WALKER
PARKING CONSULTANTS

CAPITAL IMPROVEMENT &
PROTECTION PLAN

CITY OF TAMPA PARKING STRUCTURES

TAMPA, FLORIDA

Prepared for:
CITY OF TAMPA, FLORIDA
PARKING DIVISION
DEPARTMENT OF PUBLIC WORKS

PROJECT # 15-1340.40

FEBRUARY, 2006

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COMBINED STRUCTURES EXECUTIVE SUMMARY

Walker Parking Consultants has reviewed nine (9) parking structures for the City of Tampa, Florida Parking Division. These structures range in age from three years old (Palm Avenue) to forty-two years old (Whiting Street). The structures reviewed included:

- Fort Brooke Garage and vertical expansion
- Twiggs Street Garage
- South Regional Garage
- William Poe Garage
- Centro Ybor Garage
- Palm Avenue Garage
- Whiting Street Garage and horizontal expansion
- Police Headquarters Garage, and
- Convention Center Garage

These nine structures provide a combined total of over 9,000 parking spaces, or more than 3,370,000 square feet of parking, for downtown Tampa and Ybor City.

With the exception of the Twiggs Street and Whiting Street garages, the structures were found to be in generally good condition, with mostly maintenance-type repairs required. More extensive concrete, waterproofing, and mechanical/electrical repairs were identified at Twiggs and Whiting Street garages. Approximately ¾ of the identified costs are to address problems in these two structures in the first two years of the program.

Repair costs to address current conditions are anticipated at approximately $2,818,000. On a system-wide basis, this is approximately $305/space or $0.84/square foot. Overall system costs, including projected maintenance costs and escalated costs for deferred work over the next 10 years, are anticipated to be approximately $8,275,000 (in 2005 dollars). This equates to approximately $89/space/year, or $0.25/square foot/year.

We have provided an initial plan to accomplish current required repairs and expected future maintenance repairs while minimizing annual funding requirement fluctuations. Recognizing that the City of Tampa has its own priorities and funding constraints, we look forward to working with City representatives to tailor this program to your specific needs.

Annual repair costs are summarized, by structure and work type, in **Table CS - 1** below. Additional information, specific to each structure, is provided in the following Sections 1 – 9, and the Appendices.

TABLE CS-1
Combined Structures
Executive Summary

WALKER PARKING CONSULTANTS

Executive Summary by Work Description

NO.	WORK DESCRIPTION	CURRENT REPAIRS	10 YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Concrete Repairs	$ 393,500	$ 500,500	$ 163,500	$ 193,000	$ 24,500	$ 25,500	$ 12,500	$ 22,500	$ 12,000	$ 18,000	$ 29,000	$ -
2	Waterproofing	$ 931,500	$ 2,648,000	$ 390,000	$ 221,500	$ 209,500	$ 227,000	$ 194,500	$ 195,000	$ 432,000	$ 375,000	$ 288,000	$ 115,500
3	Stair/Elevator Tower Repair	$ 26,000	$ 92,500	$ 5,500	$ 19,500	$ 6,000	$ 12,500	$ 8,500	$ 23,500	$ 6,000	$ 2,500	$ 8,500	$ -
4	Mechanical/Electrical/Plumbing	$ 394,500	$ 1,053,500	$ 334,500	$ 135,500	$ 115,500	$ 13,500	$ 98,500	$ 112,000	$ 13,500	$ 84,500	$ 132,500	$ 13,500
5	Architectural/Miscellaneous	$ 88,500	$ 212,500	$ 16,500	$ 42,000	$ 6,000	$ 12,000	$ 29,000	$ 30,000	$ 5,000	$ 19,000	$ 43,000	$ 10,000
6	Enhancements	$ 352,500	$ 1,801,500	$ 260,500	$ -	$ -	$ 112,000	$ 20,000	$ 782,500	$ -	$ 136,500	$ -	$ 490,000
7	Contingency	$ 241,500	$ 738,500	$ 118,500	$ 74,000	$ 44,500	$ 49,000	$ 44,000	$ 140,500	$ 53,500	$ 77,500	$ 61,000	$ 76,000
8	General Conditions	$ 177,500	$ 516,000	$ 94,500	$ 50,000	$ 30,000	$ 33,000	$ 30,500	$ 94,000	$ 38,000	$ 52,500	$ 42,000	$ 51,500
9	Consulting & Engineering Fees	$ 210,000	$ 711,500	$ 87,000	$ 74,000	$ 44,500	$ 49,500	$ 44,000	$ 140,500	$ 56,500	$ 77,500	$ 61,500	$ 76,500
10	**Opinion of Combined Structures Annual Budget (2005 Dollars)**	**$ 2,818,000**	**$ 8,275,000**	**$ 1,470,500**	**$ 809,500**	**$ 480,500**	**$ 534,000**	**$ 481,500**	**$ 1,540,500**	**$ 616,500**	**$ 843,000**	**$ 665,500**	**$ 833,000**
11	**Opinion of Combined Structures Annual Budget (Adjusted Future Value - based on 3% discount rate)**		**$ 9,714,000**	**$ 1,514,800**	**$ 859,000**	**$ 525,300**	**$ 601,200**	**$ 558,400**	**$ 1,839,600**	**$ 758,400**	**$ 1,068,200**	**$ 868,700**	**$ 1,119,700**

Executive Summary by Structure Totals

NO.	STRUCTURE NAME	CURRENT REPAIRS	10 YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Fort Brooke Garage and Expansion	$ 130,000	$ 1,393,000	$ -	$ -	$ 337,000	$ -	$ -	$ 71,500	$ 412,000	$ 177,500	$ 241,500	$ 153,000
2	Twiggs Street Garage	$ 693,000	$ 2,033,000	$ -	$ 708,000	$ -	$ -	$ 22,000	$ 1,267,000	$ -	$ 22,000	$ -	$ 14,000
3	South Regional Garage	$ 200,000	$ 512,000	$ -	$ -	$ 54,500	$ 271,500	$ -	$ 54,500	$ -	$ 76,500	$ 54,500	$ -
4	William F. Poe Garage	$ 169,000	$ 1,147,000	$ 7,500	$ 27,500	$ -	$ 244,000	$ 27,500	$ -	$ -	$ 192,500	$ -	$ 647,500
5	Centro Ybor Garage	$ 102,000	$ 370,000	$ -	$ -	$ 69,500	$ -	$ -	$ 147,500	$ -	$ -	$ 153,000	$ -
6	Palm Avenue Garage	$ 53,000	$ 479,000	$ -	$ 36,500	$ 19,500	$ -	$ 251,500	$ -	$ -	$ 36,500	$ 135,000	$ -
7	Whiting Street Garage and Expansion	$ 1,428,000	$ 1,681,000	$ 1,427,500	$ -	$ -	$ 18,500	$ -	$ -	$ 204,500	$ -	$ 12,000	$ 18,500
8	Police Headquarters Garage	$ 28,000	$ 248,000	$ 35,500	$ -	$ -	$ -	$ 143,000	$ -	$ -	$ -	$ 69,500	$ -
9	Convention Center Garage	$ 15,000	$ 413,000	$ -	$ 37,500	$ -	$ -	$ 37,500	$ -	$ -	$ 338,000	$ -	$ -
10	**Opinion of Combined Structures Annual Budget (2005 Dollars)**	**$ 2,818,000**	**$ 8,275,000**	**$ 1,470,500**	**$ 809,500**	**$ 480,500**	**$ 534,000**	**$ 481,500**	**$ 1,540,500**	**$ 616,500**	**$ 843,000**	**$ 665,500**	**$ 833,000**
11	**Opinion of Combined Structures Annual Budget (Adjusted Future Value - based on 3% discount rate)**		**$ 9,714,000**	**$ 1,514,800**	**$ 859,000**	**$ 525,300**	**$ 601,200**	**$ 558,400**	**$ 1,839,600**	**$ 758,400**	**$ 1,068,200**	**$ 868,700**	**$ 1,119,700**

NOTES:

1 Current repairs include recommended repairs or renovations to address currently identifiable deterioration of existing systems in the structures. Current repairs include structure and/or system renovations that match the original intended usage.

2 Maintenance repairs include recommended work to prevent or slow deterioration of the structures or their systems. May include repair of minor deterioration / damage, replacement of aging joint sealants, or similar work.

3 Enhancements include additions to the existing systems, renovations or system upgrades to accommodate new criteria or code issues, and improvements for aesthetics or security.

4 The estimated costs in lines 1 though 10 are in 2005 dollars. Line 11 factors costs to show anticipated impact of inflation or financing. Costs may vary due to time of year, local economy, or other factors.

PROJECT UNDERSTANDING AND OBJECTIVES

In accordance with our proposal dated June 29, 2005, Walker Parking Consultants has performed a review of nine parking structures for the City of Tampa, Florida Parking Division. The on-site review was performed from September 26 through October 6, 2005.

In reviewing these structures, information and documentation from previous reports and testing was examined and included as a reference for establishing baseline conditions and continuing concerns.

The nine structures encompass a wide range of ages, sizes, and structure design types.

- Ages: 3 years to 42 years old
- Sizes: 280 spaces to 2523 spaces
- Design Types:
    - Cast-in-Place Post-Tensioned
    - Cast-in-Place Pan/Joist
    - Precast Double Tee
    - Precast Joist
    - Precast Keystone Joist

These structures provide a combined capacity of more than 9,000 parking spaces for the Downtown Tampa and Ybor City areas. Please refer to the following Table CS – 2 for a summary description of each structure.

It is our understanding that the City's intent is to maintain these structures in active service through the 10-year duration of this plan and well beyond. There is no known plan at this time to re-develop any of these sites to other uses.

This report is provided as a tool for the City of Tampa to plan ahead for annual budgeting needs to properly maintain these structures and prolong their useful service life. Phasing the work and scheduling normal maintenance allows priority concerns to be addressed in a timely manner, while maintaining a relatively uniform annual cash flow.

TABLE CS-2
City of Tampa Parking System
Summary of Structures

		Year Built	Spaces	System	Levels	Bays	Total Parking Area (sf)	Footprint
1	Fort Brooks Garage	1980	1500	P/C joist	6	3	520,000	518' x 186'
	- Vertical Expansion	1999	1023	P/C joist	4	3	385,000	" "
2	Twiggs Street Garage	1972	840	P/C joist	5	3	285,000	306' x 186'
3	South Regional Garage	1996	1458	CIP P/T	6	5	630,000	255' x 497'
4	William Poe Garage	1981	932	Keystone Joist	6	3	280,000	486' x 180'
5	Centro Ybor Garage	2000	930	P/C double-tee	6		325,000	
6	Palm Avenue Garage	2002	1240	P/C double-tee	4		465,000	
7	Whiting Street Garage	1963	290	CIP PanJoist	3	2	98,000	288' x 124'
	- Horizontal Expansion	1979	300	CIP PanJoist	3	2	75,000	200' x 124'
8	Police HQ Garage	2001	280	P/C double-tee	3	2	109,000	124' x 216'
9	Convention Center Garage		450	CIP Bm-Joist	2	12	205,000	
	Total Spaces		9243				3,377,000	

COMBINED CAPITAL IMPROVEMENT COSTS

CURRENT REPAIR COSTS

Estimated current repair costs were identified in this report to address currently identifiable, existing deterioration conditions. These costs are based on assumptions that all work will be completed in a single construction season. De-mobilization, re-mobilization, loss of efficiency, and similar factors are not included in these costs. While some costs were identified in all the garages, over 75% of the current repair costs are due to conditions in the Whiting Street Garage and the Twiggs Street Garage.

Both the Whiting Street and Twiggs Street garages have extensive concrete and waterproofing repairs, particularly at the roof levels of each. In addition, repair costs at the Whiting Street garage include estimated costs to completely replace the lighting system. Repair costs for the current conditions in these two garages are expected to be approximately $1.43M and $0.69M respectively.

Repairs in the other seven garages include mainly spot repairs of concrete, joint sealant spot repair or replacement, expansion joint repairs or replacement, brick and mortar repairs, and architectural joint sealant repairs.

The total estimated combined cost of the current identified repairs in all nine garages is approximately $2,818,000.

PHASING AND MAINTENANCE COSTS

It is not typically feasible from financial or operational viewpoints to perform all required work in all garages simultaneously. Loss of revenue, disruption of patrons, project management constraints, and other factors usually dictate the need to phase the work. Work may be phased by structure, by work type, by time, or by a combination of factors.

Phasing the work has advantages and disadvantages. It allows annual costs for work to be reduced and budgeted into multiple fiscal years, but increases the overall costs due to re-mobilization costs, loss of efficiency, etc. It reduces the logistical headaches at any given time, but results in longer construction duration.

This report looks at likely costs over a ten year period. During this time, normal maintenance will be required in each of these structures in addition to the deferred/phased work previously discussed. This

report anticipates maintenance repair costs related to normal aging of materials and equipment to assist in budgeting for annual funding. Costs for recommended enhancements have also been included in this report.

The following tables (TABLE CS - 3) have been developed to recognize the additional costs associated with dividing and spreading out the work and also to include predictable maintenance costs that are likely to be incurred over the selected ten-year time period.

The total predicted ten year costs for these structures are $8,275,000 (in 2005 dollars). This represents $5,457,000 in addition to the current repair costs. Enhancements recommended for later implementation account for $1,801,000, while anticipated maintenance and phasing costs account for the remaining $3,656,000.

The last line of Table CS - 3 for each structure, "Opinion of Annual Budget (Adjusted Future Value), factors in an average 3% annual cost escalation to show the approximate dollar value in a given year with normal economic inflation.

