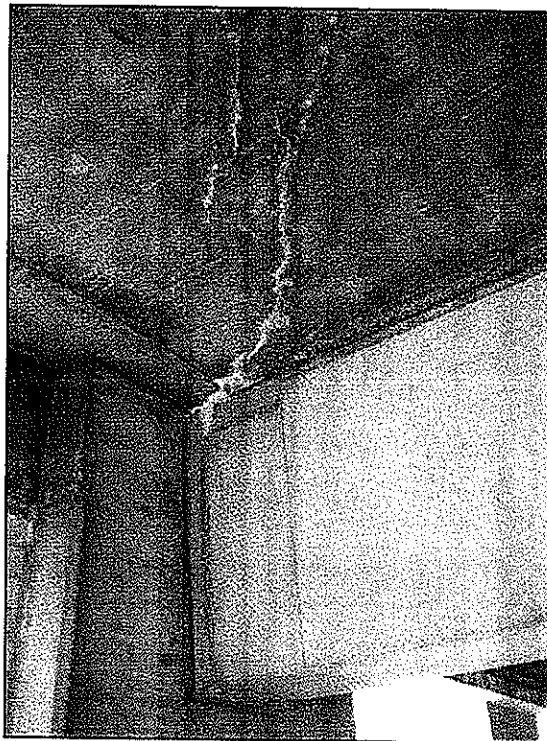


Photo 21 - Water and mineral intrusion

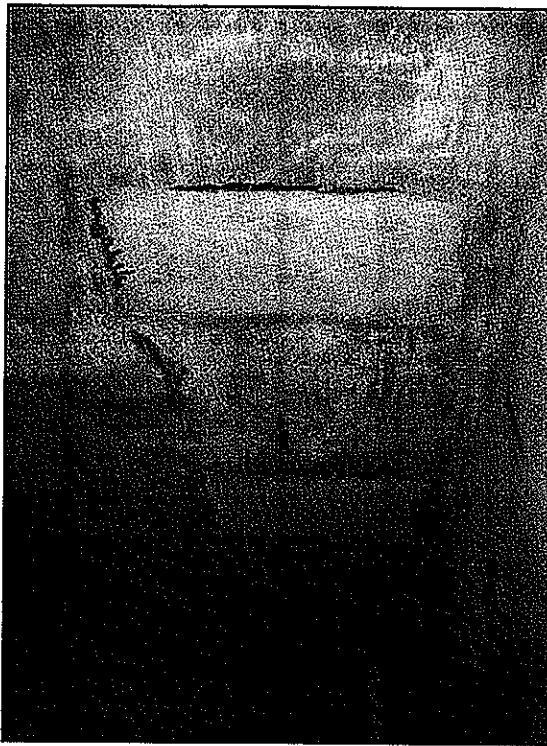


Photo 22 - Water Intrusion at concrete patch

**Structural Condition Final Assessment Report
Four Smart Park Garages
Portland, Oregon**

**Appendix C
Photographs of First and Jefferson Smart Park**



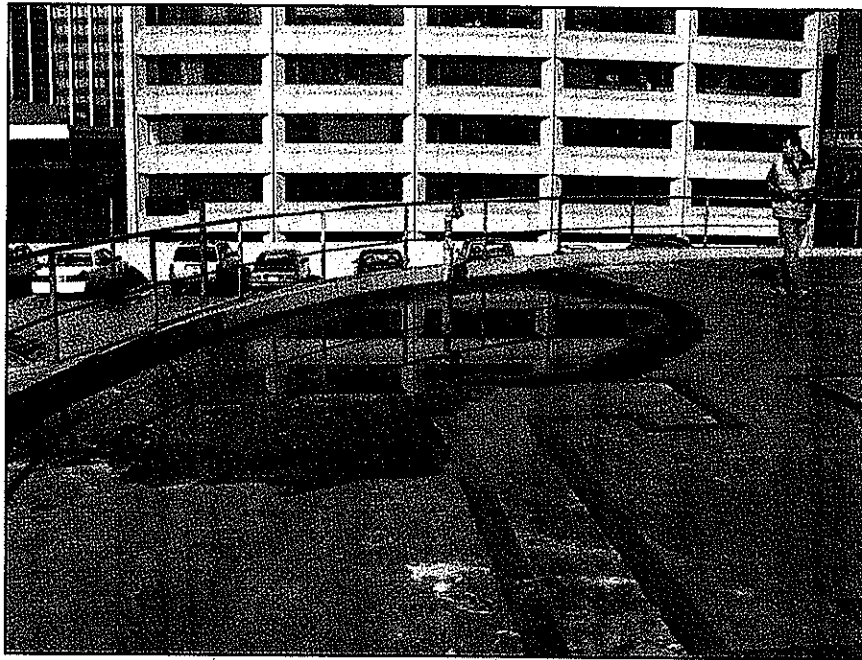


Photo 23 - Isolated water ponding

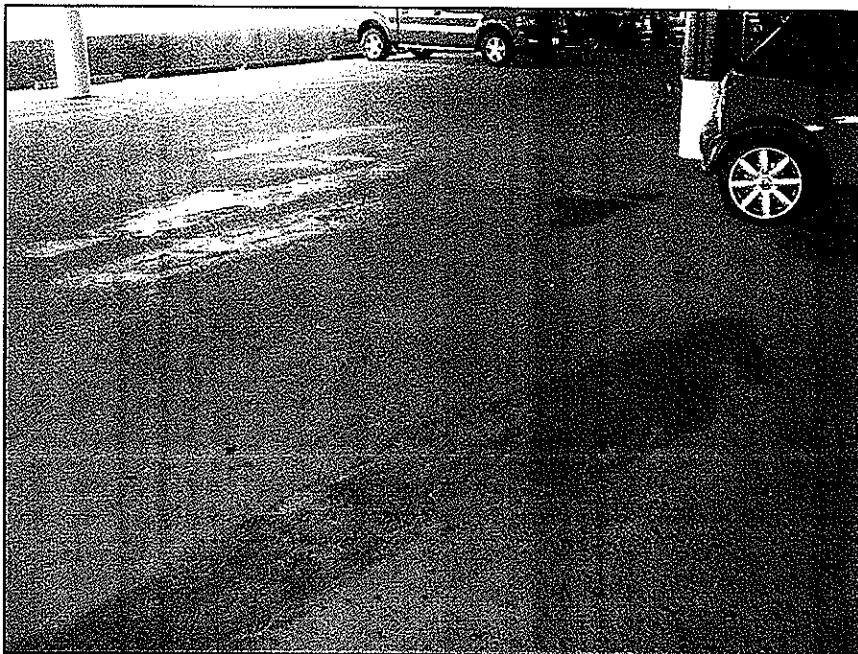


Photo 24 - Cracking and patching of concrete slab

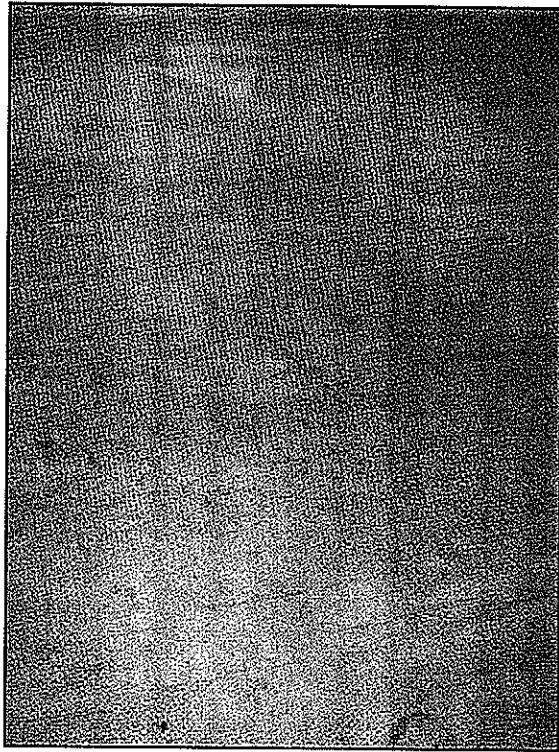


Photo 25 – Negative bending moment cracking of concrete slab

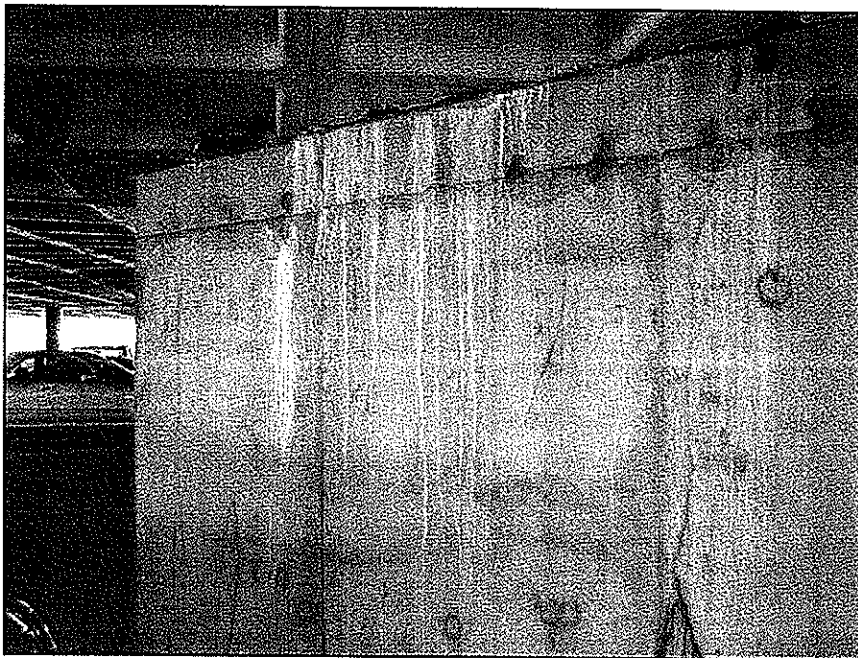