TABLE CS-3
Combined Structures
10 Year Budget Forecast

NO.	WORK DESCRIPTION	CURRENT REPAIRS	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Fort Brooke Garage and Expansion													
1	Concrete Repairs	$ 7,000	$ 10,500	$ -	$ -	$ 7,000	$ -	$ -	$ -	$ 3,500	$ -	$ -	$ -
2	Waterproofing	$ 89,500	$ 862,500	$ -	$ -	$ 186,500	$ -	$ -	$ -	$ 302,500	$ 133,500	$ 124,500	$ 115,500
3	Stair/Elevator Tower Repair	$ 1,000	$ 2,000	$ -	$ -	$ 1,000	$ -	$ -	$ -	$ 1,000	$ -	$ -	$ -
4	Mechanical/Electrical/Plumbing	$ -	$ 162,000	$ -	$ -	$ 54,000	$ -	$ -	$ 54,000	$ -	$ -	$ 54,000	$ -
5	Architectural/Miscellaneous	$ -	$ 15,000	$ -	$ -	$ 6,000	$ -	$ -	$ -	$ 5,000	$ -	$ 4,000	$ -
6	Enhancements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
7	Contingency	$ 12,000	$ 127,500	$ -	$ -	$ 31,000	$ -	$ -	$ 6,500	$ 37,500	$ 16,500	$ 22,000	$ 14,000
8	General Conditions	$ 8,000	$ 85,500	$ -	$ -	$ 20,500	$ -	$ -	$ 4,500	$ 25,000	$ 11,000	$ 15,000	$ 9,500
9	Consulting & Engineering Fees	$ 12,000	$ 127,500	$ -	$ -	$ 31,000	$ -	$ -	$ 6,500	$ 37,500	$ 16,500	$ 22,000	$ 14,000
10	Opinion of Annual Budget (2005 Dollars)	$ 130,000	$ 1,393,000	$ -	$ -	$ 337,000	$ -	$ -	$ 71,500	$ 412,000	$ 177,500	$ 241,500	$ 153,000
11	Opinion of Annual Budget (Adjusted Future Value)		$ 1,707,000	$ -	$ -	$ 368,300	$ -	$ -	$ 85,400	$ 506,800	$ 224,900	$ 315,200	$ 205,700
Twiggs Street Garage													
1	Concrete Repairs	$ 184,500	$ 215,500	$ -	$ 193,000	$ -	$ -	$ -	$ 22,500	$ -	$ -	$ -	$ -
2	Waterproofing	$ 213,000	$ 336,500	$ -	$ 214,000	$ -	$ -	$ -	$ 122,500	$ -	$ -	$ -	$ -
3	Stair/Elevator Tower Repair	$ 19,500	$ 23,000	$ -	$ 19,500	$ -	$ -	$ -	$ 3,500	$ -	$ -	$ -	$ -
	Mechanical/Electrical/Plumbing	$ 65,500	$ 100,500	$ -	$ 67,500	$ -	$ -	$ 16,500	$ -	$ -	$ 16,500	$ -	$ -
5	Architectural/Miscellaneous	$ 42,000	$ 80,000	$ -	$ 42,000	$ -	$ -	$ -	$ 28,000	$ -	$ -	$ -	$ 10,000
6	Enhancements	$ -	$ 782,500	$ -	$ -	$ -	$ -	$ -	$ 782,500	$ -	$ -	$ -	$ -
7	Contingency	$ 63,000	$ 185,500	$ -	$ 64,500	$ -	$ -	$ 2,000	$ 115,500	$ -	$ 2,000	$ -	$ 1,500
8	General Conditions	$ 42,000	$ 124,000	$ -	$ 43,000	$ -	$ -	$ 1,500	$ 77,000	$ -	$ 1,500	$ -	$ 1,000
9	Consulting & Engineering Fees	$ 63,000	$ 185,500	$ -	$ 64,500	$ -	$ -	$ 2,000	$ 115,500	$ -	$ 2,000	$ -	$ 1,500
10	Opinion of Annual Budget (2005 Dollars)	$ 693,000	$ 2,033,000	$ -	$ 708,000	$ -	$ -	$ 22,000	$ 1,267,000	$ -	$ 22,000	$ -	$ 14,000
11	Opinion of Annual Budget (Adjusted Future Value)		$ 2,337,000	$ -	$ 751,200	$ -	$ -	$ 25,600	$ 1,512,900	$ -	$ 27,900	$ -	$ 18,900
South Regional Garage													
1	Concrete Repairs	$ 13,000	$ 19,500	$ -	$ -	$ -	$ 14,500	$ -	$ -	$ -	$ 5,000	$ -	$ -
2	Waterproofing	$ 137,500	$ 223,000	$ -	$ -	$ -	$ 170,500	$ -	$ -	$ -	$ 52,500	$ -	$ -
3	Stair/Elevator Tower Repair	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4	Mechanical/Electrical/Plumbing	$ -	$ 123,000	$ -	$ -	$ 41,000	$ -	$ -	$ 41,000	$ -	$ -	$ 41,000	$ -
5	Architectural/Miscellaneous	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6	Enhancements	$ -	$ 20,000	$ -	$ -	$ -	$ 20,000	$ -	$ -	$ -	$ -	$ -	$ -
7	Contingency	$ 18,500	$ 47,000	$ -	$ -	$ 5,000	$ 25,000	$ -	$ 5,000	$ -	$ 7,000	$ 5,000	$ -
8	General Conditions	$ 12,500	$ 32,000	$ -	$ -	$ 3,500	$ 16,500	$ -	$ 3,500	$ -	$ 5,000	$ 3,500	$ -
9	Consulting & Engineering Fees	$ 18,500	$ 47,000	$ -	$ -	$ 5,000	$ 25,000	$ -	$ 5,000	$ -	$ 7,000	$ 5,000	$ -
10	Opinion of Annual Budget (2005 Dollars)	$ 200,000	$ 512,000	$ -	$ -	$ 54,500	$ 271,500	$ -	$ 54,500	$ -	$ 76,500	$ 54,500	$ -
11	Opinion of Annual Budget (Adjusted Future Value)		$ 599,000	$ -	$ -	$ 59,600	$ 305,600	$ -	$ 65,100	$ -	$ 97,000	$ 71,200	$ -

TABLE CS-3
Combined Structures
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	CURRENT REPAIRS	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
William F. Poe Garage													
1	Concrete Repairs	$ 14,000	$ 25,000	$ 5,000	$ -	$ -	$ 11,000	$ -	$ -	$ -	$ 9,000	$ -	$ -
2	Waterproofing	$ 11,500	$ 159,000	$ -	$ -	$ -	$ 56,500	$ -	$ -	$ -	$ 102,500	$ -	$ -
3	Stair/Elevator Tower Repair	$ -	$ 15,000	$ -	$ -	$ -	$ 12,500	$ -	$ -	$ -	$ 2,500	$ -	$ -
4	Mechanical/Electrical/Plumbing	$ -	$ 61,500	$ -	$ 20,500	$ -	$ -	$ 20,500	$ -	$ -	$ 20,500	$ -	$ -
5	Architectural/Miscellaneous	$ 10,000	$ 23,000	$ -	$ -	$ -	$ 12,000	$ -	$ -	$ -	$ 11,000	$ -	$ -
6	Enhancements	$ 92,000	$ 582,000	$ -	$ -	$ -	$ 92,000	$ -	$ -	$ -	$ -	$ -	$ 490,000
7	Contingency	$ 15,500	$ 105,000	$ 1,000	$ 2,500	$ -	$ 22,500	$ 2,500	$ -	$ -	$ 17,500	$ -	$ 59,000
8	General Conditions	$ 10,500	$ 71,000	$ 500	$ 2,000	$ -	$ 15,000	$ 2,000	$ -	$ -	$ 12,000	$ -	$ 39,500
9	Consulting & Engineering Fees	$ 15,500	$ 105,000	$ 1,000	$ 2,500	$ -	$ 22,500	$ 2,500	$ -	$ -	$ 17,500	$ -	$ 59,000
10	Opinion of Annual Budget (2005 Dollars)	$ 169,000	$ 1,147,000	$ 7,500	$ 27,500	$ -	$ 244,000	$ 27,500	$ -	$ -	$ 192,500	$ -	$ 647,500
11	Opinion of Annual Budget (Adjusted Future Value)		$ 1,458,000	$ 7,800	$ 29,200	$ -	$ 274,700	$ 31,900	$ -	$ -	$ 243,900	$ -	$ 870,200
Centro Ybor Garage													
1	Concrete Repairs	$ 4,000	$ 12,500	$ -	$ -	$ 5,000	$ -	$ -	$ -	$ -	$ -	$ 7,500	$ -
2	Waterproofing	$ 72,500	$ 159,500	$ -	$ -	$ 21,500	$ -	$ -	$ 72,500	$ -	$ -	$ 65,500	$ -
3	Stair/Elevator Tower Repair	$ -	$ 25,000	$ -	$ -	$ 5,000	$ -	$ -	$ 20,000	$ -	$ -	$ -	$ -
4	Mechanical/Electrical/Plumbing	$ -	$ 61,000	$ -	$ -	$ 20,500	$ -	$ -	$ 17,000	$ -	$ -	$ 23,500	$ -
5	Architectural/Miscellaneous	$ -	$ 21,000	$ -	$ -	$ -	$ -	$ -	$ 2,000	$ -	$ -	$ 19,000	$ -
6	Enhancements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
7	Contingency	$ 9,500	$ 34,000	$ -	$ -	$ 6,500	$ -	$ -	$ 13,500	$ -	$ -	$ 14,000	$ -
8	General Conditions	$ 6,500	$ 23,000	$ -	$ -	$ 4,500	$ -	$ -	$ 9,000	$ -	$ -	$ 9,500	$ -
9	Consulting & Engineering Fees	$ 9,500	$ 34,000	$ -	$ -	$ 6,500	$ -	$ -	$ 13,500	$ -	$ -	$ 14,000	$ -
10	Opinion of Annual Budget (2005 Dollars)	$ 102,000	$ 370,000	$ -	$ -	$ 69,500	$ -	$ -	$ 147,500	$ -	$ -	$ 153,000	$ -
11	Opinion of Annual Budget (Adjusted Future Value)		$ 452,000	$ -	$ -	$ 76,000	$ -	$ -	$ 176,200	$ -	$ -	$ 199,700	$ -
Palm Avenue Garage													
1	Concrete Repairs	$ 10,500	$ 18,500	$ -	$ -	$ 12,500	$ -	$ -	$ -	$ -	$ -	$ 6,000	$ -
2	Waterproofing	$ 9,000	$ 187,000	$ -	$ -	$ 1,500	$ -	$ 114,000	$ -	$ -	$ -	$ 71,500	$ -
3	Stair/Elevator Tower Repair	$ -	$ 12,000	$ -	$ -	$ -	$ -	$ 6,000	$ -	$ -	$ -	$ 6,000	$ -
4	Mechanical/Electrical/Plumbing	$ -	$ 85,000	$ -	$ 27,000	$ -	$ -	$ 27,000	$ -	$ -	$ 27,000	$ 4,000	$ -
5	Architectural/Miscellaneous	$ 20,000	$ 37,000	$ -	$ -	$ -	$ -	$ 23,000	$ -	$ -	$ -	$ 14,000	$ -
6	Enhancements	$ -	$ 20,000	$ -	$ -	$ -	$ -	$ 20,000	$ -	$ -	$ -	$ -	$ -
7	Contingency	$ 5,000	$ 44,500	$ -	$ 3,500	$ 2,000	$ -	$ 23,000	$ -	$ -	$ 3,500	$ 12,500	$ -
8	General Conditions	$ 3,500	$ 30,500	$ -	$ 2,500	$ 1,500	$ -	$ 15,500	$ -	$ -	$ 2,500	$ 8,500	$ -
9	Consulting & Engineering Fees	$ 5,000	$ 44,500	$ -	$ 3,500	$ 2,000	$ -	$ 23,000	$ -	$ -	$ 3,500	$ 12,500	$ -
10	Opinion of Annual Budget (2005 Dollars)	**$ 53,000**	**$ 479,000**	**$ -**	**$ 36,500**	**$ 19,500**	**$ -**	**$ 251,500**	**$ -**	**$ -**	**$ 36,500**	**$ 135,000**	**$ -**
11	Opinion of Annual Budget (Adjusted Future Value)		$ 575,000	$ -	$ 38,800	$ 21,400	$ -	$ 291,600	$ -	$ -	$ 46,300	$ 176,200	$ -

TABLE CS-3
Combined Structures
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	CURRENT REPAIRS	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Whiting Street Garage and Expansion													
1	Concrete Repairs	$ 154,500	$ 171,500	$ 154,500	$ -	$ -	$ -	$ -	$ -	$ 8,500	$ -	$ 8,500	$ -
2	Waterproofing	$ 373,500	$ 503,000	$ 373,500	$ -	$ -	$ -	$ -	$ -	$ 129,500	$ -	$ -	$ -
3	Stair/Elevator Tower Repair	$ 5,500	$ 10,500	$ 5,500	$ -	$ -	$ -	$ -	$ -	$ 5,000	$ -	$ -	$ -
4	Mechanical/Electrical/Plumbing	$ 329,000	$ 369,500	$ 329,000	$ -	$ -	$ 13,500	$ -	$ -	$ 13,500	$ -	$ -	$ 13,500
5	Architectural/Miscellaneous	$ 16,500	$ 16,500	$ 16,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6	Enhancements	$ 260,500	$ 260,500	$ 260,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
7	Contingency	$ 114,000	$ 134,000	$ 114,000	$ -	$ -	$ 1,500	$ -	$ -	$ 16,000	$ -	$ 1,000	$ 1,500
8	General Conditions	$ 91,500	$ 108,500	$ 91,500	$ -	$ -	$ 1,500	$ -	$ -	$ 13,000	$ -	$ 1,000	$ 1,500
9	Consulting & Engineering Fees	$ 82,500	$ 107,000	$ 82,500	$ -	$ -	$ 2,000	$ -	$ -	$ 19,000	$ -	$ 1,500	$ 2,000
10	Opinion of Annual Budget (2005 Dollars)	$ 1,428,000	$ 1,681,000	$ 1,427,500	$ -	$ -	$ 18,500	$ -	$ -	$ 204,500	$ -	$ 12,000	$ 18,500
11	Opinion of Annual Budget (Adjusted Future Value)		$ 1,784,000	$ 1,470,400	$ -	$ -	$ 20,900	$ -	$ -	$ 251,600	$ -	$ 15,700	$ 24,900
Police Headquarters Garage													
1	Concrete Repairs	$ 4,000	$ 18,000	$ 4,000	$ -	$ -	$ -	$ 7,000	$ -	$ -	$ -	$ 7,000	$ -
2	Waterproofing	$ 16,500	$ 123,500	$ 16,500	$ -	$ -	$ -	$ 80,500	$ -	$ -	$ -	$ 26,500	$ -
3	Stair/Elevator Tower Repair	$ -	$ 5,000	$ -	$ -	$ -	$ -	$ 2,500	$ -	$ -	$ -	$ 2,500	$ -
	Mechanical/Electrical/Plumbing	$ -	$ 27,500	$ 5,500	$ -	$ -	$ -	$ 12,000	$ -	$ -	$ -	$ 10,000	$ -
	Architectural/Miscellaneous	$ -	$ 12,000	$ -	$ -	$ -	$ -	$ 6,000	$ -	$ -	$ -	$ 6,000	$ -
6	Enhancements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
7	Contingency	$ 2,500	$ 23,000	$ 3,500	$ -	$ -	$ -	$ 13,000	$ -	$ -	$ -	$ 6,500	$ -
8	General Conditions	$ 2,000	$ 16,000	$ 2,500	$ -	$ -	$ -	$ 9,000	$ -	$ -	$ -	$ 4,500	$ -
9	Consulting & Engineering Fees	$ 2,500	$ 23,000	$ 3,500	$ -	$ -	$ -	$ 13,000	$ -	$ -	$ -	$ 6,500	$ -
10	Opinion of Annual Budget (2005 Dollars)	$ 28,000	$ 248,000	$ 35,500	$ -	$ -	$ -	$ 143,000	$ -	$ -	$ -	$ 69,500	$ -
11	Opinion of Annual Budget (Adjusted Future Value)		$ 294,000	$ 36,600	$ -	$ -	$ -	$ 165,800	$ -	$ -	$ -	$ 90,700	$ -
Convention Center Garage													
1	Concrete Repairs	$ 2,000	$ 9,500	$ -	$ -	$ -	$ -	$ 5,500	$ -	$ -	$ 4,000	$ -	$ -
2	Waterproofing	$ 8,500	$ 94,000	$ -	$ 7,500	$ -	$ -	$ -	$ -	$ -	$ 86,500	$ -	$ -
3	Stair/Elevator Tower Repair	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4	Mechanical/Electrical/Plumbing	$ -	$ 63,500	$ -	$ 20,500	$ -	$ -	$ 22,500	$ -	$ -	$ 20,500	$ -	$ -
5	Architectural/Miscellaneous	$ -	$ 8,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 8,000	$ -	$ -
6	Enhancements	$ -	$ 136,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 136,500	$ -	$ -
7	Contingency	$ 1,500	$ 38,000	$ -	$ 3,500	$ -	$ -	$ 3,500	$ -	$ -	$ 31,000	$ -	$ -
8	General Conditions	$ 1,000	$ 25,500	$ -	$ 2,500	$ -	$ -	$ 2,500	$ -	$ -	$ 20,500	$ -	$ -
9	Consulting & Engineering Fees	$ 1,500	$ 38,000	$ -	$ 3,500	$ -	$ -	$ 3,500	$ -	$ -	$ 31,000	$ -	$ -
10	Opinion of Annual Budget (2005 Dollars)	$ 15,000	$ 413,000	$ -	$ 37,500	$ -	$ -	$ 37,500	$ -	$ -	$ 338,000	$ -	$ -
11	Opinion of Annual Budget (Adjusted Future Value)		$ 512,000	$ -	$ 39,800	$ -	$ -	$ 43,500	$ -	$ -	$ 428,200	$ -	$ -
Opinion of Combined Structures Annual Budget (2005 Dollars)		**$2,818,000**	**$ 8,275,000**	**$1,470,500**	**$ 809,500**	**$ 480,500**	**$ 534,000**	**$ 481,500**	**$1,540,500**	**$ 616,500**	**$ 843,000**	**$ 665,500**	**$ 833,000**
Opinion of Combined Structures Annual Budget (Adjusted Future Value - based on 3% discount rate)			**$ 9,714,000**	**$1,514,800**	**$ 859,000**	**$ 525,300**	**$ 601,200**	**$ 558,400**	**$1,839,600**	**$ 758,400**	**$1,068,200**	**$ 868,700**	**$1,119,700**

LIMITATIONS

Walker Parking Consultants developed this report to assist the City of Tampa, Florida in planning for improvements and maintenance of the Structured Parking component of the Tampa Parking System. We have summarized the evaluation and recommendations in this report for use with additional fiscal and technical judgments. This report is not for the benefit of or use by others without the written permission of Walker Parking Consultants/Engineers, Inc.