Photo 26 - Water intrusion

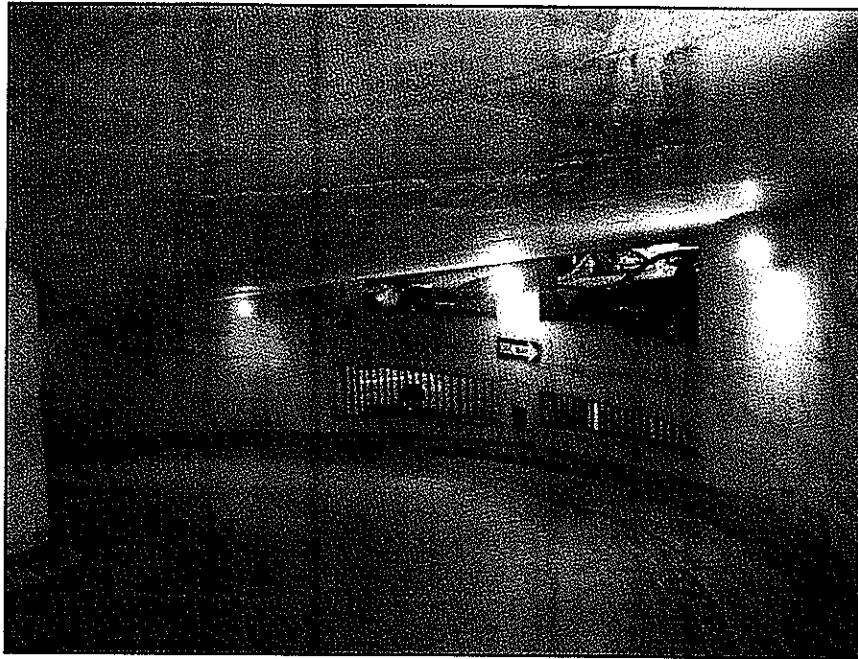


Photo 27 - Water intrusion

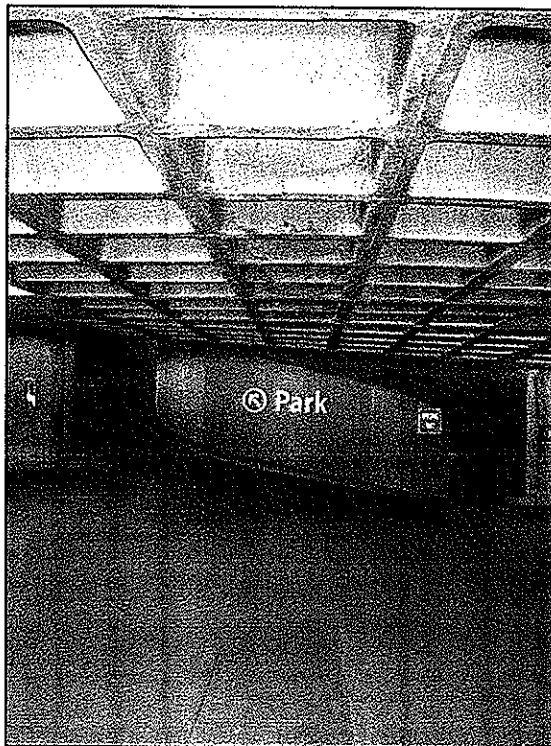


Photo 28 - Concrete slab closure pour

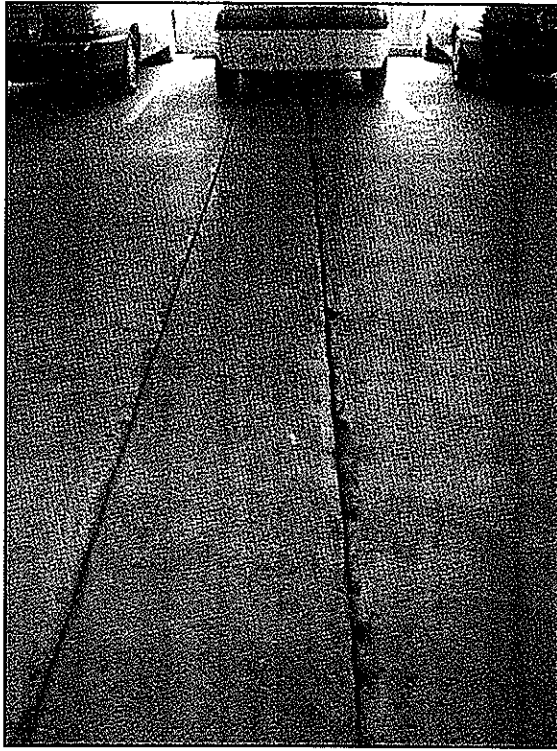


Photo 29 - Concrete slab closure pour with spalling

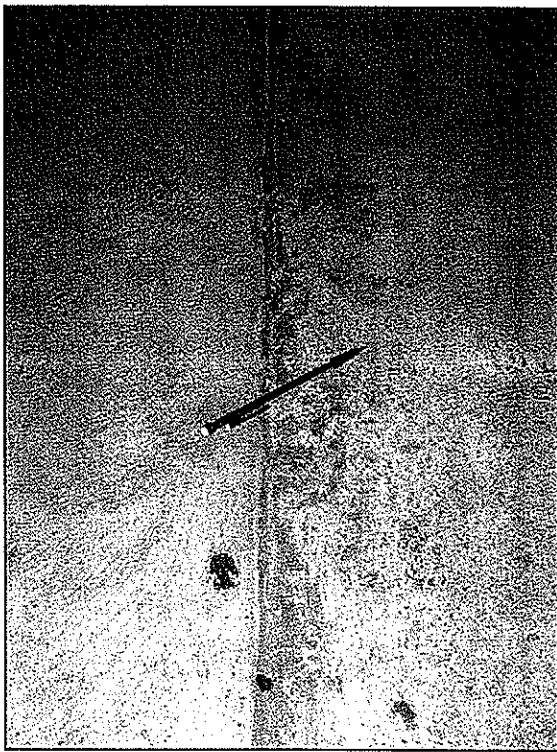


Photo 30 - Concrete spalling

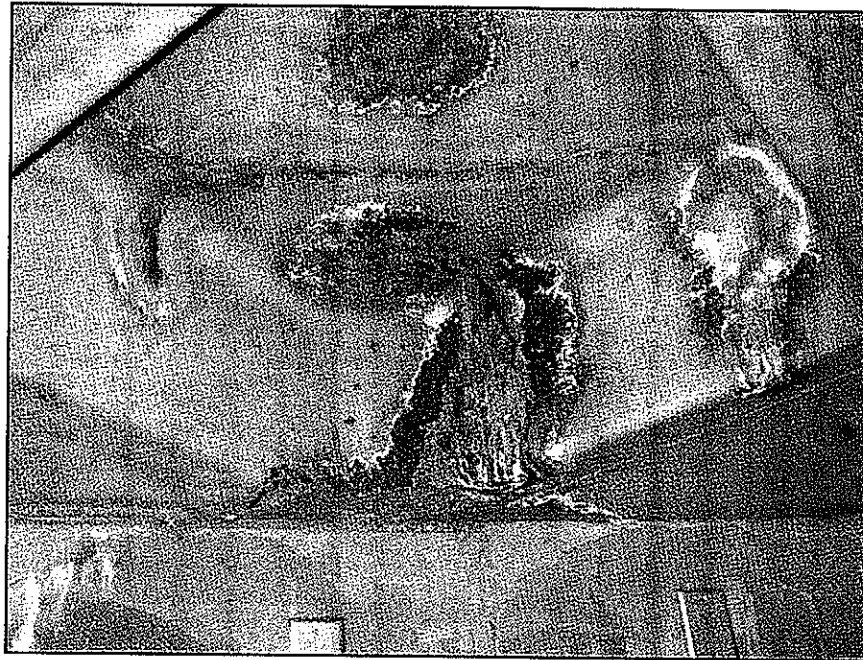


Photo 31 - Concrete cracking with water intrusion



Photo 32 - Rebar exposure

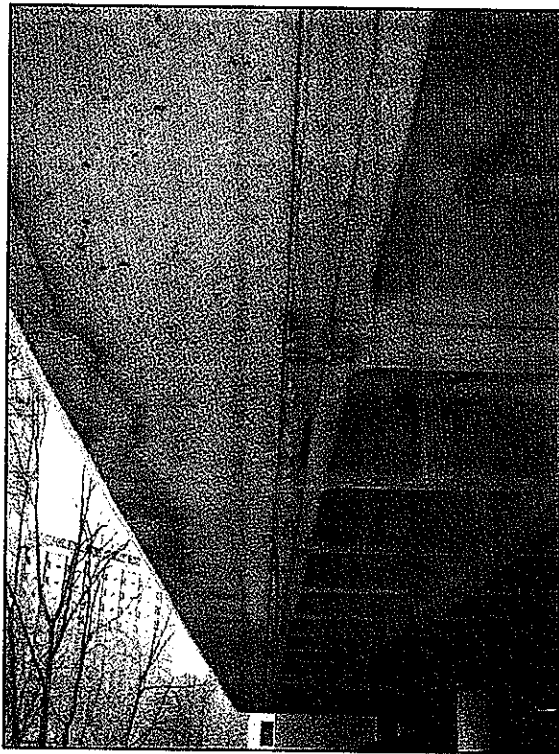


Photo 33 - Rebar exposure

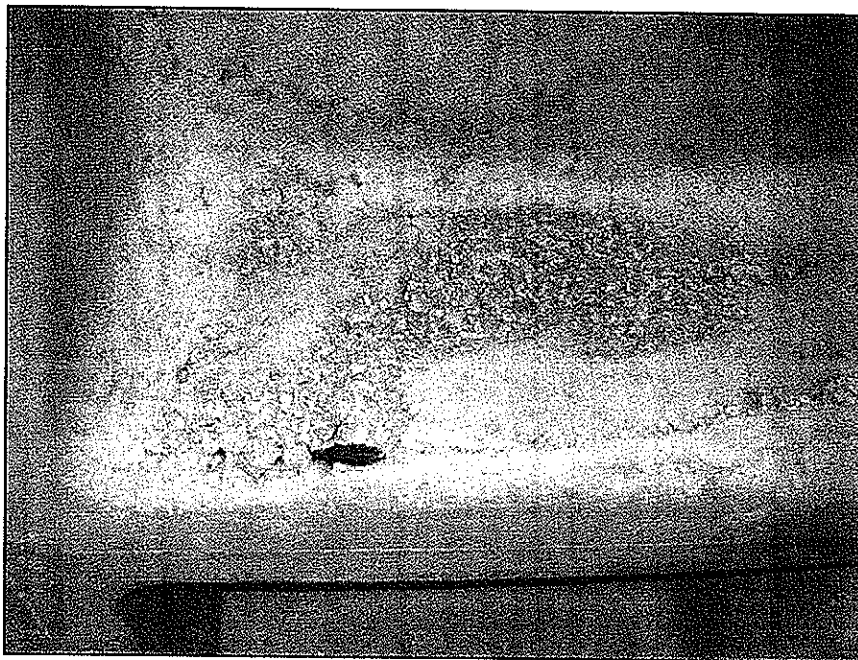


Photo 34 - Concrete deterioration with rebar exposure at "rock pocket"