The evaluation required that certain assumptions be made regarding existing conditions, and some of these assumptions cannot be verified without expending additional sums of money or destroying otherwise adequate or serviceable portions of the building. Since these facilities are currently functioning without evidence of shortcomings in the original design of the buildings, we did not include review of the design, inspection of concealed conditions, or detailed analysis. A review of the facilities for ADA compliance was not included in the scope of this project. This report is not a warranty or guarantee of the items noted. The extent of our evaluation was limited, and we cannot guarantee that the appraisal discovered or disclosed possible latent conditions.

This condition assessment provides budgeting information based on professional judgment and the experience of Walker Parking Consultants. This assessment does not provide specific repair details or methods, construction contract documents, material specifications, or details to develop the construction cost from a contractor. We have estimated the work-item costs from visual observations and limited field survey work and there is no warranty as to the accuracy of such cost opinions as compared to bids or actual costs.

The recommendations outlined represent current technology for parking structure renovation and maintenance. We have assumed the buildings will continue in their present use and will require appropriate repairs and maintenance for this use. Parking 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 cost.

FORT BROOKE GARAGE

FACILITY DESCRIPTION AND BACKGROUND INFORMATION

YEAR BUILT: 1980, 1999 Vertical Expansion

PARKING CAPACITY: 1,500 + 1,023 = 2,523 Vehicles

The parking structure is located between Franklin Street on the west side and Florida Avenue on the east side, and spans over Whiting Street. The original (1980) construction included on-grade plus five supported levels for a total parking area of approximately 520,000 square feet to provide 1500 parking spaces. The structure covers a footprint of 518 feet (north to south) by 186 feet (east to west).

In 1999, a four level vertical expansion of the facility was constructed. This addition provided approximately 385,000 square feet of additional floor space and added 1023 spaces to the parking capacity.

Vehicular access to the structure is located on the north and south sides of Whiting Street as it passes under the central portion of the structure. Access to monthly parking is on the north side of the street and access to hourly parking is on the south side. Additional access is provided at the north and south ends of the structure.

The ten-level structure (grade plus nine supported levels) is three parking bays wide with a flat perimeter and sloped center bay. The north and south portions of the structure function independently as single-threaded helices, with one-way traffic on the flat perimeter bays and two-way traffic on the sloped center bay providing vehicular access between floors.

Pedestrian access is accommodated by eight cast-in-place stairs, located at the ground level corners of the structure (includes two on each side of Whiting Street). Additional pedestrian access and circulation is provided by an interior stair and stair/elevator core in each half of the structure.

The structural system consists of 24" deep precast concrete joists supporting a 4-1/2" to 5" thick, one-way reinforced concrete slab. The precast joists span typical bay widths of 62 feet and are supported by 35" deep cast-in-place concrete beam. The beams are supported by cast-in-place columns or walls, which carry the loads to the foundation.

BACKGROUND INFORMATION

Previous investigations have looked into various concerns. A summary of these investigations follows:

1. A 1985 investigation of diagonal cracking in the spandrel beams adjacent to the columns was performed by Reynolds, Smith, and Hills. The investigation found the cracks to be "an expected, predictable response to the geometry and loading conditions present", and that designed reinforcement is adequate.

2. A reported "structural failure of 4 precast beams" in the upper levels of the Fort Brooke Garage initiated a 1987 investigation of the precast joist support connections (Cazally hangers). Biltmore Construction Co., Prestressed Systems, Inc., Rich Associates, and the Design Arts Group, Inc. participated in the investigation.

   As a result of the investigation, 1"x 2"x 8" steel bars were welded to the face of the bearing support angle embedded in the beam at all locations with gaps in excess of 2" between beam face and joist. Available correspondence indicates that concerns have been resolved.

3. A Condition Appraisal report by Walker Parking Consultants, dated January 1988, indicated the following items of concern:
   - Random full-depth floor slab cracking due to volume change restraint during thermal cycling.
   - Water leakage and leaching at cracks.
   - Adhesive failure of floor slab construction joint sealants.
   - Leakage at precast joist "cazaly hangers".
   - Spalled and delaminated concrete at precast louvered façade due to shallow concrete cover over reinforcement.
   - Leakage through the second level waterproofing into offices and retail space.

   The report also indicates that the following repairs had been recently completed:
   - Expansion joints were replaced using "Wabocrete" system (1987).
   - Traffic topping system (United Coatings "Uniflex 455") was applied to roof level (1987).

CAPITAL IMPROVEMENT COSTS

The Fort Brooke Garage is in generally good condition. Built in 1980, repairs were reported to have been performed in 1988 and in conjunction with the expansion in 1999. This proactive maintenance effort has resulted in minimal deterioration beyond that expected as part of normal maintenance. Due to the size of the structure, even minimal repairs correspond to fairly significant costs.

CURRENT REPAIR COSTS

Estimated current repair costs were identified in this report to address currently identifiable, existing deterioration conditions. For comparison, these costs are based on assumptions that all work will be completed in a single construction season. De-mobilization, re-mobilization, loss of efficiency, and similar factors are not included in these costs.

Current repair needs in the Fort Brooke garage are fairly minimal, and focus primarily on waterproofing issues on the lower levels. Repair cost for the current conditions in this garage is expected to be approximately $130,000.

PHASING AND MAINTENANCE COSTS

With the understanding that it is not feasible from financial or operational viewpoints to perform all required work in all garages simultaneously, we anticipate that the work in the Fort Brooke Garage will be deferred to allow higher priority work at Twiggs Street and Whiting Street Garages to be performed first.

This report looks at likely costs for this structure over a ten year period. During this time, normal maintenance will be required in addition to the deferred/phased work previously discussed. This report anticipates maintenance repair costs related to normal aging of materials and equipment to assist in budgeting for annual funding. Costs for recommended enhancements, if applicable have also been included in this report.

The following table "Individual Structure Summary – 10 Year Budget Forecast" has been developed to recognize the additional costs associated with dividing and spreading out the work and also to include predictable maintenance costs that are likely to be incurred over the selected ten-year time period.

Individual Structure Summary
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	CURRENT REPAIRS	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Fort Brooke Garage and Expansion													
1	Concrete Repairs	$ 7,000	$ 10,500	$ -	$ -	$ 7,000	$ -	$ -	$ -	$ 3,500	$ -	$ -	$ -
2	Waterproofing	$ 89,500	$ 862,500	$ -	$ -	$ 186,500	$ -	$ -	$ -	$ 302,500	$ 133,500	$ 124,500	$ 115,500
3	Stair/Elevator Tower Repair	$ 1,000	$ 2,000	$ -	$ -	$ 1,000	$ -	$ -	$ -	$ 1,000	$ -	$ -	$ -
4	Mechanical/Electrical/Plumbing	$ -	$ 162,000	$ -	$ -	$ 54,000	$ -	$ -	$ 54,000	$ -	$ -	$ 54,000	$ -
5	Architectural/Miscellaneous	$ -	$ 15,000	$ -	$ -	$ 6,000	$ -	$ -	$ -	$ 5,000	$ -	$ 4,000	$ -
6	Enhancements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
7	Contingency	$ 12,000	$ 127,500	$ -	$ -	$ 31,000	$ -	$ -	$ 6,500	$ 37,500	$ 16,500	$ 22,000	$ 14,000
8	General Conditions	$ 8,000.00	$ 85,500.00	$ -	$ -	$ 20,500	$ -	$ -	$ 4,500	$ 25,000	$ 11,000	$ 15,000	$ 9,500
9	Consulting & Engineering Fees	$ 12,000	$ 127,500	$ -	$ -	$ 31,000	$ -	$ -	$ 6,500	$ 37,500	$ 16,500	$ 22,000	$ 14,000
10	Opinion of Annual Budget (2005 Dollars)	$ 130,000	$ 1,393,000	$ -	$ -	$ 337,000	$ -	$ -	$ 71,500	$ 412,000	$ 177,500	$ 241,500	$ 153,000
11	Opinion of Annual Budget (Adjusted Future Value)		$ 1,707,000	$ -	$ -	$ 368,300	$ -	$ -	$ 85,400	$ 506,800	$ 224,900	$ 315,200	$ 205,700

The total forecasted ten year cost for this structure is $1,393,000. This represents $1,263,000 in addition to the current repair costs for maintenance over the next ten years. No enhancements have been recommended for this structure. Since the level of structural deterioration in this garage is very low, there is very little additional cost for deferring the current repairs as long as they are performed within the next 3-4 years.

The last line "Opinion of Annual Budget (Adjusted Future Value)" of the following Table, factors in an average 3% annual cost escalation to show the approximate dollar value in a given year with normal economic inflation.

RECOMMENDATIONS

The following recommendations have been developed based on our on-site review of the Fort Brooke Garage and review of available documentation. Our recommendations are divided into four types: Immediate, Recommended, Maintenance, and Enhancements. Each of these recommendation categories is described below.

SUMMARY OF IMMEDIATE REPAIRS

Immediate Repairs address conditions of immediate concern related to structure and/or patron safety.

- No conditions requiring immediate repairs were found.

SUMMARY OF RECOMMENDED CURRENT REPAIRS

We recommend the following repairs be implemented to address current deterioration in this structure:

1. Repair spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Repair or replace damaged or leaking expansion joints.
3. Seal leaking cracks and joints.
4. Repair concrete stair treads and/or landings.

SUMMARY OF MAINTENANCE

We recommend the following repairs be implemented on a scheduled basis to address on-going maintenance requirements for this structure:

1. Repair miscellaneous spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Repair or replace damaged or leaking expansion joints.
3. Repair and/or recoat traffic topping at roof level.
4. Re-seal cracks and joints.
5. Repair concrete stair treads and/or landings.
6. Maintain / replace PARCS equipment as needed.
7. Repair / replace light fixtures as needed.
8. Re-lamp light fixtures bi-annually.
9. Re-paint traffic markings and maintain graphics as needed.

ENHANCEMENT OPTIONS

No enhancement options were identified for this garage.

SUMMARY DISCUSSION

The following sections provide a summary of the basis and reasoning used to develop our recommendations as well as a general discussion of observations made during the on-site review and testing results.

RECOMMENDATIONS

The recommendations have been separated into four categories based on urgency of implementation.

- **Immediate repairs** address structural integrity and/or personal safety. Immediate Repairs are considered to be urgent in nature, potentially requiring temporary shoring, barricading, and/or closing portions of a structure to reduce risk of damage or injury. These items should be implemented as soon as is practical to reduce potential for injury and liability exposure.
- **Current repairs** address existing structural, architectural, functional, and/or aesthetic conditions that need to be corrected, but can be implemented in a scheduled or phased approach.
- **Enhancements** are items identified for improvement of the structure versus return to original design. These are usually optional items for Owner consideration.
- **Maintenance** is long-term scheduled work to prolong the service life of the structure. This work is based on typical useful life of component materials and is intended to allow the materials to be replaced before general material failure occurs.

As indicated above, we did not find any conditions which warranted classification as "Immediate Repair". We did find limited amounts of small area concrete spalls and delaminations and several locations where expansion joint seals or nosing are splitting or de-bonding from the substrate concrete. These existing conditions are included with the "Recommended Current Repairs".

Although the lower six floors of this structure are now 25 years old, the structure has aged well. Presumably the non-structural systems (lighting, elevators, drainage, were also evaluated at the time the vertical addition was designed. With proper maintenance of the existing systems, we found no conditions in need of enhancement.

Maintenance aims to prevent or reduce deterioration before it becomes a significant problem. It is based on typical service life of sealants, coatings, and similar elements. Most preventive maintenance is directed at controlling moisture access into the structure. Although

exposure conditions differ from those in northern climates, materials still degrade over time due to traffic wear, UV exposure, and temperature cycling. Typical maintenance needs that can be anticipated in this structure include:

- **Joint Sealants** –
  Joint sealants should be on a 5 - 7 year replacement cycle for interior structure applications and a 3 – 5 year replacement cycle for applications subject to UV exposure. Spot repairs of sealant should be anticipated on a bi-annual basis.

- **Expansion Joints** –
  Expansion joint seals typically require a replacement cycle of 8 – 12 years. Limited repairs to joint seals or nosing to correct localized leakage may be anticipated on a 3-4 year cycle.

- **Re-Lamping and Lens Maintenance** –
  High intensity lamps can continue to operate while exhibiting significantly reduced light output long before the lamp actually burns out.

  High Pressure Sodium and Fluorescent lamps should be scheduled for replacement every 2 – 3 years. Metal Halide lamps should be replaced every 1-1/2 to 2 years.

  Light fixtures should be cleaned to remove accumulated dirt and insects. Lenses should be checked for yellowing and replaced as needed to prevent reduction in light output. This should be coordinated with scheduled re-lamping.

- **Parking Access and Revenue Control System** -

  PARCS equipment is exposed to heavy use (and abuse) on a daily basis. Equipment needs to be checked and worn or broken parts replaced for efficient operation.

OBSERVATIONS

The Fort Brooke Garage is in generally good condition. Minor concrete deterioration was observed, primarily at the lower levels. Random cracking was noted in various areas throughout the structure, most of these cracks were previously sealed.

The entire top level has traffic topping. The topping is currently functioning adequately, but some locations are showing wear.

The high pressure sodium lighting system seems to be functioning well, but most of the light fixture lenses in the lower levels (original structure) are showing significant yellowing.

TESTING

Testing at the Fort Brooke Garage included Petrographic Analysis of concrete cores, compressive strength testing, and chloride ion content testing. The results of the testing are summarized below. Refer to Appendix F for detailed testing results.

Compressive strength test results ranged from 3,480 to 4,850 psi, with an average of 4,258 psi. This correlates closely with the range and average test results of 4,453 psi from 1988. Typical design compressive strengths for floor slabs in this type of structure are in the 4,000 to 5,000 psi range.

Chloride contents from samples taken throughout the structure ranged from a low of 20 ppm at a 3" depth in most samples to a high of 300 ppm in the top inch of one sample. The chloride content in all samples was below that required for chloride to be the primary driver of corrosion activity.

Petrographic analysis of two samples found #3 reinforcing bars and ¼" welded wire fabric reinforcement at 1- ½" and 1- ¾" depths with no corrosion evident. Air content was found to range from 4% to 5.2%, with an air void structure rated as marginal to acceptable. The w/c ratio was found to be 0.43 – 0.44 with an estimated 610 lbs of cement per cubic yard. 1988 test results found air content less than 1% (non-air-entrained) and w/c ratio of 0.52 to 0.58. W/C ratios less than 0.45 (0.40 in northern climates) are recommended for durable concrete.

TWIGGS STREET GARAGE

FACILITY DESCRIPTION AND BACKGROUND INFORMATION

YEAR BUILT: 1972

PARKING CAPACITY: 840 Vehicles

The Twiggs Street parking structure is located on the south side of Twiggs Street between East Street and Nebraska Avenue and occupies a footprint area of 306 feet (east to west) by 186 feet (north to south). The "split-level" structure includes two full parking bays to the north and one bay to the south, with a 5' elevation difference and three speed ramps connecting the north and south areas.

Slab-on-grade parking plus four supported levels provide a total parking area of approximately 285,000 square feet to accommodate 840 parking spaces.

The primary vehicular entrance/exit to the structure is located on the north side of the structure from Twiggs Street. A secondary access point was provided on the south side of the structure from Madison Street (off Brush Street). Monthly parkers can enter from grade at the southeast corner of the garage, and exit from Level 1B on the south side, near the center of the garage.

The five-level structure (grade plus four supported levels) is three parking bays wide with a flat perimeter to provide level building lines. The three speed ramps allow the structure to function as end-to-end single-threaded helices, with one-way traffic on the end ramps and flat bays and two-way traffic on the center ramp providing vehicular access between floors.

Pedestrian access is accommodated by two cast-in-place stair/elevator towers adjacent to the end ramps, and one stair tower located near the northeast corner of the structure.

The structural system consists of 12" deep precast concrete joists supporting a 3" to 3-1/2" thick, one-way reinforced concrete slab. The precast joists span typical bay widths of 26 feet 4 inches (29 feet 4 inches at east and west end bays) and are supported by 42" deep cast-in-place concrete beam. The beams are supported by cast-in-place columns or walls, which carry the loads to the foundation.

BACKGROUND INFORMATION

A previous Condition Appraisal of this structure, dated January 1988, was performed by Walker Parking Consultants. A summary of this investigation follows:

The 1988 Condition Appraisal report indicated the following additional items of concern:

- Random full-depth floor slab cracking due to volume change restraint during thermal cycling.
- Full-depth slab cracking at or parallel to embedded conduit.
- Water and oil leakage and leaching at cracks.
- Unsealed floor slab construction joints.
- Ponding water throughout the structure.
- Minor amounts of spalled and delaminated concrete floor, ceiling, and beam surfaces, typically due to shallow concrete cover over reinforcement.
- Leakage through the second level waterproofing into occupied space.

The report also indicates that the following repairs were already completed:

- Expansion joints were replaced using "Wabocrete" system (1987).
- Concrete washes installed at roof level expansion joints.
- Traffic topping system (United Coatings "Uniflex 455") was applied to roof level (1987).

CAPITAL IMPROVEMENT COSTS

The Twiggs Street Garage is exhibiting extensive deterioration, especially at the roof level. Built in 1972, repairs were reported to have been performed in 1988. Although the expansion joints and traffic topping installed in 1988 are now well past their normal service life and are showing indication of failure, they have helped limit deterioration on the lower levels. There is no indication of other repairs since that time. This previous maintenance effort has resulted in a narrower scope of required current repairs. Most of the identified repairs are directed at the roof level.

CURRENT REPAIR COSTS

Estimated current repair costs were identified in this report to address currently identifiable, existing deterioration conditions. For comparison, these costs are based on assumptions that all work will be completed in a single construction season. De-mobilization, re-mobilization, loss of efficiency, and similar factors are not included in these costs.

Current repair needs in the Twiggs Street Garage are fairly extensive at this time, but focus primarily on concrete and waterproofing issues on the roof level. Repair cost for the current conditions in this garage is expected to be approximately $693,000.

PHASING AND MAINTENANCE COSTS

With the understanding that it is not feasible from financial or operational viewpoints to perform all required work in all garages simultaneously, we anticipate that the work in the Twiggs Street Garage will be deferred one year to allow higher priority work at Whiting Street Garage to be performed first.

This report looks at likely costs for this structure over a ten year period. During this time, normal maintenance will be required in addition to the deferred/phased work previously discussed. This report anticipates maintenance repair costs related to normal aging of materials and equipment to assist in budgeting for annual funding. Costs for recommended enhancements, if applicable have also been included in this report.

The following table "Individual Structure Summary – 10 Year Budget Forecast" has been developed to recognize the additional costs associated with dividing and spreading out the work and also to include predictable maintenance costs that are likely to be incurred

Individual Structure Summary
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	CURRENT REPAIRS	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Twiggs Street Garage													
1	Concrete Repairs	$ 184,500	$ 215,500	$ -	$ 193,000	$ -	$ -	$ -	$ 22,500	$ -	$ -	$ -	$ -
2	Waterproofing	$ 213,000	$ 336,500	$ -	$ 214,000	$ -	$ -	$ -	$ 122,500	$ -	$ -	$ -	$ -
3	Stair/Elevator Tower Repair	$ 19,500	$ 23,000	$ -	$ 19,500	$ -	$ -	$ -	$ 3,500	$ -	$ -	$ -	$ -
4	Mechanical/Electrical/Plumbing	$ 65,500	$ 100,500	$ -	$ 67,500	$ -	$ -	$ 16,500	$ -	$ -	$ 16,500	$ -	$ -
5	Architectural/Miscellaneous	$ 42,000	$ 80,000	$ -	$ 42,000	$ -	$ -	$ -	$ 28,000	$ -	$ -	$ -	$ 10,000
6	Enhancements	$ -	$ 782,500	$ -	$ -	$ -	$ -	$ -	$ 782,500	$ -	$ -	$ -	$ -
7	Contingency	$ 63,000	$ 185,500	$ -	$ 64,500	$ -	$ -	$ 2,000	$ 115,500	$ -	$ 2,000	$ -	$ 1,500
8	General Conditions	$ 42,000	$ 124,000	$ -	$ 43,000	$ -	$ -	$ 1,500	$ 77,000	$ -	$ 1,500	$ -	$ 1,000
9	Consulting & Engineering Fees	$ 63,000	$ 185,500	$ -	$ 64,500	$ -	$ -	$ 2,000	$ 115,500	$ -	$ 2,000	$ -	$ 1,500
10	Opinion of Annual Budget (2005 Dollars)	$ 693,000	$ 2,033,000	$ -	$ 708,000	$ -	$ -	$ 22,000	$ 1,267,000	$ -	$ 22,000	$ -	$ 14,000
11	Opinion of Annual Budget (Adjusted Future Value)		$ 2,337,000	$ -	$ 751,200	$ -	$ -	$ 25,600	$ 1,512,900	$ -	$ 27,900	$ -	$ 18,900

over the selected ten-year time period.

The total forecasted ten year cost for this structure is $2,033,000. This represents $1,340,000 in addition to the current repair costs. This cost increase is due to both recommended enhancements and maintenance over the next ten years. Recommended enhancements account for approximately $782,000, with continuing maintenance accounting for the remaining cost increase.

The last line "Opinion of Annual Budget (Adjusted Future Value)" of the following Table, factors in an average 3% annual cost escalation to show the approximate dollar value in a given year with normal economic inflation.

RECOMMENDATIONS

The following recommendations have been developed based on our on-site review of the Twiggs Street Garage and review of available documentation. Our recommendations are divided into three types: Immediate, Recommended, and Maintenance. Each of these are described below.

SUMMARY OF IMMEDIATE REPAIRS

Immediate Repairs address conditions of immediate concern related to structure and/or patron safety.

- No conditions requiring immediate repairs were found.

SUMMARY OF RECOMMENDED CURRENT REPAIRS

We recommend the following repairs be implemented to address current deterioration in this structure:

1. Repair spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Repair or replace damaged or leaking expansion joints.
3. Install a traffic topping on the roof level drainage overlay.
4. Seal leaking cracks and joints.
5. Apply concrete sealer to lower level floors.
6. Repair concrete stair treads and/or landings.
7. Re-paint stair towers and hand rails.
8. Repair or replace damaged or defective light fixtures.
9. Re-lamp light fixtures.
10. Repair or replace damaged drains and install supplemental drains.
11. Repair brick/block masonry.
12. Re-paint perimeter and interior handrails.

SUMMARY OF MAINTENANCE

We recommend the following repairs be implemented on a scheduled basis to address on-going maintenance requirements for this structure:

1. Repair miscellaneous spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Repair or replace damaged or leaking expansion joints.
3. Repair and/or re-coat traffic topping at roof level.
4. Re-seal cracks and joints.
5. Repair concrete stair treads and/or landings.
6. Maintain / replace PARCS equipment as needed.
7. Repair / replace light fixtures as needed.
8. Re-lamp light fixtures bi-annually.
9. Repair brick / block masonry as needed.
10. Re-paint traffic markings and maintain graphics as needed.

ENHANCEMENT OPTIONS

We recommend that the City of Tampa give consideration to implementation of the following enhancements to improve conditions in this structure:

1. Replace existing HPS lighting system.
2. Paint or stain ceilings, beams, etc. (interior superstructure).

The enhancement items listed above have been tentatively included in the draft budget forecast in year 2011.

These enhancement options are intended to provide improvements or upgrades in structure appearance, energy efficiency, and passive security.

SUMMARY DISCUSSION

The following sections provide a summary of the basis and reasoning used to develop our recommendations as well as a general discussion of observations made during the on-site review and testing results.

RECOMMENDATIONS

The recommendations have been separated into four categories based on urgency of implementation.

- **Immediate repairs** address structural integrity and/or personal safety. Immediate Repairs are considered to be urgent in nature, potentially requiring temporary shoring, barricading, and/or closing portions of a structure to reduce risk of damage or injury. These items should be implemented as soon as is practical to reduce potential for injury and liability exposure.
- **Current repairs** address existing structural, architectural, functional, and/or aesthetic conditions that need to be corrected, but can be implemented in a scheduled or phased approach.
- **Enhancements** are items identified for improvement of the structure versus return to original design. These are usually optional items for Owner consideration.
- **Maintenance** is long-term scheduled work to prolong the service life of the structure. This work is based on typical useful life of component materials and is intended to allow the materials to be replaced before general material failure occurs.

As indicated above, we did not find any conditions which warranted classification as "Immediate Repair". We did find large amounts of concrete spalls and delaminations over wide-spread areas on the roof level and several locations where expansion joint seals or nosing are splitting or de-bonding from the substrate concrete.

Ponding water on the roof level also requires a new waterproofing system and supplemental drains to improve drainage. Re-lamping of the high pressure sodium lamps and replacement of most of the light fixture lenses is also needed. These existing conditions are included with the "Recommended Current Repairs".

This structure is now 33 years old and is showing a lot of wear. The lighting system has many non-functional fixtures, and expected concrete repairs of supported floors will be visible from below. Replacement of the existing lighting system with higher, more uniform light levels will improve visibility in the structure. Painting or staining the ceiling and

interior superstructure does not significantly increase light levels, but it does improve patron confidence and can provide better visual recognition due to background contrast.

Maintenance aims to prevent or reduce deterioration before it becomes a significant problem. It is based on typical service life of sealants, coatings, and similar elements. Most preventive maintenance is directed at controlling moisture access into the structure. Although exposure conditions differ from those in northern climates, materials still degrade over time due to traffic wear, UV exposure, and temperature cycling. Typical maintenance needs that can be anticipated in this structure include:

- **Joint Sealants** –
  Joint sealants should be on a 5 - 7 year replacement cycle for interior structure applications and a 3 – 5 year replacement cycle for applications subject to UV exposure. Spot repairs of sealant should be anticipated on a bi-annual basis.

- **Expansion Joints** –
  Expansion joint seals typically require a replacement cycle of 8 – 12 years. Limited repairs to joint seals or nosing to correct localized leakage may be anticipated on a 3-4 year cycle.

- **Traffic Topping Maintenance** –
  Traffic toppings are subject to heavy wear conditions at locations where acceleration, braking, and turning occur. Periodic repair of these high wear areas may be required every 3 – 4 years, and re-application of a top coat (traction coat) should be anticipated on a 8 – 10 year cycle.

- **Re-Lamping and Lens Maintenance** –
  High intensity lamps can continue to operate while exhibiting significantly reduced light output long before the lamp actually burns out.

  High Pressure Sodium and Fluorescent lamps should be scheduled for replacement every 2 – 3 years. Metal Halide lamps should be replaced every 1-1/2 to 2 years.

  Light fixtures should be cleaned to remove accumulated dirt and insects. Lenses should be checked for yellowing and

replaced as needed to prevent reduction in light output. This should be coordinated with scheduled re-lamping.

- **Parking Access and Revenue Control System** -

  PARCS equipment is exposed to heavy use (and abuse) on a daily basis. Equipment needs to be checked and worn or broken parts replaced for efficient operation.

- **Masonry Repair / Tuckpointing** –
  Brick and CMU masonry at stair towers and perimeter is exposed to weather and stresses due to structure movement. Tuck-pointing joints and replacing damaged masonry should be anticipated periodically.

- **Painting** –
  Perimeter and interior handrails are a very visible component of this structure and are subject to wear. Re-painting the handrails should be expected every 3 – 4 years.

OBSERVATIONS

Deterioration is most prevalent on the roof level. Debonded concrete toppings, scaled concrete, spalled concrete over shallow bars, and ponding water all contribute to the deterioration. Lower levels are in better condition, but still require significant repairs.

Much of the structure seemed dark due to dark yellowing of light fixture lenses and non-functioning fixtures. Several floor drains have sustained damage to the surface grate, resulting in potential tripping hazards.

Most of the expansion joints have cracked or damaged nosing material and show indications of leaking.

Most of the handrails show chipped or flaked paint and need re-painting.

TESTING

Testing at the Twiggs Street Garage included Petrographic Analysis of concrete cores, compressive strength testing, and chloride ion content testing. The results of the testing are summarized below. Refer to Appendix F for detailed testing results.

Compressive strength test results ranged from 3,180 to 3,800 psi, with an average of 3,490 psi. This correlates fairly well with the range and average test results of 3,926 psi from 1988. Typical design compressive strengths for floor slabs in this type of structure are in the 4,000 to 5,000 psi range.

Chloride contents from samples taken throughout the structure ranged from a low of 20 ppm at a 3" depth in most samples to a high of 310 ppm in the top inch of one sample. The chloride content in all samples was below that required for chloride to be the primary driver of corrosion activity. Chloride levels have not changed significantly since 1988.

Petrographic analysis found #3 reinforcing bars and ¼" welded wire fabric reinforcement at ¾" depth with light corrosion evident. Air content was found to be low at 3.6% with a coarse air void structure rated as marginal to acceptable. The w/c ratio was found to be 0.44 with an estimated 610 lbs of cement per cubic yard. 1988 test results found air contents ranging from less than 1% (non-air-entrained) to 3% (low) and w/c ratio greater than 0.60. W/C ratios less than 0.45 (0.40 in northern climates) are recommended for durable concrete.

Test results indicate that the concrete in this structure is non-air-entrained, porous and relatively low strength and does not meet typical ACI recommended parameters for durable concrete.

SOUTH REGIONAL GARAGE

FACILITY DESCRIPTION AND BACKGROUND INFORMATION

YEAR BUILT: 1996

PARKING CAPACITY: 1,458 Vehicles

ARCHITECT/ENGINEER: Walker Parking Consultants
Tampa, Florida

The South Regional Garage parking structure is located on the south side of Channelside Drive between Florida Avenue and Morgan Street and provides parking for the Tampa Convention Center and the St. Pete Times Forum. The structure occupies a footprint area of 497 feet (east to west) by 255 feet (north to south). This five-bay garage utilizes flat parking floors with express ramps on the north side for floor-to-floor access.

Slab-on-grade parking plus four supported levels provide a total parking area of approximately 630,000 square feet to accommodate 1,458 parking spaces.

The vehicular entrances/exits to the structure are located on Florida Avenue and on Morgan Street, below the St. Pete Times Forum plaza. The Florida Avenue entrance/exit is used for hourly parking, while the Morgan Street entrance/exit is used for monthly permit parkers. Vehicle circulation utilizes one-way traffic in the parking bays and express ramps.

Pedestrian access is accommodated by three cast-in-place concrete stair/elevator towers at the southeast, southwest, and northwest corners, an interior stair tower core in the northeast quadrant and two open stairs along the south face of the structure.

The structural system consists of 32" deep cast-in-place post-tensioned concrete beams at 27 feet on center supporting a 5-1/2" thick, one-way post-tensioned reinforced concrete slab. The post-tensioned beams span typical bay widths of 55 feet (36 feet at north bay). The beams are supported by cast-in-place columns or walls, which carry the loads to the foundation. The exterior façade is composed of precast concrete panels and metal grillwork.

BACKGROUND INFORMATION

Garage operators reported on-going problems with loose expansion joint cover plates. Some cover plate sections are missing; others are currently loose and make a lot of noise when driven over.

An investigation of the cascading stairs on the south side of the structure was performed by Walker Parking Consultants in 2004. A report and anchor repair details were issued.