Photo 35 - Concrete delamination with rebar exposure

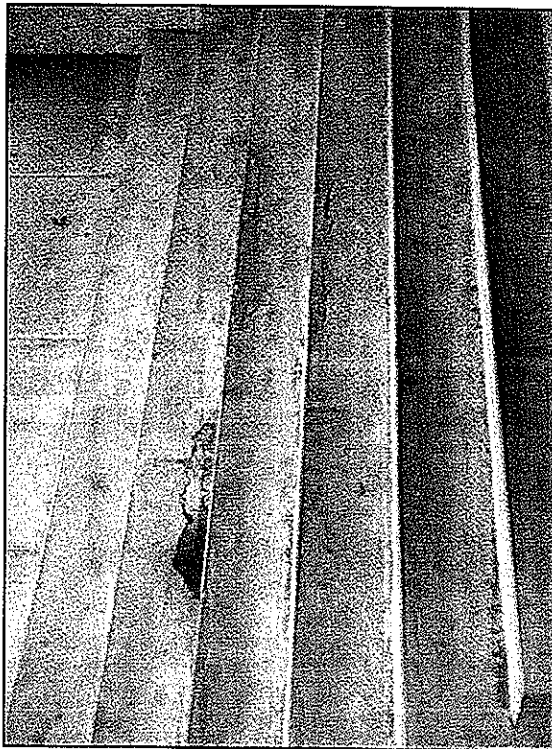


Photo 36 - Concrete stairway cracking

**Structural Condition Final Assessment Report
Four Smart Park Garages
Portland, Oregon**

**Appendix D
Photographs of Naito and Davis Smart Park**



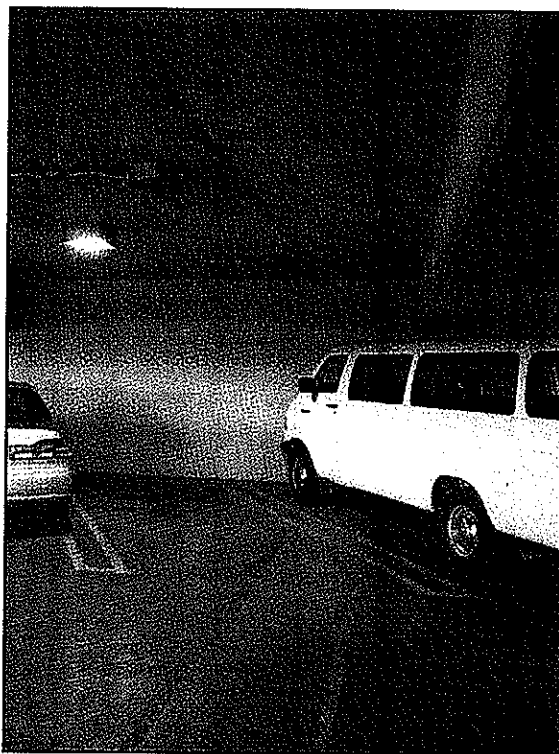


Photo 37 - Concrete slab closure pour and water intrusion

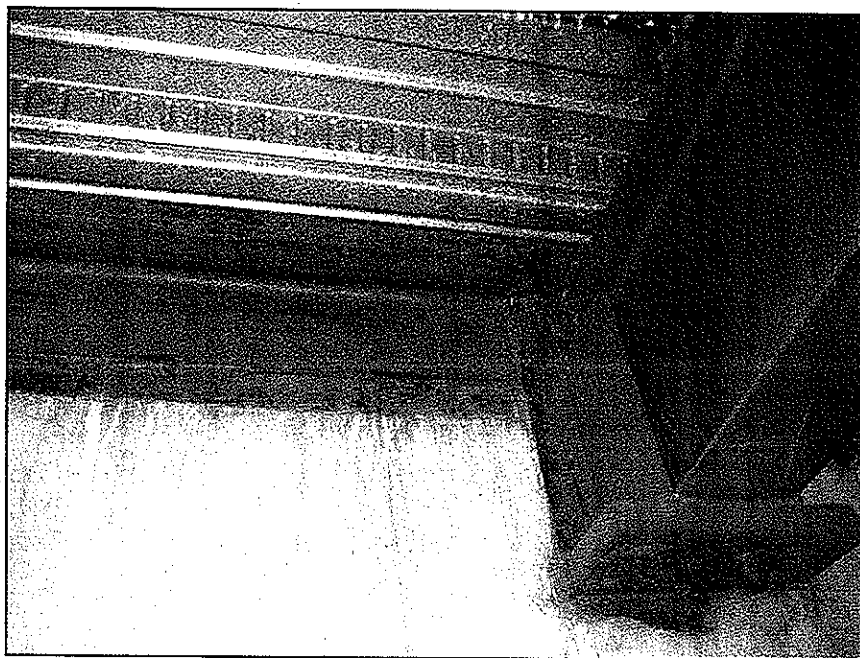


Photo 38 - Steel beam corrosion

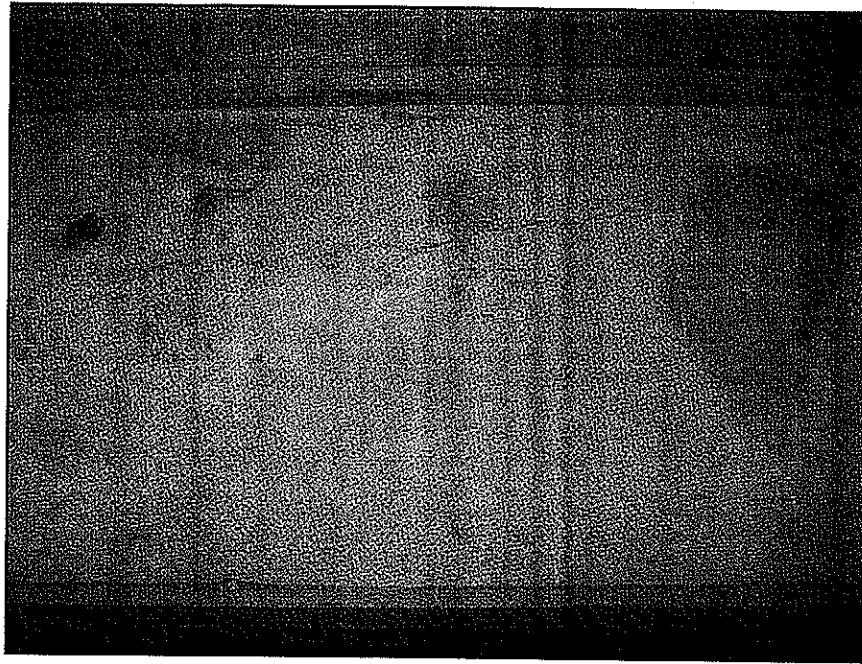


Photo 39 - Concrete beam cracking

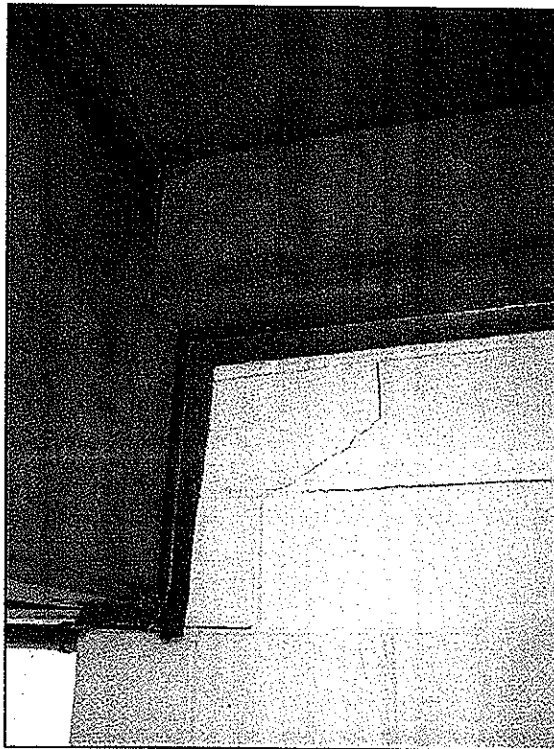


Photo 40 - Masonry cracking

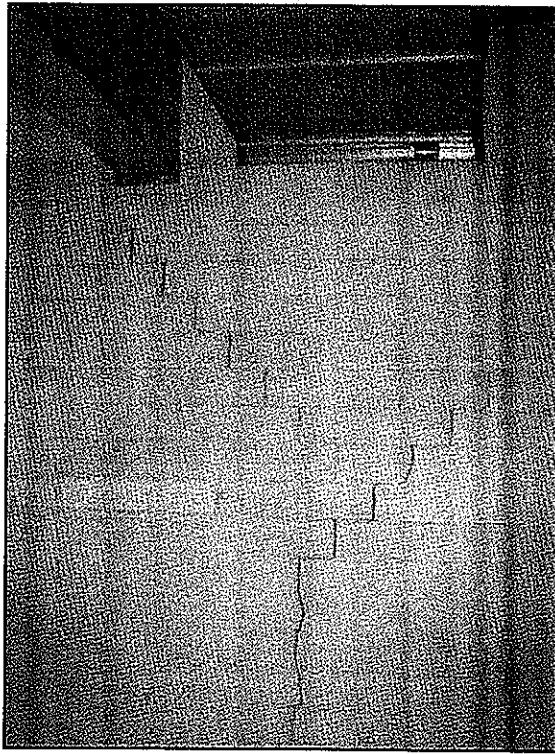


Photo 41 - Masonry cracking

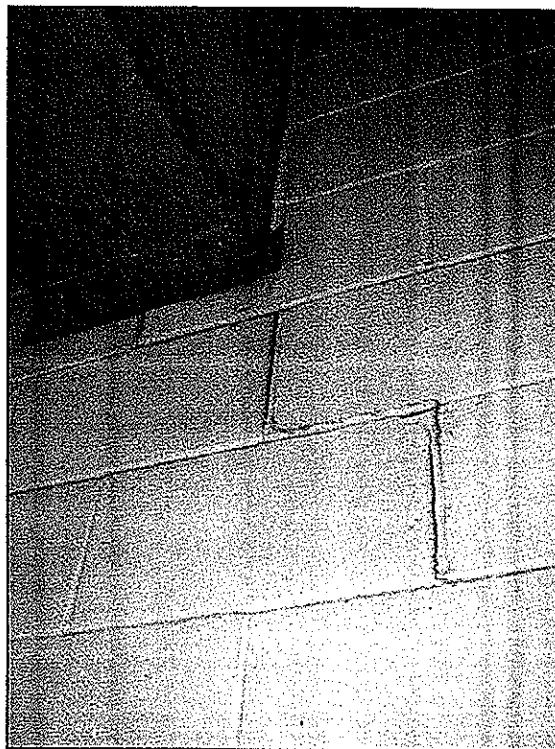


Photo 42 - Masonry cracking

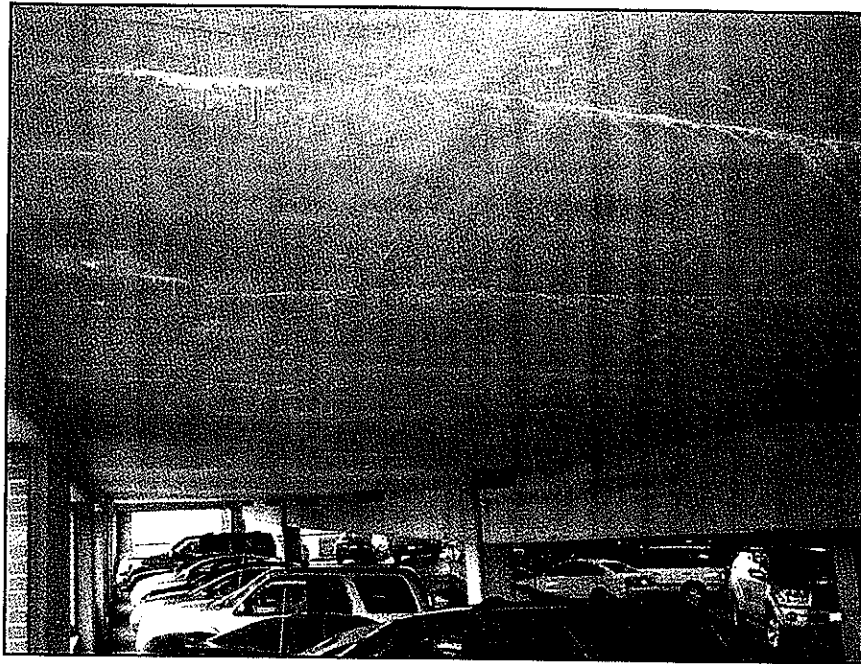


Photo 43 - Concrete cracking



Photo 44 - Concrete joint sealant deterioration

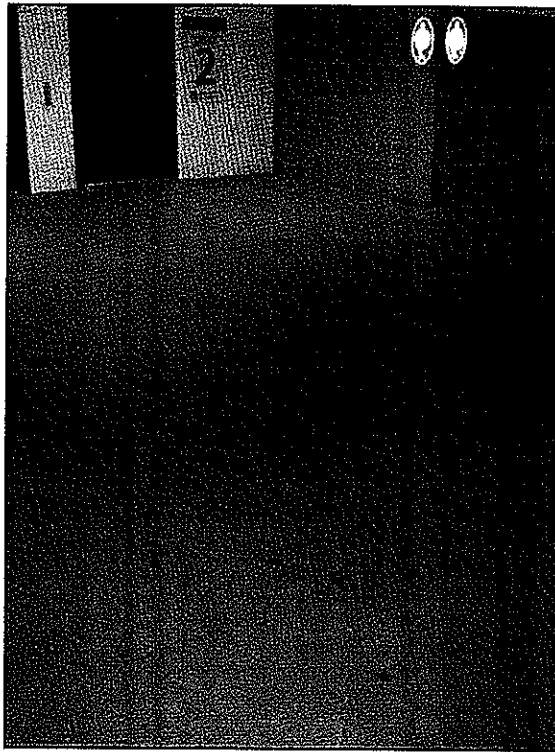


Photo 45 - Concrete slab cracking

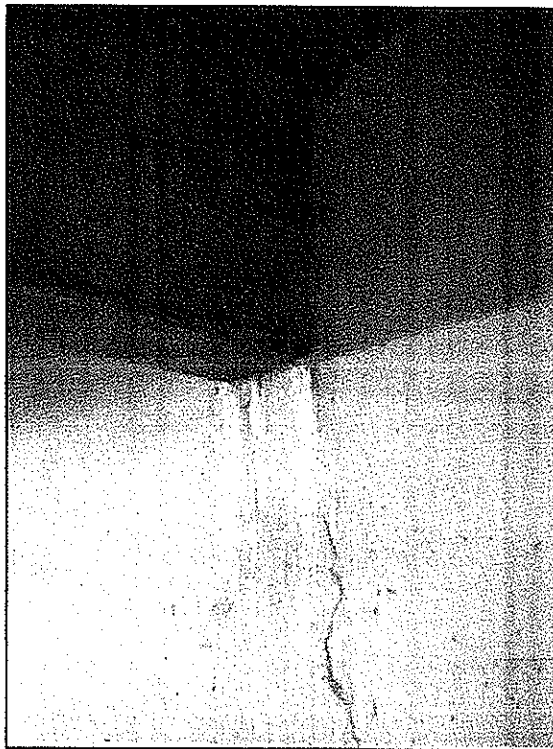


Photo 46 - Water intrusion at beam-wall connection (wall cracking)

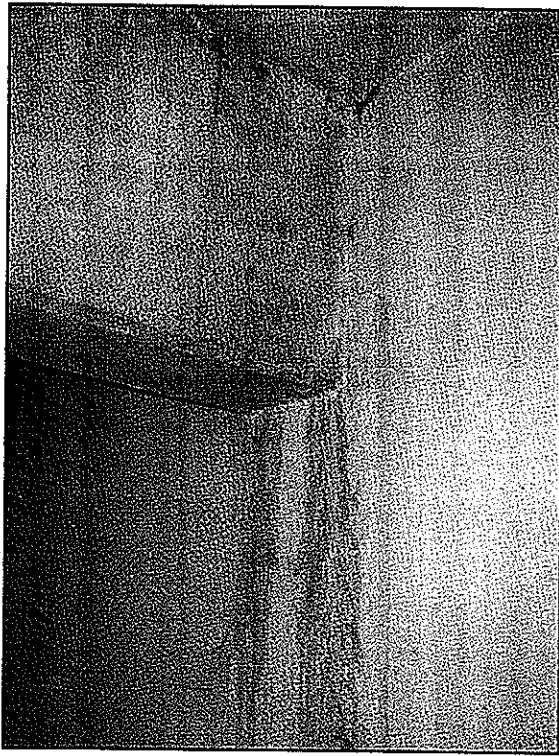


Photo 47 - Water intrusion at beam-wall connection (wall cracking)