CAPITAL IMPROVEMENT COSTS

The South Regional Garage is in generally good condition. Built in 1996, some repairs apparently were performed as part of the construction punchlist, but no additional repairs have been performed since.

CURRENT REPAIR COSTS

Estimated current repair costs were identified in this report to address currently identifiable, existing deterioration conditions. These costs are based on assumptions that all work will be completed in a single construction season. De-mobilization, re-mobilization, loss of efficiency, and similar factors are not included in these costs.

Current repair needs in the South Regional Garage are fairly minimal at this time, and focus primarily on expansion joints and waterproofing issues on the roof level. Repair cost for the current conditions in this garage is expected to be approximately $200,000.

PHASING AND MAINTENANCE COSTS

Understanding that it is not feasible from financial or operational viewpoints to perform all required work in all garages simultaneously, we anticipate that most of the work in the South Regional Garage will be deferred until 2009 to allow higher priority work at Twiggs Street and Whiting Street Garages to be performed first. Limited work including maintenance of the lighting and PARCS is included in 2008.

Along with current deterioration, this report looks at likely costs for this structure over a ten year period. During this time, normal maintenance will be required in addition to the deferred/phased work previously discussed. This report anticipates maintenance repair costs related to normal aging of materials and equipment to assist in budgeting for annual funding. Costs for recommended enhancements, if applicable have also been included in this report.

The following table "Individual Structure Summary – 10 Year Budget Forecast" has been developed to recognize the additional costs associated with dividing and spreading out the work and also to include predictable maintenance costs that are likely to be incurred over the selected ten-year time period.

Individual Structure Summary
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	CURRENT REPAIRS	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
South Regional Garage													
1	Concrete Repairs	$ 13,000	$ 19,500	$ -	$ -	$ -	$ 14,500	$ -	$ -	$ -	$ 5,000	$ -	$ -
2	Waterproofing	$ 137,500	$ 223,000	$ -	$ -	$ -	$ 170,500	$ -	$ -	$ -	$ 52,500	$ -	$ -
3	Stair/Elevator Tower Repair	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4	Mechanical/Electrical/Plumbing	$ -	$ 123,000	$ -	$ -	$ 41,000	$ -	$ -	$ 41,000	$ -	$ -	$ 41,000	$ -
5	Architectural/Miscellaneous	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6	Enhancements	$ -	$ 20,000	$ -	$ -	$ -	$ 20,000	$ -	$ -	$ -	$ -	$ -	$ -
7	Contingency	$ 18,500	$ 47,000	$ -	$ -	$ 5,000	$ 25,000	$ -	$ 5,000	$ -	$ 7,000	$ 5,000	$ -
8	General Conditions	$ 12,500	$ 32,000	$ -	$ -	$ 3,500	$ 16,500	$ -	$ 3,500	$ -	$ 5,000	$ 3,500	$ -
9	Consulting & Engineering Fees	$ 18,500	$ 47,000	$ -	$ -	$ 5,000	$ 25,000	$ -	$ 5,000	$ -	$ 7,000	$ 5,000	$ -
10	Opinion of Annual Budget (2005 Dollars)	$ 200,000	$ 512,000	$ -	$ -	$ 54,500	$ 271,500	$ -	$ 54,500	$ -	$ 76,500	$ 54,500	$ -
11	Opinion of Annual Budget (Adjusted Future Value)		$ 599,000	$ -	$ -	$ 59,600	$ 305,600	$ -	$ 65,100	$ -	$ 97,000	$ 71,200	$ -

The total forecasted ten year cost for this structure is $512,000. This represents an increase of $312,000 over the current repair costs. This cost increase is primarily due to maintenance over the next ten years. Signage enhancements to install an exterior illuminated garage identification sign, estimated to cost $20,000, have been recommended for this structure. Since the level of structural deterioration in this garage is very low, there is very little additional cost for deferring the current repairs as long as they are performed within the next 3-4 years.

The last line "Opinion of Annual Budget (Adjusted Future Value)" of the following Table, factors in an average 3% annual cost escalation to show the approximate dollar value in a given year with normal economic inflation.

RECOMMENDATIONS

The following recommendations have been developed based on our on-site review of the South Regional Garage and review of available documentation. Our recommendations are divided into four types: Immediate, Recommended, Maintenance, and Enhancements. Each of these is described below.

SUMMARY OF IMMEDIATE REPAIRS

Immediate Repairs address conditions of immediate concern related to structure and/or patron safety.

- No safety or structural integrity conditions requiring immediate repairs were found in this facility.

SUMMARY OF RECOMMENDED CURRENT REPAIRS

We recommend the following repairs be implemented to address current deterioration in this structure:

1. Repair spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Repair or replace damaged or leaking expansion joints and remove or secure cover plates.
3. Recoat existing traffic topping on roof level pour strip and on second level.
4. Seal leaking cracks and joints.
5. Replace concrete washes at stairways and stair towers.

SUMMARY OF MAINTENANCE

We recommend the following repairs be implemented on a scheduled basis to address on-going maintenance requirements for this structure:

1. Repair miscellaneous spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Repair or replace damaged or leaking expansion joints.
3. Repair and/or recoat traffic topping at roof and 2nd levels.
4. Re-seal cracks and joints.
5. Maintain / replace PARCS equipment as needed.
6. Repair / replace light fixtures as needed.
7. Re-lamp light fixtures bi-annually.
8. Re-paint traffic markings and maintain graphics as needed.

ENHANCEMENT OPTIONS

Illuminated exterior identification sign(s) are recommended to improve recognition of the structure as a public garage.

SUMMARY DISCUSSION

The following sections provide a summary of the basis and reasoning used to develop our recommendations as well as a general discussion of observations made during the on-site review and testing results.

RECOMMENDATIONS

The recommendations have been separated into four categories based on urgency of implementation.

- **Immediate repairs** address structural integrity and/or personal safety. Immediate Repairs are considered to be urgent in nature, potentially requiring temporary shoring, barricading, and/or closing portions of a structure to reduce risk of damage or injury. These items should be implemented as soon as is practical to reduce potential for injury and liability exposure.
- **Current repairs** address existing structural, architectural, functional, and/or aesthetic conditions that need to be corrected, but can be implemented in a scheduled or phased approach.
- **Enhancements** are items identified for improvement of the structure versus return to original design. These are usually optional items for Owner consideration.
- **Maintenance** is long-term scheduled work to prolong the service life of the structure. This work is based on typical useful life of component materials and is intended to allow the materials to be replaced before general material failure occurs.

As indicated above, we did not find any conditions which warranted classification as "Immediate Repair". We did find minor amounts of small, scattered, concrete spalls and delaminations at various locations throughout the garage. A few small spots were found where expansion joint seals or nosings are leaking. Cover plates over the expansion joints prevent direct viewing of the joint seal. They are also loose and are very loud when traffic drives over them. Loose cover plates should be re-secured, or removed. These existing conditions are included with the "Recommended Current Repairs".

This structure is now 9 years old and appears to be in very good condition. With proper maintenance of the existing systems, we found no conditions in need of enhancement.

Maintenance aims to prevent or reduce deterioration before it becomes a significant problem. It is based on typical service life of sealants, coatings, and similar elements. Most preventive maintenance is

directed at controlling moisture access into the structure. Although exposure conditions differ from those in northern climates, materials still degrade over time due to traffic wear, UV exposure, and temperature cycling. Typical maintenance needs that can be anticipated in this structure include:

- **Joint Sealants** –
  Joint sealants should be on a 5 - 7 year replacement cycle for interior structure applications and a 3 – 5 year replacement cycle for applications subject to UV exposure. Spot repairs of sealant should be anticipated on a bi-annual basis.

- **Expansion Joints** –
  Expansion joint seals typically require a replacement cycle of 8 – 12 years. Limited repairs to joint seals or nosing to correct localized leakage may be anticipated on a 3-4 year cycle.

- **Re-Lamping and Lens Maintenance** –
  High intensity lamps can continue to operate while exhibiting significantly reduced light output long before the lamp actually burns out.

  High Pressure Sodium and Fluorescent lamps should be scheduled for replacement every 2 – 3 years. Metal Halide lamps should be replaced every 1-1/2 to 2 years.

  Light fixtures should be cleaned to remove accumulated dirt and insects. Lenses should be checked for yellowing and replaced as needed to prevent reduction in light output. This should be coordinated with scheduled re-lamping.

- **Parking Access and Revenue Control System** -

  PARCS equipment is exposed to heavy use (and abuse) on a daily basis. Equipment needs to be checked and worn or broken parts replaced for efficient operation.

OBSERVATIONS

The structure appears to be in very good condition. Only a couple of leaks were found at expansion joints. Metal cover plates over many of the expansion joints were loose or bent, and were very loud when driven over. Concrete washes added at stair locations are debonded and breaking apart.
An area near the northeast stair tower has been milled and remnants of a thin concrete overlay are visible. The traffic coating on the roof level pour strip and on the south portion of Level 2 is showing signs of traffic abrasion wear.

Stairs are in good condition and there is no indication of damage at perimeter precast panels or connections.

TESTING

Testing at the South Regional Garage included Petrographic Analysis of concrete cores, compressive strength testing, and chloride ion content testing. The results of the testing are summarized below. Refer to Appendix F for detailed testing results.

Compressive strength test results ranged from 3,060 to 4,850 psi, with an average of 3,863 psi. Typical design compressive strengths for floor slabs in this type of structure are in the 4,000 to 5,000 psi range.

Chloride contents from samples taken throughout the structure ranged from a low of 20 ppm at a 3" depth in most samples to a high of 90 ppm in the top inch of one sample. The chloride content in all samples was below that required for chloride to be the primary driver of corrosion activity.

Petrographic analysis found the concrete to be well air-entrained with 5.2% air content and an air void structure rated as good. The w/c ratio was found to be 0.41 with an estimated 610 lbs of cement per cubic yard. W/C ratios less than 0.45 (0.40 in northern climates) are recommended for durable concrete.

Test results indicate that the concrete in this structure is air-entrained, well compacted, and meets ACI recommended parameters for durable concrete.

WILLIAM F. POE GARAGE

FACILITY DESCRIPTION AND BACKGROUND INFORMATION

YEAR BUILT: 1981

PARKING CAPACITY: 932 Vehicles

The William F. Poe Garage is located on the southwest corner of Cass Street and Ashley Drive. The structure occupies a triangular footprint for Ground Level through 3rd Level due to a railroad right-of-way on the south side of the structure. The structure widens out at the 4th and 5th levels into a parallelogram that spans over the right-of-way.

Slab-on-grade parking plus four supported levels provide a total parking area of approximately 280,000 square feet to accommodate 932 parking spaces. Vehicle circulation utilizes sloping floors to provide helical traffic flow for vertical movement.

Vehicular entrances/exits to the structure are located along Ashley Drive on the east side, Cass Street on the north, and Doyle Carlton Drive on the west side of the structure.

Pedestrian access is accommodated by two cast-in-place stair/elevator towers, and three stair towers.

The structural system consists of 24" deep precast concrete joists supporting a 4-1/2" to 5" thick, one-way reinforced concrete slab. The precast joists span typical bay widths of 64 feet and are supported by 30" deep cast-in-place concrete beam. The beams are supported by cast-in-place columns or walls, which carry the loads to the foundation.

BACKGROUND INFORMATION

A 1985 investigation of a precast joist member that fell onto a car resulted in installation of supplemental steel collars at all "cazaly" joist hanger locations. The investigation determined that this remedial action adequately resolved the structural concerns.

A 1988 Condition Appraisal report by Walker Parking Consultants indicated the following additional items of concern:

- Expansion joint failure at locations throughout the structure.
- Random full-depth floor slab cracking due to volume change restraint during thermal cycling.

- Full-depth slab cracking at or parallel to sawn joints.
- Water and oil leakage and leaching at cracks.
- Failed sealant at floor slab construction joints, curbs and vertical joints.
- Ponding water at south bays and western expansion joint of roof level.
- Minor amounts of spalled and delaminated concrete floor, ceiling, and beam surfaces, typically due to shallow concrete cover over reinforcement.
- Worn traffic topping and leakage through the second level waterproofing into office space.

CAPITAL IMPROVEMENT COSTS

The William F. Poe Garage is in generally good condition. Built in 1981, repairs were reported to have been performed in 1985 following the fall of a precast joist. Supplemental steel collars were installed at that time and additional waterproofing repairs were performed in 1988/89.

CURRENT REPAIR COSTS

Estimated current repair costs were identified in this report to address currently identifiable, existing deterioration conditions. These costs are based on assumptions that all work will be completed in a single construction season. De-mobilization, re-mobilization, loss of efficiency, and similar factors are not included in these costs.

Current repair needs in the William F. Poe Garage are fairly minimal at this time, and focus primarily on spot repair of concrete and waterproofing issues on the upper levels. Two locations in the garage are currently blocked off to parking due to remaining concerns about the joist anchorage. These should be addressed as soon as possible to return these areas to parking use. Repair cost for the current conditions in this garage is expected to be approximately $169,000.

PHASING AND MAINTENANCE COSTS

Since it is not feasible to perform all required work in all garages simultaneously, we anticipate that most of the work in the William F. Poe Garage will be deferred until 2009 to allow higher priority work at Twiggs Street and Whiting Street Garages to be performed first.

This report looks at likely predictable costs for this structure over a ten year period, along with the current deterioration. During this time, normal maintenance will be required in addition to the deferred/phased work previously discussed. This report anticipates maintenance repair costs related to normal aging of materials and equipment to assist in budgeting for annual funding. Costs for recommended enhancements, if applicable have also been included in this report.

The following table "Individual Structure Summary – 10 Year Budget Forecast" has been developed to recognize the additional costs associated with dividing and spreading out the work and also to

Individual Structure Summary
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	CURRENT REPAIRS	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
William F. Poe Garage													
1	Concrete Repairs	$ 14,000	$ 25,000	$ 5,000	$ -	$ -	$ 11,000	$ -	$ -	$ -	$ 9,000	$ -	$ -
2	Waterproofing	$ 11,500	$ 159,000	$ -	$ -	$ -	$ 56,500	$ -	$ -	$ -	$ 102,500	$ -	$ -
3	Stair/Elevator Tower Repair	$ -	$ 15,000	$ -	$ -	$ -	$ 12,500	$ -	$ -	$ -	$ 2,500	$ -	$ -
4	Mechanical/Electrical/Plumbing	$ -	$ 61,500	$ -	$ 20,500	$ -	$ -	$ 20,500	$ -	$ -	$ 20,500	$ -	$ -
5	Architectural/Miscellaneous	$ 10,000	$ 23,000	$ -	$ -	$ -	$ 12,000	$ -	$ -	$ -	$ 11,000	$ -	$ -
6	Enhancements	$ 92,000	$ 582,000	$ -	$ -	$ -	$ 92,000	$ -	$ -	$ -	$ -	$ -	$ 490,000
7	Contingency	$ 15,500	$ 105,000	$ 1,000	$ 2,500	$ -	$ 22,500	$ 2,500	$ -	$ -	$ 17,500	$ -	$ 59,000
8	General Conditions	$ 10,500	$ 71,000	$ 500	$ 2,000	$ -	$ 15,000	$ 2,000	$ -	$ -	$ 12,000	$ -	$ 39,500
9	Consulting & Engineering Fees	$ 15,500	$ 105,000	$ 1,000	$ 2,500	$ -	$ 22,500	$ 2,500	$ -	$ -	$ 17,500	$ -	$ 59,000
11	Opinion of Annual Budget (2005 Dollars)	$ 169,000	$ 1,147,000	$ 7,500	$ 27,500	$ -	$ 244,000	$ 27,500	$ -	$ -	$ 192,500	$ -	$ 647,500
12	Opinion of Annual Budget (Adjusted Future Value)		$ 1,458,000	$ 7,800	$ 29,200	$ -	$ 274,700	$ 31,900	$ -	$ -	$ 243,900	$ -	$ 870,200

include predictable maintenance costs that are likely to be incurred over the selected ten-year time period.

The total forecasted ten year cost for this structure is $1,147,000. This represents an increase of $978,000 over the current repair costs. This cost increase is due to both recommended enhancements and maintenance over the next ten years. Recommended enhancements account for approximately $582,000, with continuing maintenance accounting for the remaining cost increase.

The last line "Opinion of Annual Budget (Adjusted Future Value)" of the following Table, factors in an average 3% annual cost escalation to show the approximate dollar value in a given year with normal economic inflation.

RECOMMENDATIONS

The following recommendations have been developed based on our on-site review of the William F. Poe Garage and review of available documentation. Our recommendations are divided into four types: Immediate, Recommended, Maintenance and Enhancements. Each of these is described below.

SUMMARY OF IMMEDIATE REPAIRS

Immediate Repairs address conditions of immediate concern related to structure and/or patron safety.

- We recommend joist bearing repairs be performed as soon as practical to correct deterioration conditions at two precast joists at third and fourth levels.

  Concern remains regarding joist bearing conditions two locations in the structure. One precast joist hanger at third level is rusted and has moderate concrete deterioration. One precast joist hanger at fourth level exhibits concrete deterioration of the bearing area in the steel bracket. Both of these areas are currently barricaded. We recommend that these joists be shored, deteriorated concrete removed, and concrete repairs performed. Following concrete repairs, these areas can be returned to service and painted warning signs removed.

SUMMARY OF RECOMMENDED CURRENT REPAIRS

We recommend the following repairs be implemented to address current deterioration in this structure:

1. Repair spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Seal leaking cracks and joints.
3. Clean and apply uniform color coat to perimeter façade.
4. Remove residual dirt, debris and vegetation from perimeter planters.

SUMMARY OF MAINTENANCE

We recommend the following repairs be implemented on a scheduled basis to address on-going maintenance requirements for this structure:

1. Repair miscellaneous spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Repair or replace damaged or leaking expansion joints.
3. Repair and/or recoat traffic topping at 2nd and 3rd levels.
4. Re-seal cracks and joints.
5. Repair concrete stair treads and/or landings.
6. Re-paint stair tower interiors.
7. Maintain / replace PARCS equipment as needed.
8. Repair / replace light fixtures as needed.
9. Re-lamp light fixtures bi-annually.
10. Re-paint traffic markings and maintain graphics as needed.

ENHANCEMENT OPTIONS

We recommend that the City of Tampa give consideration to implementation of the following enhancements to improve conditions in this structure:

1. Clean and apply uniform color coat (paint/stain/other) to perimeter façade.
2. Replace existing HPS lighting system.

The enhancement items listed above have been tentatively included in the draft budget forecast. The façade work has been budgeted in year 2009 and the lighting system replacement in year 2015. The lighting system will be 34 years old at that time.

These enhancement options are intended to provide improvements or upgrades in structure appearance, energy efficiency, and passive security.

SUMMARY DISCUSSION

The following sections provide a summary of the basis and reasoning used to develop our recommendations as well as a general discussion of observations made during the on-site review and testing results.

RECOMMENDATIONS

The recommendations have been separated into four categories based on urgency of implementation.

- **Immediate repairs** address structural integrity and/or personal safety. Immediate Repairs are considered to be urgent in nature, potentially requiring temporary shoring, barricading, and/or closing portions of a structure to reduce risk of damage or injury. These items should be implemented as soon as is practical to reduce potential for injury and liability exposure.
- **Current repairs** address existing structural, architectural, functional, and/or aesthetic conditions that need to be corrected, but can be implemented in a scheduled or phased approach.
- **Enhancements** are items identified for improvement of the structure versus return to original design. These are usually optional items for Owner consideration.
- **Maintenance** is long-term scheduled work to prolong the service life of the structure. This work is based on typical useful life of component materials and is intended to allow the materials to be replaced before general material failure occurs.

Two joist bearing conditions were identified as "Immediate Repairs", these occur at the third and fourth levels. These locations are currently blocked off due to concerns. Examination of the locations revealed deterioration of the bearing for these joists, but the extent of the deterioration cannot be confirmed without chipping out the damaged concrete. Repair of these bearing points will allow the parking spaces to be returned to service.

We also found less urgent conditions which should be addressed under the classification of "Current Repairs". Small, shallow concrete spalls and delaminations were found at scattered locations throughout the structure. These typically occurred where shallow reinforcement was present in floors or at beam and column locations below leaking joints. Expansion joint seals and nosing appear to be intact and appear to have been replaced recently. The perimeter façade panels exhibit a very irregular coloration. Cleaning the panels and applying a stain or color coat should correct this condition. Along with cleaning

the perimeter façade, unintended vegetation in the perimeter planters should be removed for a positive aesthetic impact. These existing conditions are included with the "Recommended Current Repairs".

This structure is now 24 years old but has had previous maintenance repairs. These repairs appear to be functioning appropriately and have been helpful in slowing deterioration of the structure.

Two garage enhancements have been recommended. The lighting system is still functional, but many fixture lenses need to be replaced due to severe yellowing, which reduces light output. Replacement of the existing lighting system will improve visibility in the structure, and should be anticipated in the near future. Painting or staining the façade is an aesthetic treatment, but it does improve patron confidence and community appearance.

Maintenance aims to prevent or reduce deterioration before it becomes a significant problem. It is based on typical service life of sealants, coatings, and similar elements. Most preventive maintenance is directed at controlling moisture access into the structure. Although exposure conditions differ from those in northern climates, materials still degrade over time due to traffic wear, UV exposure, and temperature cycling. Typical maintenance needs that can be anticipated in this structure include:

- **Joint Sealants** –
  Joint sealants should be on a 5 - 7 year replacement cycle for interior structure applications and a 3 – 5 year replacement cycle for applications subject to UV exposure. Spot repairs of sealant should be anticipated on a bi-annual basis.

- **Expansion Joints** –
  Expansion joint seals typically require a replacement cycle of 8 – 12 years. Limited repairs to joint seals or nosing to correct localized leakage may be anticipated on a 3-4 year cycle.

- **Re-Lamping and Lens Maintenance** –
  High intensity lamps can continue to operate while exhibiting significantly reduced light output long before the lamp actually burns out.

High Pressure Sodium and Fluorescent lamps should be scheduled for replacement every 2 – 3 years. Metal Halide lamps should be replaced every 1-1/2 to 2 years.

Light fixtures should be cleaned to remove accumulated dirt and insects. Lenses should be checked for yellowing and replaced as needed to prevent reduction in light output. This should be coordinated with scheduled re-lamping.

- **Parking Access and Revenue Control System** -

  PARCS equipment is exposed to heavy use (and abuse) on a daily basis. Equipment needs to be checked and worn or broken parts replaced for efficient operation.

OBSERVATIONS

The garage was found to be in generally good condition, with limited concrete deterioration. Steel bearing collars have been installed at the support points of all the precast joists. Small concrete delaminations occur on beams and columns in conjunction with leakage staining from above.

Wide-spread cracking was found on all floors, but has been previously sealed. Traffic topping installed on Lower levels is beginning to show wear from traffic at turning and acceleration areas. The expansion joints were in good condition and appear to have been replaced recently.

Large areas of the structure seemed dark due to dark yellowing of light fixture lenses. Several floor drains have sustained damage to the surface grate, resulting in potential tripping hazards.

Perimeter precast planters have been emptied are no longer used, however, "volunteer" vegetation of varying size has taken root.

TESTING

Testing at the William F. Poe Garage included Petrographic Analysis of concrete cores, compressive strength testing, and chloride ion content testing. The results of the testing are summarized below. Refer to Appendix F for detailed testing results.

Compressive strength test results ranged from 3,120 to 5,000 psi, with an average of 4,060 psi. This correlates well with the range and average test results of 4,046 psi from 1988. Typical design compressive strengths for floor slabs in this type of structure are in the 4,000 to 5,000 psi range.

Chloride contents from samples taken throughout the structure ranged from a low of 20 ppm at a 3" depth in all samples to a high of 110 ppm in the top inch of one sample. The chloride content in all samples was below that required for chloride to be the primary driver of corrosion activity. Chloride levels have not changed significantly since 1988.

Petrographic analysis found the concrete to be air entrained and the air content to be 5.7% with an air void structure rated as "good". The w/c ratio was found to be 0.44 with an estimated 610 lbs of cement per cubic yard. 1988 test results found air contents ranging from 4% to 7% and w/c ratio of 0.50 to 0.58. W/C ratios less than 0.45 (0.40 in northern climates) are recommended for durable concrete.

Test results indicate that the concrete in this structure is air-entrained, well consolidated and within the normal strength range for this application. It also meets ACI recommended parameters for durable concrete.

FACILITY DESCRIPTION AND BACKGROUND INFORMATION

CENTRO YBOR GARAGE

YEAR BUILT: 2000

PARKING CAPACITY: 930 Vehicles (estimated)

The Centro Ybor Garage is located in Ybor City and is bounded by 5th Avenue to the south, 6th Avenue to the north, 15th Street to the west, and 16th Street to the east. The structure occupies a footprint area of approximately 300 feet (east to west) by 180 feet (north to south). Drawings for this garage were not available at the time of this review. Sizes and car count are based on rough field measurement and comparison to the Palm Avenue Garage, which is of similar design.

Slab-on-grade parking plus five supported levels provide a total parking area of approximately 325,000 square feet to accommodate 930 parking spaces.

The vehicular entrances/exits to the structure are located at ground level from 15th Street on the west and 16th Street on the east.

The six-level structure (grade plus five supported levels) is three parking bays wide with a flat bay on the south side to provide level building lines. The sloped north and center bays allow the structure to function as a single-threaded helix, with one-way traffic on the flat bays and two-way traffic on the center ramp providing vehicular access between floors.

Pedestrian access is accommodated by two precast concrete elevator towers at the northeast and northwest corners of the structure, and by external open steel framed stair towers attached to each elevator tower.

The structural system consists of 9' wide precast pre-topped concrete double tees supported by precast concrete columns or "lightwall" panels. The precast double tees span typical bay widths of approximately 60 feet.

CAPITAL IMPROVEMENT COSTS

The Centro Ybor Garage is in generally good condition. Built in 2000, there is no indication that any repairs or structural maintenance has been performed since construction.

CURRENT REPAIR COSTS

Estimated current repair costs were identified in this report to address currently identifiable, existing deterioration conditions. These costs are based on assumptions that all work will be completed in a single construction season. De-mobilization, re-mobilization, loss of efficiency, and similar factors are not included in these costs.

Current repair needs in the Centro Ybor Garage are fairly minimal at this time, and focus primarily on waterproofing issues on the upper levels. Repair cost for the current conditions in this garage is expected to be approximately $102,000.

PHASING AND MAINTENANCE COSTS

We anticipate that the work in the Centro Ybor Garage will be deferred until 2008 and 2011. Since it is not feasible to perform all required work in all garages simultaneously, deferring this work will allow higher priority work at Twiggs Street and Whiting Street Garages to be performed first. This structure is still quite new and the deterioration rate appears to be low, so we do not anticipate a significant increase in repair costs by deferring the work as indicated.

This report looks at likely costs for this structure over a ten year period. During this time, normal maintenance will be required in addition to the deferred/phased work previously discussed. This report anticipates maintenance repair costs related to normal aging of materials and equipment to assist in budgeting for annual funding. Costs for recommended enhancements, if applicable have also been included in this report.

The following table "Individual Structure Summary – 10 Year Budget Forecast" has been developed to recognize the additional costs associated with dividing and spreading out the work and also to include predictable maintenance costs that are likely to be incurred over the selected ten-year time period.

The total forecasted ten year cost for this structure is $370,000. This represents $268,000 in addition to the current repair costs. This additional cost is primarily due to maintenance over the next ten years. No enhancements have been recommended for this structure. Since the level of structural deterioration in this garage is very low, there is very little additional cost for deferring the current repairs as long as they are performed within the next 3-4 years.

The last line "Opinion of Annual Budget (Adjusted Future Value)" of the following Table, factors in an average 3% annual cost escalation to show the approximate dollar value in a given year with normal economic inflation.

Individual Structure Summary
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	CURRENT REPAIRS	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Centro Ybor Garage													
1	Concrete Repairs	$ 4,000	$ 12,500	$ -	$ -	$ 5,000	$ -	$ -	$ -	$ -	$ -	$ 7,500	$ -
2	Waterproofing	$ 72,500	$ 159,500	$ -	$ -	$ 21,500	$ -	$ -	$ 72,500	$ -	$ -	$ 65,500	$ -
3	Stair/Elevator Tower Repair	$ -	$ 25,000	$ -	$ -	$ 5,000	$ -	$ -	$ 20,000	$ -	$ -	$ -	$ -
4	Mechanical/Electrical/Plumbing	$ -	$ 61,000	$ -	$ -	$ 20,500	$ -	$ -	$ 17,000	$ -	$ -	$ 23,500	$ -
5	Architectural/Miscellaneous	$ -	$ 21,000	$ -	$ -	$ -	$ -	$ -	$ 2,000	$ -	$ -	$ 19,000	$ -
6	Enhancements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
7	Contingency	$ 9,500	$ 34,000	$ -	$ -	$ 6,500	$ -	$ -	$ 13,500	$ -	$ -	$ 14,000	$ -
8	General Conditions	$ 6,500	$ 23,000	$ -	$ -	$ 4,500	$ -	$ -	$ 9,000	$ -	$ -	$ 9,500	$ -
9	Consulting & Engineering Fees	$ 9,500	$ 34,000	$ -	$ -	$ 6,500	$ -	$ -	$ 13,500	$ -	$ -	$ 14,000	$ -
10	Opinion of Annual Budget (2005 Dollars)	$ 102,000	$ 370,000	$ -	$ -	$ 69,500	$ -	$ -	$ 147,500	$ -	$ -	$ 153,000	$ -
11	Opinion of Annual Budget (Adjusted Future Value)		$ 452,000	$ -	$ -	$ 76,000	$ -	$ -	$ 176,200	$ -	$ -	$ 199,700	$ -

RECOMMENDATIONS

The following recommendations have been developed based on our on-site review of the Centro Ybor Garage and review of available documentation. Our recommendations are divided into four types: Immediate, Recommended, Maintenance, and Enhancements. Each of these is described below.

SUMMARY OF IMMEDIATE REPAIRS

Immediate Repairs address conditions of immediate concern related to structure and/or patron safety.

- No safety or structural integrity conditions requiring immediate repairs were found in this facility.

SUMMARY OF RECOMMENDED CURRENT REPAIRS

We recommend the following repairs be implemented to address current deterioration in this structure:

1. Repair spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Seal leaking cracks and joints.

SUMMARY OF MAINTENANCE

We recommend the following repairs be implemented on a scheduled basis to address on-going maintenance requirements for this structure:

1. Repair miscellaneous spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Repair or replace damaged or leaking expansion joints.
3. Re-seal cracks and joints.
4. Repair brick / block masonry as needed.
5. Repaint steel stair towers as needed.
6. Maintain / replace PARCS equipment as needed.
7. Repair / replace light fixtures as needed.
8. Re-lamp light fixtures bi-annually.
9. Re-paint traffic markings and maintain graphics as needed.

ENHANCEMENT OPTIONS

No enhancement options were identified for this garage.

SUMMARY DISCUSSION

The following sections provide a summary of the basis and reasoning used to develop our recommendations as well as a general discussion of observations made during the on-site review and testing results.

RECOMMENDATIONS

The recommendations have been separated into four categories based on urgency of implementation.

- **Immediate repairs** address structural integrity and/or personal safety. Immediate Repairs are considered to be urgent in nature, potentially requiring temporary shoring, barricading, and/or closing portions of a structure to reduce risk of damage or injury. These items should be implemented as soon as is practical to reduce potential for injury and liability exposure.
- **Current repairs** address existing structural, architectural, functional, and/or aesthetic conditions that need to be corrected, but can be implemented in a scheduled or phased approach.
- **Enhancements** are items identified for improvement of the structure versus return to original design. These are usually optional items for Owner consideration.
- **Maintenance** is long-term scheduled work to prolong the service life of the structure. This work is based on typical useful life of component materials and is intended to allow the materials to be replaced before general material failure occurs.