Photo 48 - Negative bending moment cracking of concrete slab

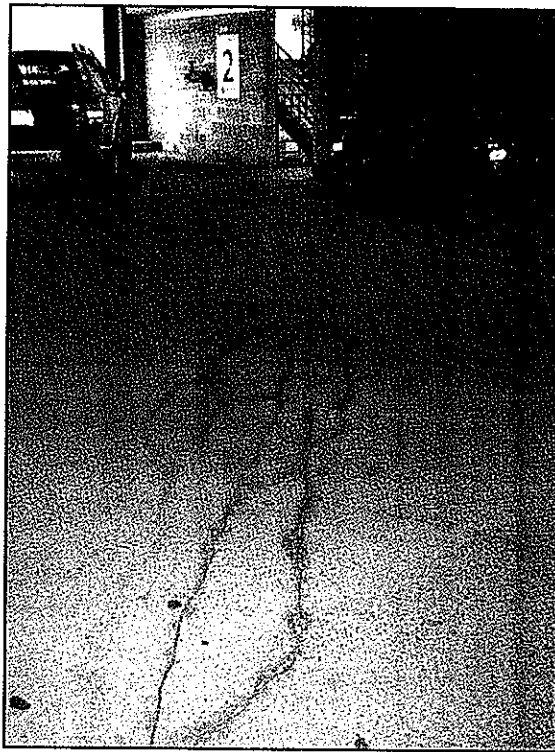


Photo 49 - Concrete slab cracking



Photo 50 - Rebar exposure

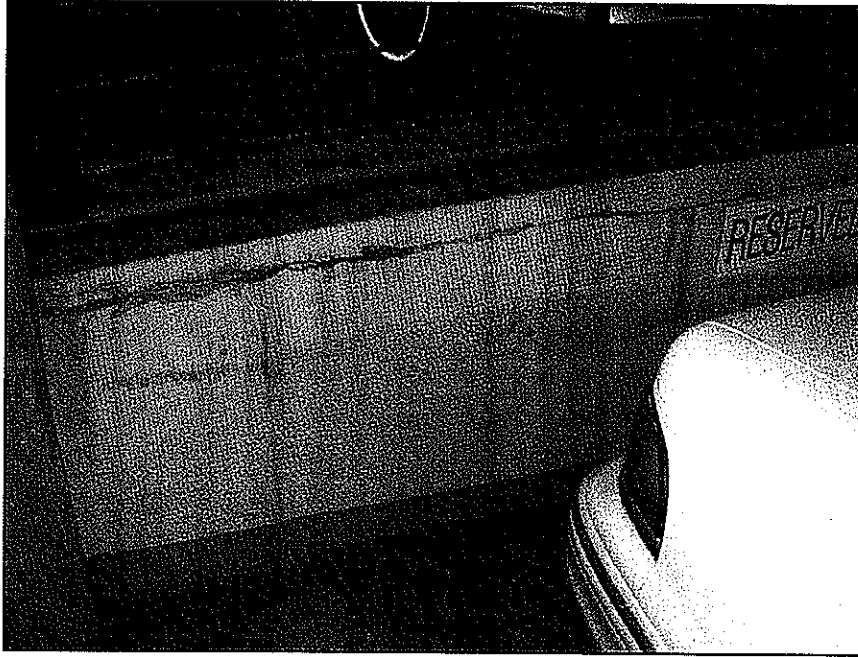


Photo 51 - Concrete top slab cracking



Photo 52 - Concrete sidewalk cracking

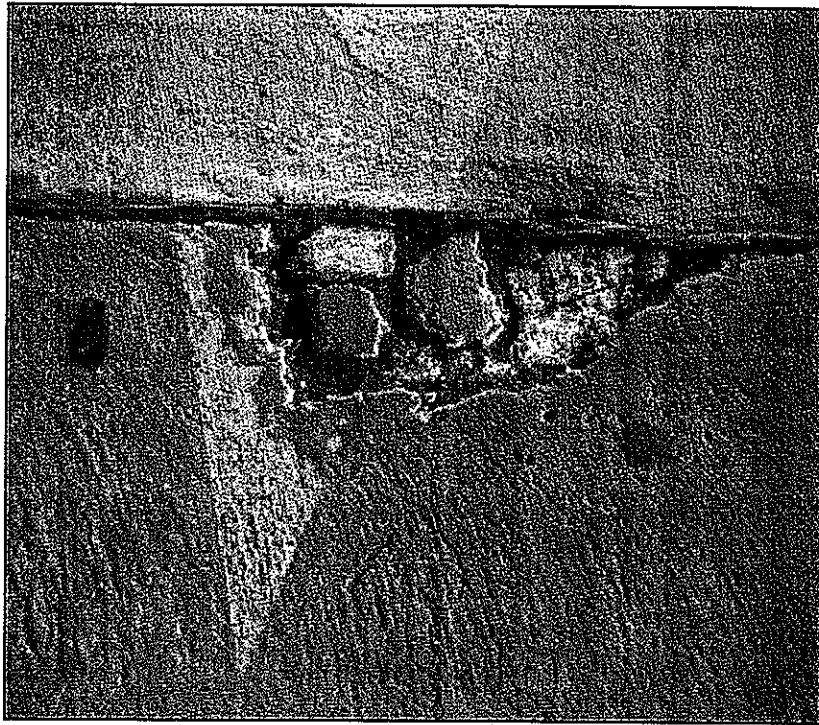


Photo 53 - Concrete spalling

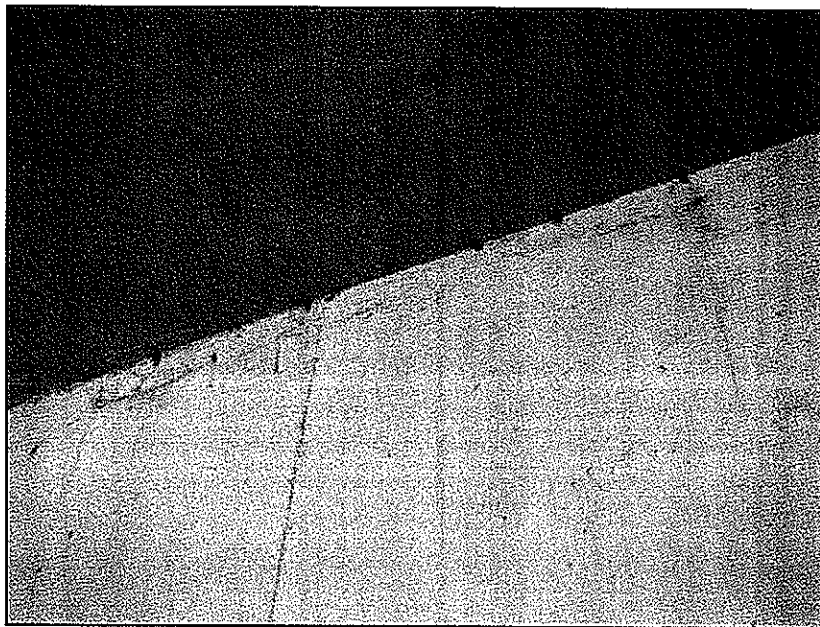


Photo 54 - Rebar exposure

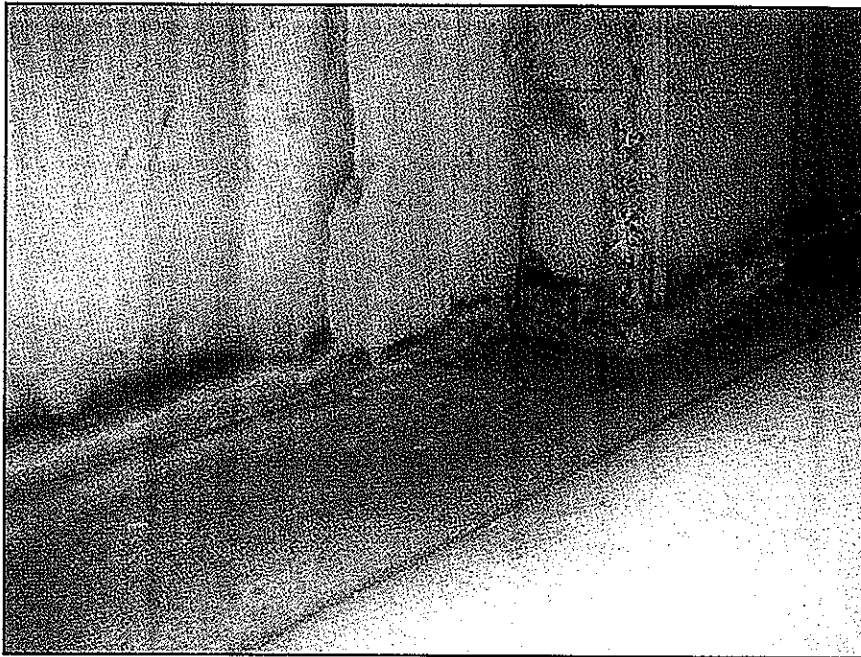


Photo 55 - Concrete deterioration

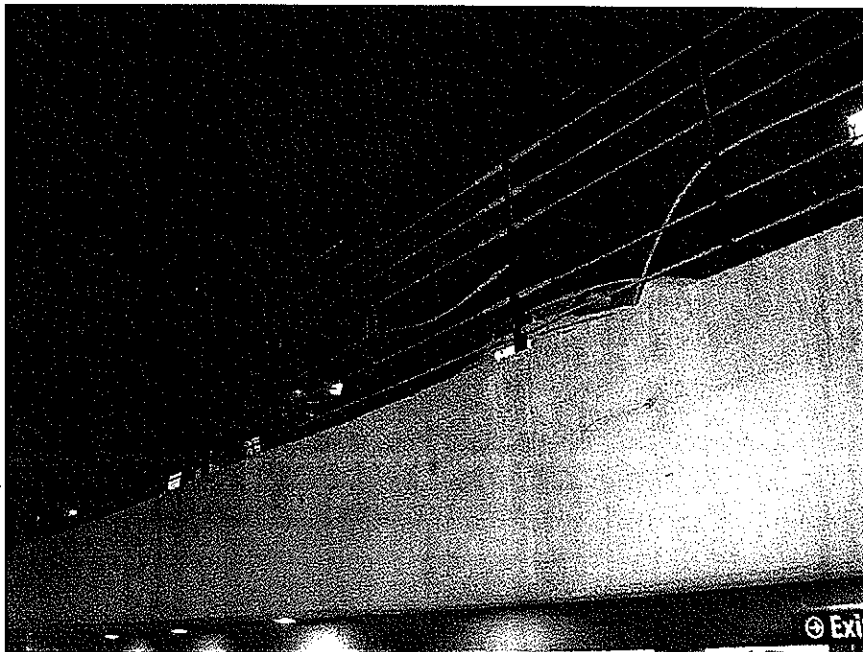


Photo 56 - Loose guard cables

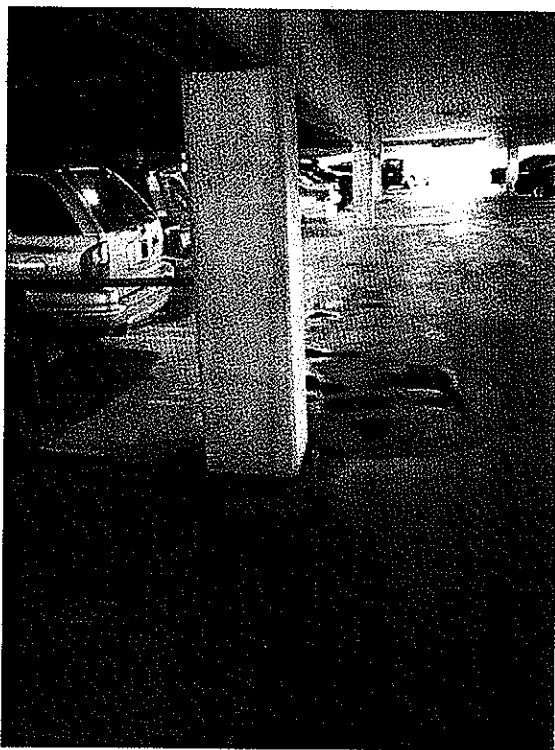


Photo 57 - Isolated ponding



Photo 58 - Cracked brick veneer

**Structural Condition Final Assessment Report
Four Smart Park Garages
Portland, Oregon**

**Appendix E
Rehabilitation Cost Estimates**

BERGER/ABAM ENGINEERS INC.

REHABILITATION COST ESTIMATE

CLIENT City of Portland - Office of Management and Finance		DATE: 5/29/2008		ABAM PROJECT NO.: PAPOR-04-112	
PROJECT TITLE 3rd & Alder Smart Park (Structural Rehabilitation Cost Estimate)		ESTIMATED BY: JRB		DESIGN STATUS: Final	
DESCRIPTION (Prioritized from high severity to low severity within individual floors)		QUANTITY		ESTIMATE	
		QTY	UNIT	UNIT COST	TOTAL
10th Floor / Top of Garage					
1	Water intrusion @ concrete expansion pour joints - Apply joint sealant	440	LF	\$12	\$5,280
2	Water intrusion @ concrete expansion pour joints - Apply impervious membrane	1100	SF	\$8	\$8,800
3	Concrete column delamination - Remove, clean, and apply rebar coating and epoxy concrete or mortar	40	SF	\$200	\$8,000
4	Concrete slab delamination - Remove, clean, and apply rebar coating and epoxy concrete or mortar	25	SF	\$200	\$5,000
5	Top Deck Vehicular Waterproofing	40000	SF	\$7	\$280,000
6	Exposed Rebar - Remove rust, coat, & apply cement mortar	50	SF	\$65	\$3,250
7	Deteriorating traffic striping - Repaint striping (after application of membrane)	1800	LF	\$0.41	\$738
SUB-TOTAL					
					\$311,068
9th Floor					
8	Water intrusion @ concrete expansion pour joints - Apply joint sealant	440	LF	\$12	\$5,280
9	Water intrusion @ concrete expansion pour joints - Apply impervious membrane	1100	SF	\$8	\$8,800
10	Concrete slab delamination - Remove, clean, and apply rebar coating and epoxy concrete or mortar	180	SF	\$200	\$36,000
11	Ceiling concrete pop-outs - Apply damp pack mortar	60	SF	\$35	\$2,100
12	Exposed Rebar - Remove rust, coat, & apply cement mortar	60	SF	\$65	\$3,900
13	Concrete slab cracks - Apply resinous crack healing	125	SF	\$8	\$1,000
14	Ceiling cracking - Clean & inject epoxy	200	LF	\$10	\$2,000
15	Deteriorating traffic striping - Repaint striping (after application of membrane)	1560	LF	\$0.41	\$640
SUB-TOTAL					
					\$59,720
8th Floor					
16	Water intrusion @ concrete expansion pour joints - Apply joint sealant	440	LF	\$12	\$5,280
17	Water intrusion @ concrete expansion pour joints - Apply impervious membrane	1100	SF	\$8	\$8,800
18	Concrete slab delamination - Remove, clean, and apply rebar coating and epoxy concrete or mortar	170	SF	\$200	\$34,000
19	Exposed Rebar - Remove rust, coat, & apply cement mortar	20	SF	\$65	\$1,300
20	Ceiling cracking - Clean & inject epoxy	200	LF	\$10	\$2,000
21	Deteriorating traffic striping - Repaint striping (after application of membrane)	1560	LF	\$0.41	\$640
SUB-TOTAL					
					\$52,020
7th Floor					
22	Water intrusion @ concrete expansion pour joints - Apply joint sealant	440	LF	\$12	\$5,280
23	Water intrusion @ concrete expansion pour joints - Apply impervious membrane	1100	SF	\$8	\$8,800
24	Concrete slab delamination - Remove, clean, and apply rebar coating and epoxy concrete or mortar	140	SF	\$200	\$28,000
25	Leaking and leachate on 6th floor ceiling - Apply impervious membrane	3000	SF	\$8	\$24,000
26	Concrete column cracking - Inject epoxy bonded mortar	8	LF	\$65	\$520
27	Concrete slab cracks - Apply resinous crack healing	50	SF	\$8	\$400
28	Pop-outs - Apply damp pack mortar	10	SF	\$35	\$350
29	Deteriorating traffic striping - Repaint striping (after application of membrane)	1560	LF	\$0.41	\$640
SUB-TOTAL					
					\$67,990
6th Floor					
30	Water intrusion @ concrete expansion pour joints - Apply joint sealant	440	LF	\$12	\$5,280
31	Water intrusion @ concrete expansion pour joints - Apply impervious membrane	1100	SF	\$8	\$8,800
32	Concrete slab delamination - Remove, clean, and apply rebar coating and epoxy concrete or mortar	100	SF	\$200	\$20,000
33	Exposed Rebar - Remove rust, coat, & apply cement mortar	45	SF	\$65	\$2,925
34	Leaking and leachate through slab-wall connection at ceiling - Clean and inject epoxy	34	LF	\$64	\$2,176
35	Pop-outs - Apply damp pack mortar	20	SF	\$35	\$700
36	Deteriorating traffic striping - Repaint striping (after application of membrane)	1560	LF	\$0.41	\$640
SUB-TOTAL					
					\$40,521
5th Floor					
37	Water intrusion @ concrete expansion pour joints - Apply joint sealant	440	LF	\$12	\$5,280
38	Water intrusion @ concrete expansion pour joints - Apply impervious membrane	1100	SF	\$8	\$8,800
39	Concrete column delamination - Remove, clean, and apply rebar coating and epoxy concrete or mortar	15	SF	\$200	\$3,000
40	Concrete slab delamination - Remove, clean, and apply rebar coating and epoxy concrete or mortar	120	SF	\$200	\$24,000
41	Ceiling cracking - Clean & inject epoxy	60	LF	\$10	\$600
42	Foot print patch work - Grind and re-apply cementitious mortar	400	SF	\$14	\$5,600
43	Deteriorating traffic striping - Repaint striping (after application of membrane)	1560	LF	\$0.41	\$640
SUB-TOTAL					
					\$47,920
4th Floor					
44	Water intrusion @ concrete expansion pour joints - Apply joint sealant	440	LF	\$12	\$5,280
45	Water intrusion @ concrete expansion pour joints - Apply impervious membrane	1100	SF	\$8	\$8,800
46	Pop-outs - Apply damp pack mortar	5	SF	\$35	\$175
47	Deteriorating traffic striping - Repaint striping (after application of membrane)	1560	LF	\$0.41	\$640
SUB-TOTAL					
					\$14,895