Our review of this structure did not reveal any conditions which warranted classification as "Immediate Repair", however; it did reveal other less urgent conditions which should be addressed. Small, concrete spalls and delaminations were found at scattered locations throughout the structure. These typically occurred at tee-to-tee connetctions, at shear walls, and at tee-to-column or tee-to-beam connections. These are likely due to a combination of shallow reinforcement was present in floors or at beam and column locations and high stresses from thermal expansion and contraction of the structure. Floor-to-wall joints are typically unsealed except at the connections. These existing conditions are included with the "Recommended Current Repairs".

Maintenance aims to prevent or reduce deterioration before it becomes a significant problem. It is based on typical service life of sealants, coatings, and similar elements. Most preventive maintenance is directed at controlling moisture access into the structure. Although

exposure conditions differ from those in northern climates, materials still degrade over time due to traffic wear, UV exposure, and temperature cycling. Typical maintenance needs that can be anticipated in this structure include:

- **Joint Sealants** –
  Joint sealants should be on a 5 - 7 year replacement cycle for interior structure applications and a 3 – 5 year replacement cycle for applications subject to UV exposure. Spot repairs of sealant should be anticipated on a bi-annual basis.

- **Expansion Joints** –
  Expansion joint seals typically require a replacement cycle of 8 – 12 years. Limited repairs to joint seals or nosing to correct localized leakage may be anticipated on a 3-4 year cycle.

- **Re-Lamping and Lens Maintenance** –
  High intensity lamps can continue to operate while exhibiting significantly reduced light output long before the lamp actually burns out.

  High Pressure Sodium and Fluorescent lamps should be scheduled for replacement every 2 – 3 years. Metal Halide lamps should be replaced every 1-1/2 to 2 years.

  Light fixtures should be cleaned to remove accumulated dirt and insects. Lenses should be checked for yellowing and replaced as needed to prevent reduction in light output. This should be coordinated with scheduled re-lamping.

- **Parking Access and Revenue Control System** -

  PARCS equipment is exposed to heavy use (and abuse) on a daily basis. Equipment needs to be checked and worn or broken parts replaced for efficient operation.

OBSERVATIONS

The Centro Ybor Garage is in generally good condition. This structure is now 5 years old, but has had some previous repairs. Most of these repairs have failed at this time. Minor concrete deterioration has re-occurred, primarily at the roof level. Random cracking was noted in various areas throughout the structure, most of these cracks were previously sealed.

Many of the joints in this structure are not sealed. The joints between precast tees and shear walls, columns, or beams are typically not sealed, or sealed only at connection points.

The metal halide lighting system, mechanical systems, and PARCS all seem to be functioning well.

TESTING

Testing at the Centro Ybor Garage included Petrographic Analysis of concrete cores, compressive strength testing, and chloride ion content testing. The results of the testing are summarized below. Refer to Appendix F for detailed testing results.

Compressive strength test results ranged from 4,010 to 6,240 psi, with an average of 5,125 psi. Typical design compressive strengths for floor slabs in this type of structure are in the 4,000 to 5,000 psi range.

Chloride contents from samples taken throughout the structure ranged from a low of 20 ppm at a 3" depth in all samples to a high of 150 ppm in the top inch of one sample. The chloride content in all samples was below that required for chloride to be the primary driver of corrosion activity.

Petrographic analysis found the concrete to be marginally air-entrained with 2.9% air content and an air void structure rated as coarse. The w/c ratio was found to be 0.40 with an estimated 610 lbs of cement per cubic yard. W/C ratios less than 0.45 (0.40 in northern climates) are recommended for durable concrete.

Test results indicate that the concrete in this structure is marginally air-entrained, well compacted, and meets ACI recommended parameters for acceptable concrete.

FACILITY DESCRIPTION AND BACKGROUND INFORMATION

PALM AVENUE GARAGE

YEAR BUILT: 2002

PARKING CAPACITY: 1240 Vehicles

The Palm Avenue Garage is located in Ybor City and is bounded by 8th Avenue to the south, Palm Avenue (10th Ave) to the north, Nuccio Parkway to the west, and 13th Street to the east. 9th Street separates the garage into two independent structures, with connecting bridges at the east and west ends which span 67 feet across 9th Street at the 3rd and 4th (roof) levels.

The combined slab-on-grade parking plus three supported levels provide a total parking area of approximately 465,000 square feet to accommodate 1240 parking spaces.

The primary vehicular entrances/exits to the structure are located on each side of 9th Avenue. Signs indicate that the north structure is primarily reserved permit parking for Hillsborough Community College, while the south structure is available for hourly parking.

Each half of the four-level structure (grade plus three supported levels) is three parking bays wide with a flat perimeter to provide level building lines. The sloped center bay allows the structures to function as side-by-side single-threaded helices, with one-way traffic on the flat bays and two-way traffic on the center ramp providing vehicular access between floors.

Pedestrian access is accommodated by two elevator towers with open steel-frame stairs along 13th Street at the 8th Avenue and Palm Avenue corners. Two additional open steel-frame stair towers are provided at the west end on each side of 9th Avenue, adjacent to the bridge.

The structural system consists of 10' wide precast pre-topped concrete double tees supported by precast concrete columns or "lightwall" panels. The precast double tees span typical bay widths of approximately 53 to 64 feet.

CAPITAL IMPROVEMENT COSTS

The Palm Avenue Garage, built in 2002, is in generally good condition. The projected costs for this structure are summarized below.

CURRENT REPAIR COSTS

Estimated current repair costs were identified in this report to address currently identifiable, existing deterioration conditions. These costs are based on assumptions that all work will be completed in a single construction season. De-mobilization, re-mobilization, loss of efficiency, and similar factors are not included in these costs.

Current repair needs in the Palm Avenue Garage are minimal at this time, and focus on minor concrete and waterproofing issues on the roof level. Repair cost for the current conditions in this garage is expected to be approximately $53,000.

PHASING AND MAINTENANCE COSTS

With the limited amount of deterioration present in this structure, we anticipate that most of the work in the Palm Avenue Garage will be deferred until 2008 and 2010 to allow higher priority work at Twiggs Street and Whiting Street Garages to be performed first.

During the ten year time period considered in this report, normal maintenance will be required in addition to the deferred/phased work previously discussed. This report anticipates maintenance repair costs related to normal aging of materials and equipment to assist in budgeting for annual funding. Costs for recommended enhancements, if applicable have also been included in this report.

The following table "Individual Structure Summary – 10 Year Budget Forecast" has been developed to recognize the additional costs associated with dividing and spreading out the work and also to include predictable maintenance costs that are likely to be incurred over the selected ten-year time period.

The total forecasted ten year cost for this structure is $479,000. This represents $426,000 in to the current repair costs. This additional cost is primarily due to maintenance over the next ten years. Signage and graphics enhancements, estimated at $20,000 have been recommended for this structure. Since the level of structural deterioration in this garage is very low, there is very little additional

cost for deferring the current repairs as long as they are performed within the next 3-4 years.

The last line "Opinion of Annual Budget (Adjusted Future Value)" of the following Table, factors in an average 3% annual cost escalation to show the approximate dollar value in a given year with normal economic inflation.

Individual Structure Summary
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	CURRENT REPAIRS	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Palm Avenue Garage													
1	Concrete Repairs	$ 10,500	$ 18,500	$ -	$ -	$ 12,500	$ -	$ -	$ -	$ -	$ -	$ 6,000	$ -
2	Waterproofing	$ 9,000	$ 187,000	$ -	$ -	$ 1,500	$ -	$ 114,000	$ -	$ -	$ -	$ 71,500	$ -
3	Stair/Elevator Tower Repair	$ -	$ 12,000	$ -	$ -	$ -	$ -	$ 6,000	$ -	$ -	$ -	$ 6,000	$ -
4	Mechanical/Electrical/Plumbing	$ -	$ 85,000	$ -	$ 27,000	$ -	$ -	$ 27,000	$ -	$ -	$ 27,000	$ 4,000	$ -
5	Architectural/Miscellaneous	$ 20,000	$ 37,000	$ -	$ -	$ -	$ -	$ 23,000	$ -	$ -	$ -	$ 14,000	$ -
6	Enhancements	$ -	$ 20,000	$ -	$ -	$ -	$ -	$ 20,000	$ -	$ -	$ -	$ -	$ -
7	Contingency	$ 5,000	$ 44,500	$ -	$ 3,500	$ 2,000	$ -	$ 23,000	$ -	$ -	$ 3,500	$ 12,500	$ -
8	General Conditions	$ 3,500	$ 30,500	$ -	$ 2,500	$ 1,500	$ -	$ 15,500	$ -	$ -	$ 2,500	$ 8,500	$ -
9	Consulting & Engineering Fees	$ 5,000	$ 44,500	$ -	$ 3,500	$ 2,000	$ -	$ 23,000	$ -	$ -	$ 3,500	$ 12,500	$ -
10	Opinion of Annual Budget (2005 Dollars)	**$ 53,000**	**$ 479,000**	**$ -**	**$ 36,500**	**$ 19,500**	**$ -**	**$ 251,500**	**$ -**	**$ -**	**$ 36,500**	**$ 135,000**	**$ -**
11	Opinion of Annual Budget (Adjusted Future Value)		$ 575,000	$ -	$ 38,800	$ 21,400	$ -	$ 291,600	$ -	$ -	$ 46,300	$ 176,200	$ -

RECOMMENDATIONS

The following recommendations have been developed based on our on-site review of the Palm Avenue Garage and review of available documentation. Our recommendations are divided into four types: Immediate, Recommended, Maintenance, and Enhancements. Each of these is described below.

SUMMARY OF IMMEDIATE REPAIRS

Immediate Repairs address conditions of immediate concern related to structure and/or patron safety.

- No safety or structural integrity conditions requiring immediate repairs were found in this facility.

SUMMARY OF RECOMMENDED CURRENT REPAIRS

We recommend the following repairs be implemented to address current deterioration in this structure:

1. Repair spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Seal leaking cracks and joints.
3. Repair brick masonry.

SUMMARY OF MAINTENANCE

We recommend the following repairs be implemented on a scheduled basis to address on-going maintenance requirements for this structure:

1. Repair miscellaneous spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Repair or replace damaged or leaking expansion joints.
3. Re-seal cracks and joints.
4. Maintain / replace PARCS equipment as needed.
5. Repair / replace light fixtures as needed.
6. Re-lamp light fixtures bi-annually.
7. Re-paint traffic markings and maintain graphics as needed.

ENHANCEMENT OPTIONS

We recommend that the City of Tampa give consideration to implementation of the following enhancements to improve conditions in this structure:

- Upgrade graphics and signage to provide better wayfinding to pedestrian access points.

SUMMARY DISCUSSION

The following sections provide a summary of the basis and reasoning used to develop our recommendations as well as a general discussion of observations made during the on-site review and testing results.

RECOMMENDATIONS

The recommendations have been separated into four categories based on urgency of implementation.

- **Immediate repairs** address structural integrity and/or personal safety. Immediate Repairs are considered to be urgent in nature, potentially requiring temporary shoring, barricading, and/or closing portions of a structure to reduce risk of damage or injury. These items should be implemented as soon as is practical to reduce potential for injury and liability exposure.
- **Base repairs** address existing structural, architectural, functional, and/or aesthetic conditions that need to be corrected, but can be implemented in a scheduled or phased approach.
- **Enhancements** are items identified for improvement of the structure versus return to original design. These are usually optional items for Owner consideration.
- **Preventive maintenance** is long-term scheduled work to prolong the service life of the structure. This work is based on typical useful life of component materials and is intended to allow the materials to be replaced before general material failure occurs.

We did not find any conditions during our review of this structure which warranted classification as "Immediate Repair", however; we did find other less urgent conditions which should be addressed. Small, concrete spalls and delaminations were found at scattered locations throughout the structure. These typically occurred at tee-to-tee connections, at shear walls, and at tee-to-column or tee-to-beam connections. These are likely due to a combination of shallow reinforcement that is present in floors or at beam and column locations and high stresses from thermal expansion and contraction of the structure. These need to be repaired to prevent water from accumulating in the recess and causing corrosion of the embedded steel. These existing conditions are included with the "Recommended Current Repairs".

Maintenance aims to prevent or reduce deterioration before it becomes a significant problem. It is based on typical service life of sealants,

coatings, and similar elements. Most preventive maintenance is directed at controlling moisture access into the structure. Although exposure conditions differ from those in northern climates, materials still degrade over time due to traffic wear, UV exposure, and temperature cycling. Typical maintenance needs that can be anticipated in this structure include:

- **Joint Sealants** –
  Joint sealants should be on a 5 - 7 year replacement cycle for interior structure applications and a 3 – 5 year replacement cycle for applications subject to UV exposure. Spot repairs of sealant should be anticipated on a bi-annual basis.

- **Expansion Joints** –
  Expansion joint seals typically require a replacement cycle of 8 – 12 years. Limited repairs to joint seals or nosing to correct localized leakage may be anticipated on a 3-4 year cycle.

- **Re-Lamping and Lens Maintenance** –
  High intensity lamps can continue to operate while exhibiting significantly reduced light output long before the lamp actually burns out.

  High Pressure Sodium and Fluorescent lamps should be scheduled for replacement every 2 – 3 years. Metal Halide lamps should be replaced every 1-1/2 to 2 years.

  Light fixtures should be cleaned to remove accumulated dirt and insects. Lenses should be checked for yellowing and replaced as needed to prevent reduction in light output. This should be coordinated with scheduled re-lamping.

- **Parking Access and Revenue Control System** -

  PARCS equipment is exposed to heavy use (and abuse) on a daily basis. Equipment needs to be checked and worn or broken parts replaced for efficient operation.

OBSERVATIONS

The Palm Avenue Garage is similar in design to the Centro Ybor Garage, and is in generally good condition. This structure is only 3 years old, but is exhibiting some limited damage and has had some spot repairs. Most of these repairs have already failed at this time. Minor concrete deterioration has re-occurred, primarily at the roof level. Random cracking was noted in various areas throughout the structure, most of these cracks were previously sealed.

Most of the joints in this structure are sealed, but spot repairs of sealant are evident on the roof level. The joints between precast tees and between the tees and between tees and shear walls, columns, or beams are exhibiting splitting or separation from the concrete in various locations.

Joint sealants in the brick façade are splitting in many locations, and bricks with cracking and face splitting damage were found.

The lighting system, mechanical systems, and PARCS all seem to be functioning well.

TESTING

Testing at the Palm Avenue Garage included Petrographic Analysis of concrete cores, compressive strength testing, and chloride ion content testing. The results of the testing are summarized below. Refer to Appendix F for detailed testing results.

Compressive strength test results ranged from 4,080 to 6,060 psi, with an average of 4,930 psi. Typical design compressive strengths for floor slabs in this type of structure are in the 4,000 to 5,000 psi range.

Chloride contents from samples taken throughout the structure ranged from a low of 20 ppm at a 3" depth in all samples to a high of 50 ppm in the top inch of one sample. The chloride content in all samples was below that required for chloride to be the primary driver of corrosion activity.

Petrographic analysis found the concrete to be marginally air-entrained with 5.0% air content and an air void structure rated as coarse, but acceptable. The w/c ratio was found to be 0.42 with an estimated

610 lbs of cement per cubic yard. W/C ratios less than 0.45 (0.40 in northern climates) are recommended for durable concrete.

Test results indicate that the concrete in this structure is marginally air-entrained, well compacted, and meets ACI recommended parameters for acceptable concrete.

FACILITY DESCRIPTION AND BACKGROUND INFORMATION

WHITING STREET GARAGE

YEAR BUILT: 1963, 1979 Horizontal Expansion

PARKING CAPACITY: 290 + 300 = 500 Vehicles

The parking structure is located on the south side of Whiting Street between Florida Avenue on the west side and Morgan Street on the east side. The original (1963) construction included slab on grade plus two supported levels, extending from Florida Avenue to Marion Street, for an original total parking area of approximately 106,000 square feet to accommodate 290 parking spaces. The structure covered a footprint of 124 feet (north to south) by 288 feet (east to west).