CLIENT City of Portland - Office of Management and Finance		DATE: 5/29/2008		ABAM PROJECT NO.: PAPOR-04-112	
PROJECT TITLE 3rd & Alder Smart Park (Structural Rehabilitation Cost Estimate)		ESTIMATED BY: JRB		DESIGN STATUS: Final	
DESCRIPTION (Prioritized from high severity to low severity within Individual floors)		QUANTITY		ESTIMATE	
		QTY	UNIT	UNIT COST	TOTAL
3rd Floor					
48	Water intrusion @ concrete expansion pour joints - Apply joint sealant	440	LF	\$12	\$5,280
49	Water intrusion @ concrete expansion pour joints - Apply impervious membrane	1100	SF	\$8	\$8,800
50	Water intrusion @ concrete cracks - Apply impervious traffic wear membrane	22645	SF	\$4	\$90,580
51	Exposed Rebar - Remove rust, coat, & apply cement mortar	40	SF	\$65	\$2,600
52	Pop-outs - Apply damp pack mortar	60	SF	\$35	\$2,100
53	Ceiling cracking - Clean & Inject epoxy	40	LF	\$10	\$400
54	Concrete wall cracks - Inject epoxy	45	LF	\$10	\$450
55	Deteriorating traffic striping - Repaint striping (after application of membrane)	1560	LF	\$0.41	\$640
SUB-TOTAL					\$110,850
2nd Floor					
56	Water intrusion @ concrete cracks - Apply impervious traffic wear membrane	22645	SF	\$4	\$90,580
57	Poor ceiling patch work (exposed rebar) - Re-apply damp pack mortar or Inject epoxy mortar	35	SF	\$65	\$2,275
58	Concrete wall cracks - Inject epoxy	75	LF	\$10	\$750
59	Ceiling cracking - Clean & Inject epoxy	60	LF	\$10	\$600
60	Deteriorating traffic striping - Repaint striping (after application of membrane)	1560	LF	\$0.41	\$640
SUB-TOTAL					\$94,845
1st Floor					
61	Concrete wall cracks - Inject epoxy	60	LF	\$10	\$600
SUB-TOTAL					\$600
Entrance/Exit Ramp					
62	Water intrusion @ concrete joints - Apply joint sealant	450	LF	\$12	\$5,400
63	Exit ramp delamination (even numbered floors) - Remove, clean, and apply rebar coating and epoxy concrete	240	SF	\$200	\$48,000
SUB-TOTAL					\$53,400
NOTE - Suggest city maintenance to clean & flush drainage system prior to rehabilitation					
Construction Sub-Total					\$853,826
Contractor Mobilization/Demobilization (2%)					\$17,077
Contingency (10%)					\$85,383
PROJECT TOTAL					\$956,285

BERGER/ABAM

ENGINEERS INC.

REHABILITATION COST ESTIMATE

CLIENT

City of Portland - Office of Management and Finance

DATE:
5/29/2008

ABAM PROJECT NO.:
PAPOR-04-112

PROJECT TITLE

4th & Yamhill Smart Park (Structural Rehabilitation Cost Estimate)

ESTIMATED BY:
JRB

DESIGN STATUS:
Final

DESCRIPTION

(Prioritized from high severity to low severity within individual floors)

QUANTITY

QTY UNIT

ESTIMATE

UNIT COST TOTAL

8th Floor / Top of Garage

1	Leaking and leachate around elevator - Clean & inject urethane	20	LF	\$64	\$1,280
2	Concrete slab delamination - Remove, clean, and apply rebar coating and epoxy concrete or mortar	30	SF	\$200	\$6,000
3	Water intrusion @ concrete expansion joints - Apply joint sealant	100	LF	\$12	\$1,200
4	Water ponding - Clean out / install additional weep holes (ramp down to 7th floor)	1	LS	\$1,000	\$1,000
5	Concrete column cracking - Inject epoxy bonded mortar	16	LF	\$65	\$1,040
6	Concrete slab patch work leakage - Apply impervious membrane	16	SF	\$50	\$800
7	Top deck vehicular waterproofing	28268	SF	\$7	\$197,876
8	Exposed rebar - Remove rust, coat, & apply cement mortar	24	SF	\$65	\$1,560
9	Loose cable barrier - Tighten cables	1	LS	\$500	\$500
10	Deteriorating traffic striping - Repaint striping (after application of membrane)	1590	LF	\$0.41	\$652
SUB-TOTAL					\$211,908

7th Floor

11	Water intrusion @ concrete expansion pour joints - Apply joint sealant	155	LF	\$12	\$1,860
12	Leaking and leachate - Clean & inject urethane	65	LF	\$44	\$2,860
13	Ceiling crack @ concrete expansion joint - route and install urethane	100	LF	\$10	\$1,000
14	Water ponding - Clean out / install additional weep holes	1	LS	\$1,000	\$1,000
15	Concrete slab patch work leakage - Apply impervious membrane	64	SF	\$20	\$1,280
16	Loose cable barrier - Tighten cables	1	LS	\$500	\$500
17	Efflorescence mineral deposits - Remove & seal masonry	420	SF	\$6	\$2,520
SUB-TOTAL					\$11,020

6th Floor

18	Water intrusion @ concrete expansion pour joints - Apply joint sealant	382	LF	\$12	\$4,584
19	Leaking and leachate from 6th to 5th floor - Apply impervious traffic membrane	25656	SF	\$8	\$205,248
20	Leaking and leachate through slab-wall connection - Clean & inject urethane	240	LF	\$64	\$15,360
21	Ceiling cracking - Clean & inject epoxy	220	LF	\$10	\$2,200
22	Water ponding - Clean out / install additional weep holes	1	LS	\$1,000	\$1,000
23	Concrete slab patch work leakage - Apply impervious membrane	64	SF	\$20	\$1,280
24	Exposed rebar - Remove rust, coat, & apply cement mortar	25	SF	\$65	\$1,625
25	Loose cable barrier - Tighten cables	1	LS	\$500	\$500
26	Deteriorating traffic striping - Repaint striping (after application of membrane)	657	LF	\$0.41	\$269
SUB-TOTAL					\$232,066

5th Floor

27	Water intrusion @ concrete expansion pour joints - Apply joint sealant	382	LF	\$12	\$4,584
28	Leaking and leachate - Clean & inject epoxy	211	LF	\$44	\$9,284
29	Water ponding - Clean out / install additional weep holes	1	LS	\$1,000	\$1,000
30	Concrete slab patch work leakage - Apply impervious membrane	64	SF	\$20	\$1,280
31	Efflorescence mineral deposits - Remove & seal masonry	1200	SF	\$6	\$7,200
SUB-TOTAL					\$23,348

4th Floor

32	Water intrusion @ concrete expansion pour joints - Apply joint sealant	110	LF	\$12	\$1,320
33	Water ponding - Clean out / install additional weep holes	1	LS	\$1,000	\$1,000
34	Concrete slab patch work leakage - Apply impervious membrane	64	SF	\$20	\$1,280
SUB-TOTAL					\$3,600

3rd Floor

35	Water Ponding - Clean out / install additional weep holes	1	LS	\$1,000	\$1,000
36	Concrete slab patch work leakage - Apply impervious membrane	64	SF	\$20	\$1,280
SUB-TOTAL					\$2,280

2nd Floor

No work required					
SUB-TOTAL					\$0-

1st Floor Entrance/Exit Ramp

37	Leaking and leachate from 1st to underground floors - Apply impervious traffic membrane	41250	SF	\$8	\$330,000
38	Deteriorating traffic striping - Repaint striping (after application of membrane)	450	LF	\$0.41	\$185
SUB-TOTAL					\$330,185

Miscellaneous

39	Water intrusion into wall causing efflorescence - Apply waterproof joint between garage and bldg. to south	191	LF	\$12	\$2,292
SUB-TOTAL					\$2,292

NOTE - Suggest city maintenance to clean & flush drainage system prior to rehabilitation

**NOTE - Approval from adjacent building owner required

Construction Sub-Total

\$816,699

Contractor Mobilization/Demobilization (2%)

\$16,334

Contingency (10%)

\$81,670

PROJECT TOTAL

\$914,703

BERGER/ABAM ENGINEERS INC.

REHABILITATION COST ESTIMATE

CLIENT

City of Portland - Office of Management and Finance

DATE:
5/29/2008

ABAM PROJECT NO.:
PAPOR-04-112

PROJECT TITLE

1st & Jefferson Smart Park (Structural Rehabilitation Cost Estimate)

ESTIMATED BY:
JRB

DESIGN STATUS:
Final

DESCRIPTION

(Prioritized from high severity to low severity within individual floors)

QUANTITY

QTY UNIT

ESTIMATE

UNIT COST TOTAL

9th Floor / Top of Garage

1	Ponding on hellpad - Apply Impervious membrane	2463	SF	\$8	\$19,704
2	Deteriorating hellpad striping - Repaint striping (after application of membrane)	112	LF	\$0.41	\$46
SUB-TOTAL					\$19,750

8th Floor

3	Water intrusion @ concrete expansion pour joints - Apply joint sealant	400	LF	\$12	\$4,800
4	Water intrusion @ concrete expansion pour joints - Apply Impervious traffic membrane	1000	SF	\$8	\$8,000
5	Exposed rebar - Remove rust, coat, & apply cement mortar	20	SF	\$65	\$1,300
6	Leaking and leachate through slab-wall connection & ceiling - Clean & Inject epoxy	220	LF	\$64	\$14,080
7	Negative bending moment slab cracking - Apply resinous crack healing	1200	SF	\$8	\$9,600
8	Pop-outs & cracks - Apply damp pack mortar	320	SF	\$35	\$11,200
9	Deteriorating traffic striping - Repaint striping (after application of membrane)	1860	LF	\$0.41	\$763
SUB-TOTAL					\$49,743

7th Floor

10	Water intrusion @ concrete expansion pour joints - Apply joint sealant	400	LF	\$12	\$4,800
11	Water intrusion @ concrete expansion pour joints - Apply Impervious traffic membrane	1000	SF	\$8	\$8,000
12	Exposed rebar - Remove rust, coat, & apply cement mortar	40	SF	\$65	\$2,600
13	Leaking and leachate through slab-wall connection & ceiling - Clean & Inject epoxy	50	LF	\$64	\$3,200
14	Negative bending moment slab cracking - Apply resinous crack healing	1200	SF	\$8	\$9,600
15	Pop-outs & cracks - Apply damp pack mortar	320	SF	\$35	\$11,200
16	Deteriorating traffic striping - Repaint striping (after application of membrane)	1860	LF	\$0.41	\$763
SUB-TOTAL					\$40,163

6th Floor

17	NO ACCESS ALLOWED - ASSUMED TO BE SIMILAR TO 7TH FLOOR				
SUB-TOTAL					\$40,163

5th Floor

18	NO ACCESS ALLOWED - ASSUMED TO BE SIMILAR TO 4TH FLOOR				
SUB-TOTAL					\$44,113

4th Floor

19	Water intrusion @ concrete expansion pour joints - Apply joint sealant	400	LF	\$12	\$4,800
20	Water intrusion @ concrete expansion pour joints - Apply Impervious traffic membrane	1000	SF	\$8	\$8,000
21	Exposed rebar - Remove rust, coat, & apply cement mortar	150	SF	\$65	\$9,750
22	Negative bending moment slab cracking - Apply resinous crack healing	1200	SF	\$8	\$9,600
23	Pop-outs & cracks - Apply damp pack mortar	320	SF	\$35	\$11,200
24	Deteriorating traffic striping - Repaint striping (after application of membrane)	1860	LF	\$0.41	\$763
SUB-TOTAL					\$44,113

3rd Floor

25	Water intrusion @ concrete expansion pour joints - Apply joint sealant	400	LF	\$12	\$4,800
26	Water intrusion @ concrete expansion pour joints - Apply Impervious traffic membrane	1000	SF	\$8	\$8,000
27	Exposed rebar - Remove rust, coat, & apply cement mortar	130	SF	\$65	\$8,450
28	Negative bending moment slab cracking - Apply resinous crack healing	1260	SF	\$8	\$10,080
29	Pop-outs & cracks - Apply damp pack mortar	320	SF	\$35	\$11,200
30	Deteriorating traffic striping - Repaint striping (after application of membrane)	1860	LF	\$0.41	\$763
SUB-TOTAL					\$43,293

2nd Floor

31	Water intrusion @ concrete expansion pour joints - Apply joint sealant	400	LF	\$12	\$4,800
32	Water intrusion @ concrete expansion pour joints - Apply Impervious traffic membrane	1000	SF	\$8	\$8,000
33	Negative bending moment slab cracking - Apply resinous crack healing	1200	SF	\$8	\$9,600
34	Pop-outs & cracks - Apply damp pack mortar	320	SF	\$35	\$11,200
35	Deteriorating traffic striping - Repaint striping (after application of membrane)	1860	LF	\$0.41	\$763
SUB-TOTAL					\$34,363

1st Floor

SUB-TOTAL					\$0-
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Entrance/Exit Ramp

36	Water intrusion @ concrete joints - Apply joint sealant	288	LF	\$12	\$3,456
37	Concrete slab cracking - Apply polyurethane sealant	2592	LF	\$10	\$25,920
SUB-TOTAL					\$29,376

NOTE - Suggest city maintenance to clean & flush drainage system prior to rehabilitation

Construction Sub-Total	\$345,074
Contractor Mobilization/Demobilization (2%)	\$6,901
Contingency (10%)	\$34,507
PROJECT TOTAL	\$386,483

BERGER/ABAM ENGINEERS INC.

REHABILITATION COST ESTIMATE

CLIENT City of Portland - Office of Management and Finance		DATE: 5/29/2008		ABAM PROJECT NO.: PAPOR-04-112	
PROJECT TITLE Naito & Davis Smart Park (Structural Rehabilitation Cost Estimate)		ESTIMATED BY: JRB		DESIGN STATUS: Final	
DESCRIPTION (Prioritized from high severity to low severity within individual floors)		QUANTITY		ESTIMATE	
		QTY	UNIT	UNIT COST	TOTAL
5th Floor / Top of Garage (No access allowed; Assumptions based on observations from below)					
1	Stormwater ponding - Apply impervious membrane	20100	SF	\$8	\$160,800
2	Deteriorating helipad striping - Repaint striping (after application of membrane)	350	LF	\$0.41	\$144
	SUB-TOTAL				\$160,944
4th Floor					
3	Water intrusion @ concrete expansion pour joints - Apply joint sealant	215	LF	\$12	\$2,580
4	Water intrusion @ concrete expansion pour joints - Apply impervious membrane	534	SF	\$8	\$4,272
5	Steel corrosion - Rust Removal*	2220	SF	\$1	\$2,220
6	Steel corrosion - Repaint steel members*	2220	SF	\$1	\$2,220
7	Cracked brick veneer - replace cracked venner and pack mortar	350	SF	\$45	\$15,750
8	Beam/column cracking - Inject epoxy	80	LF	\$10	\$800
9	Water intrusion due to weather - Apply impervious membrane north/south sides where exposed	12000	SF	\$7	\$84,000
10	Leaking and leachate through slab-wall connection & ceiling - Clean & inject epoxy	80	LF	\$64	\$5,120
11	Exposed Rebar - Remove rust, coat, & apply cement mortar	5	SF	\$65	\$325
12	Concrete delamination (wall) - Remove and apply epoxy concrete or mortar	20	SF	\$200	\$4,000
13	Cracking of concrete block wall - Clean out and replace with epoxy mortar	30	SF	\$200	\$6,000
14	Loose/stretched cable barrier - Tighten cables	1	LS	\$1,000	\$1,000
15	Deteriorating traffic striping - Repaint striping (after application of membrane)	1000	LF	\$0.41	\$410
	SUB-TOTAL				\$128,697
3rd Floor					
16	Water intrusion @ concrete expansion pour joints - Apply joint sealant	215	LF	\$12	\$2,580
17	Water intrusion @ concrete expansion pour joints - Apply impervious membrane	534	SF	\$8	\$4,272
18	Steel corrosion - Repaint steel members*	2220	SF	\$1	\$2,220
19	Steel corrosion - Rust Removal*	2220	SF	\$1	\$2,220
20	Water intrusion due to weather - Apply impervious membrane north/south sides where exposed	10080	SF	\$7	\$70,560
21	Water intrusion @ outside columns - Apply joint epoxy sealant to column base	430	LF	\$12	\$5,160
22	Cracking of concrete block wall - Clean out and replace with epoxy mortar	80	SF	\$200	\$16,000
23	Deteriorating traffic striping - Repaint striping (after application of membrane)	720	LF	\$0.41	\$295
	SUB-TOTAL				\$103,307
2nd Floor					
24	Water intrusion @ concrete expansion pour joints - Apply joint sealant	215	LF	\$12	\$2,580
25	Water intrusion @ concrete expansion pour joints - Apply impervious membrane	534	SF	\$8	\$4,272
26	Steel corrosion - Repaint steel members*	2220	SF	\$1	\$2,220
27	Steel corrosion - Rust Removal*	2220	SF	\$1	\$2,220
28	Water intrusion due to weather - Apply impervious membrane north/south sides where exposed	10080	SF	\$4	\$40,320
29	Beam/column cracking - Inject epoxy	60	LF	\$45	\$2,700
30	Leaking and leachate through slab-wall connection & ceiling - Clean & inject epoxy	100	LF	\$64	\$6,400
31	Exposed Rebar - Remove rust, coat, & apply cement mortar	30	SF	\$65	\$1,950
32	Cracking of concrete block wall - Clean out and replace with epoxy mortar	260	SF	\$200	\$52,000
33	Cracking and seperation of concrete slab topping - Apply & inject epoxy mortar	60	SF	\$200	\$12,000
34	Negative bending moment slab cracking - Apply resinous crack healing	800	SF	\$8	\$6,400
35	Pop-outs & spalding - Apply damp pack mortar	25	SF	\$35	\$875
36	Deteriorating traffic striping - Repaint striping (after application of membrane)	720	LF	\$0.41	\$295
	SUB-TOTAL				\$134,232
1st Floor (Entrance)					
37	Pop-outs & spalding - Apply damp pack mortar	25	SF	\$35	\$875
38	Concrete sidewalk cracking - Inject epoxy	10	LF	\$10	\$100
	SUB-TOTAL				\$975
*NOTE - Excludes lead paint abatement					
NOTE - Suggest city maintenance to clean & flush drainage system prior to rehabilitation					
Construction Sub-Total					\$528,155
Contractor Mobilization/Demobilization (2%)					\$10,563
Contingency (10%)					\$52,815
PROJECT TOTAL					\$591,533