Vehicle circulation utilized a two-way traffic pattern with 90 degree parking. In 1979, a three level horizontal expansion of the facility was constructed to the east of the original structure, extending it 200 feet to Morgan Street. This addition provided approximately 75,000 square feet of additional floor space and added 300 spaces to the parking capacity.

The primary vehicular entrances/exits to the structure are located at the east and west ends on Florida Avenue and Morgan Street. Access to the structure is by monthly permit (access card) only. A secondary access point is provided along Whiting Street, near Marion Street, on the north side of the structure. This secondary access is for city vehicles only.

The three-level structure (grade plus two supported levels) is two parking bays wide with a flat perimeter on the east, west, and north faces, and on the south face of the expansion area. A sloped south bay in the original construction area provides vertical access between floors for the original structure and the expansion. The original portion of the structure was designed to function as a single-threaded helix, while the expansion provided additional flat floor parking and utilized the original structure helix for access.

Pedestrian access is accommodated by three cast-in-place stairs, located at the northwest and northeast corners of the structure and midway along Whiting Street. There are no elevators in this structure.

The structural system consists of a 14" deep, cast-in-place conventionally reinforced concrete pan-joist system supporting a 3" thick, welded wire mesh reinforced concrete slab. The joists are supported by 18" deep cast-in-place concrete beams and columns. The joists span 32' typical interior bay widths and cantilever 15' at the centerline and perimeter.

Three north-south expansion joints are provided at each supported floor. These joints consist of two continuous steel angles with a neoprene or similar compression seal. A ½" steel cover plate is stitch-welded to the angle on one side of the joint.

BACKGROUND INFORMATION

A 1988 Condition Appraisal report by Walker Parking Consultants indicated the following items of concern:

- Roof level asphalt wearing surface was in poor condition on both the original structure and the expansion. Exposed and loose aggregate over much of the roof area. Previous patching of the surface with tar had been ineffective.
- Full-depth floor slab cracking due to volume change restraint during thermal cycling.
- Water leakage and leaching at cracks.
- Ceiling and joist spalling adjacent to leaking cracks.
- Minor floor surface spalling.
- Leakage through expansion joints in original structure area and missing sections of joint cover plate.
- Ponding water.
- Bumper wall heights below code standards at curb areas.

CAPITAL IMPROVEMENT COSTS

The Whiting Street Garage is in generally poor condition. Built in 1963 and expanded horizontally in 1979, repairs were recommended following a review in 1988. These repairs were not implemented at that time, and conditions have continued to deteriorate. The costs currently projected for this structure are summarized below.

CURRENT REPAIR COSTS

Estimated current repair costs were identified in this report to address currently identifiable, existing deterioration conditions. These costs are based on assumptions that all work will be completed in a single construction season. De-mobilization, re-mobilization, loss of efficiency, and similar factors are not included in these costs.

Current repair needs in the Whiting Street Garage are extensive at this time, and include concrete, waterproofing, mechanical, lighting, and architectural issues on all levels. Repair cost for the current conditions in this garage is expected to be approximately $1,428,000.

PHASING AND MAINTENANCE COSTS

Whiting Street Garage has the highest priority of required repairs in City parking system. We anticipate that repairs in this structure will be performed in 2006. Although some work is scheduled in 2006, most of the work in the remaining eight garages will be deferred until 2007 or later. With the volume of work to be performed, it is not feasible from financial or operational viewpoints to perform all required work in all garages simultaneously.

Although repairs in this structure are expected to be performed in 2006, this report looks at likely costs for the structure over a ten-year period. During this time, normal maintenance will be required after the major repairs are completed. This report anticipates maintenance repair costs related to normal aging of materials and equipment to assist in budgeting for annual funding. Costs for recommended enhancements, if applicable have also been included in this report.

The following table "Individual Structure Summary – 10 Year Budget Forecast" has been developed to recognize the additional costs associated with dividing and spreading out the work and also to

Individual Structure Summary
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	CURRENT REPAIRS	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Whiting Street Garage and Expansion													
1	Concrete Repairs	$ 154,500	$ 171,500	$ 154,500	$ -	$ -	$ -	$ -	$ -	$ 8,500	$ -	$ 8,500	$ -
2	Waterproofing	$ 373,500	$ 503,000	$ 373,500	$ -	$ -	$ -	$ -	$ -	$ 129,500	$ -	$ -	$ -
3	Stair/Elevator Tower Repair	$ 5,500	$ 10,500	$ 5,500	$ -	$ -	$ -	$ -	$ -	$ 5,000	$ -	$ -	$ -
4	Mechanical/Electrical/Plumbing	$ 329,000	$ 369,500	$ 329,000	$ -	$ -	$ 13,500	$ -	$ -	$ 13,500	$ -	$ -	$ 13,500
5	Architectural/Miscellaneous	$ 16,500	$ 16,500	$ 16,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6	Enhancements	$ 260,500	$ 260,500	$ 260,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
7	Contingency	$ 114,000	$ 134,000	$ 114,000	$ -	$ -	$ 1,500	$ -	$ -	$ 16,000	$ -	$ 1,000	$ 1,500
8	General Conditions	$ 91,500	$ 108,500	$ 91,500	$ -	$ -	$ 1,500	$ -	$ -	$ 13,000	$ -	$ 1,000	$ 1,500
9	Consulting & Engineering Fees	$ 82,500	$ 107,000	$ 82,500	$ -	$ -	$ 2,000	$ -	$ -	$ 19,000	$ -	$ 1,500	$ 2,000
10	Opinion of Annual Budget (2005 Dollars)	$ 1,428,000	$ 1,681,000	$ 1,427,500	$ -	$ -	$ 18,500	$ -	$ -	$ 204,500	$ -	$ 12,000	$ 18,500
11	Opinion of Annual Budget (Adjusted Future Value)		$ 1,784,000	$ 1,470,400	$ -	$ -	$ 20,900	$ -	$ -	$ 251,600	$ -	$ 15,700	$ 24,900

include predictable maintenance costs that are likely to be incurred over the selected ten-year time period.

The total forecasted ten year cost for this structure is $1,681,000. This represents $253,000 in addition to the current repair costs. This additional cost is due to maintenance over the next ten years.

The last line "Opinion of Annual Budget (Adjusted Future Value)" of the following Table, factors in an average 3% annual cost escalation to show the approximate dollar value in a given year with normal economic inflation.

RECOMMENDATIONS

The following recommendations have been developed based on our on-site review of the Whiting Street Garage and review of available documentation. Our recommendations are divided into four types: Immediate, Recommended, Maintenance, and Enhancements. Each of these is described below.

SUMMARY OF IMMEDIATE REPAIRS

Immediate Repairs address conditions of immediate concern related to structure and/or patron safety.

No safety or structural integrity conditions requiring immediate repairs were found in this facility.

SUMMARY OF RECOMMENDED CURRENT REPAIRS

We recommend the following repairs be implemented to address current deterioration in this structure:

1. Repair spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Install concrete washes along expansion joints.
3. Replace all expansion joints.
4. Remove bituminous overlay and install traffic topping at roof level.
5. Seal leaking cracks and joints.
6. Replace existing lighting system on all levels.
7. Apply concrete sealer on lower supported level.
8. Repair concrete stair treads and/or landings.
9. Repair or replace damaged drains and install supplemental drains and piping.

SUMMARY OF MAINTENANCE

We recommend the following repairs be implemented on a scheduled basis to address on-going maintenance requirements for this structure:

1. Repair miscellaneous spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Repair or replace damaged or leaking expansion joints.
3. Repair and/or recoat traffic topping at roof level.

4. Re-seal cracks and joints.
5. Repair concrete stair treads and/or landings.
6. Maintain / replace PARCS equipment as needed.
7. Repair / replace light fixtures as needed.
8. Re-lamp light fixtures bi-annually.
9. Re-paint traffic markings and maintain graphics as needed.

ENHANCEMENT OPTIONS

We recommend that the City of Tampa give consideration to implementation of the following enhancements to improve conditions in this structure:

1. Replace steel guardrail bumpers.
2. Clean and paint storm drain leaders and fire protection standpipes.
3. Clean perimeter façade panels.
4. Clean and paint or stain ceilings.
5. Install supplemental handrails.

SUMMARY DISCUSSION

The following sections provide a summary of the basis and reasoning used to develop our recommendations as well as a general discussion of observations made during the on-site review and testing results.

RECOMMENDATIONS

The recommendations have been separated into four categories based on urgency of implementation.

- **Immediate repairs** address structural integrity and/or personal safety. Immediate Repairs are considered to be urgent in nature, potentially requiring temporary shoring, barricading, and/or closing portions of a structure to reduce risk of damage or injury. These items should be implemented as soon as is practical to reduce potential for injury and liability exposure.
- **Current repairs** address existing structural, architectural, functional, and/or aesthetic conditions that need to be corrected, but can be implemented in a scheduled or phased approach.
- **Enhancements** are items identified for improvement of the structure versus return to original design. These are usually optional items for Owner consideration.
- **Maintenance** is long-term scheduled work to prolong the service life of the structure. This work is based on typical useful life of component materials and is intended to allow the materials to be replaced before general material failure occurs.

The Whiting Street Garage has extensive deterioration, but we did not find any conditions which require immediate repairs for user safety.

Extensive work is needed to address Current Repair recommendations. Concrete repairs are required at various locations throughout this structure. Although the exposure conditions in Florida are not as destructive to concrete as in northern states, cracked or spalled concrete exposes embedded steel and promotes corrosion of the steel. Corrosion of the steel accelerates the deterioration process.

A bituminous overlay installed on the roof has failed and is worn away in many areas. This allows moisture to penetrate cracks in the roof level structure, resulting in leakage into the lower levels, and corrosion of steel in supporting beams and columns.

Replacing expansion joints and installing new concrete washes reduces water ingress into the structure and provides a low-impact transition across the joint.
Much of the lighting system in the structure is not working. Nearly half of the light fixtures in the structure and on the roof are non-functional. This compromises security in the structure at night. The lighting system should be replaced with energy efficient fixtures that provide acceptable light levels and uniformity of lighting.

Enhancement recommendations address two general conditions: structure appearance and handrail height. The perimeter façade has become discolored with age and should be cleaned to provide a more attractive exterior. Painting of the ceilings has been recommended to blend appearance in the structure after concrete repairs have been completed.

Supplemental handrails have been recommended to raise the perimeter wall height to 42" to meet current building codes. Although most codes allow existing conditions to remain after codes change, it is still a potential liability.

OBSERVATIONS

The structure has a generally dark and not well maintained appearance. Many light fixtures are broken, rusted, and not functioning.

Concrete deterioration is relatively low, but delaminated concrete was found on beams, columns, floors and ceilings.

Expansion joints are failed throughout the structure and some cover plates are loose or missing. Asphalt washes installed at the center expansion joint are breaking down, resulting in a severe traffic bump.

The Roof level has remnants of a bituminous overlay. It is not functioning as a waterproofing system and water leaks through roof level cracks.

Perimeter handrails do not meet current design building codes. Railing height varies from 30" to 44'.

TESTING

Testing at the Whiting Street Garage included Petrographic Analysis of concrete cores, compressive strength testing, and chloride ion content testing. The results of the testing from 1988 are summarized below. Refer to Appendix F for detailed testing results

Compressive strength test results ranged from 3,520 to 3,640 psi, with an average of 3,580 psi. Typical design compressive strengths for floor slabs in this type of structure are in the 4,000 to 5,000 psi range.

Chloride contents from samples taken throughout the structure ranged from a low of 150 ppm at a 2" depth in all samples to a high of 340 ppm in the top inch of one sample. Average chloride content was 214 ppm. The chloride content in all samples was below that required for chloride to be the primary driver of corrosion activity.

Petrographic analysis found the concrete to be non-air-entrained with less than 1.0% air content and an air void structure rated as poor to coarse. The w/c ratio was found to be 0.52 to 0.58. W/C ratios less than 0.45 (0.40 in northern climates) are currently recommended for durable concrete, but were not established at the time this structure was built.

Test results indicate that the concrete in this structure is non-air-entrained, well compacted, and has concrete strengths common for that era of construction. Air entrainment is not a major factor in the Florida environment.

POLICE HEADQUARTERS GARAGE

FACILITY DESCRIPTION AND BACKGROUND INFORMATION

YEAR BUILT: 2001

PARKING CAPACITY: 280 Vehicles

The Police Headquarters Garage is located on the northwest corner of Kennedy Boulevard and Florida Avenue. This is a controlled access structure for use by Police Department personnel only.

The combined slab-on-grade parking plus 3-¼ supported levels provide a total parking area of approximately 109,000 square feet to accommodate 280 parking spaces.

The vehicular entrance/exit to the structure is located on the east side of the garage along Florida Avenue. All floors of the structure slope so that the structure functions as a single-threaded helix with two-way traffic for vehicular access between floors.

Pedestrian access within the structure is accommodated by a stair/elevator tower at the northwest corner and a stair tower at the southeast corner. Both of these pedestrian access points are locked from the outside at grade level.

The structural system consists of 10' wide precast pre-topped concrete double tees supported by precast concrete columns or "lightwall" panels. The precast double tees span typical bay widths of approximately 62 feet. The structure is apparently designed for future vertical expansion and embedded haunch anchorage plates are incorporated in the lightwall extensions at the roof level. A horizontal precast concrete façade is incorporated into the structure at the roof level.

CAPITAL IMPROVEMENT COSTS

The Police Headquarters Garage, built in 2001, is in generally good condition. The projected costs for this structure are summarized below.

CURRENT REPAIR COSTS

Estimated current repair costs were identified in this report to address currently identifiable, existing deterioration conditions. These costs are based on assumptions that all work will be completed in a single construction season. De-mobilization, re-mobilization, loss of efficiency, and similar factors are not included in these costs.

Current repair needs in the Police Headquarters Garage are minimal at this time, and focus primarily on waterproofing issues on the roof level. Repair cost for the current conditions in this garage is expected to be approximately $28,000.

PHASING AND MAINTENANCE COSTS

We anticipate that the work in the Police Headquarters Garage will be performed in 2006 in conjunction with the work at the Whiting Street Garage. The work involved is limited and can be readily addressed in a short time and at a minor cost and would resolve a serious leakage problem in the upper levels.

Although repairs in this structure are expected to be performed in 2006, this report looks at likely costs for the structure over a ten-year period. This report anticipates maintenance repair costs related to normal aging of materials and equipment to assist in budgeting for annual funding. Costs for recommended enhancements, if applicable have also been included in this report.

The following table "Individual Structure Summary – 10 Year Budget Forecast" has been developed to recognize the additional costs associated with dividing and spreading out the work and also to include predictable maintenance costs that are likely to be incurred over the selected ten-year time period.

The total forecasted ten year cost for this structure is $248,000. This represents an increase of $220,000 over the current repair costs. This cost increase is due to maintenance over the next ten years. No enhancements have been recommended for this structure.

The last line "Opinion of Annual Budget (Adjusted Future Value)" of the following Table, factors in an average 3% annual cost escalation to show the approximate dollar value in a given year with normal economic inflation.

Individual Structure Summary
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	CURRENT REPAIRS	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Police Headquarters Garage													
1	Concrete Repairs	$ 4,000	$ 18,000	$ 4,000	$ -	$ -	$ -	$ 7,000	$ -	$ -	$ -	$ 7,000	$ -
2	Waterproofing	$ 16,500	$ 123,500	$ 16,500	$ -	$ -	$ -	$ 80,500	$ -	$ -	$ -	$ 26,500	$ -
3	Stair/Elevator Tower Repair	$ -	$ 5,000	$ -	$ -	$ -	$ -	$ 2,500	$ -	$ -	$ -	$ 2,500	$ -
4	Mechanical/Electrical/Plumbing	$ -	$ 27,500	$ 5,500	$ -	$ -	$ -	$ 12,000	$ -	$ -	$ -	$ 10,000	$ -
5	Architectural/Miscellaneous	$ -	$ 12,000	$ -	$ -	$ -	$ -	$ 6,000	$ -	$ -	$ -	$ 6,000	$ -
6	Enhancements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
7	Contingency	$ 2,500	$ 23,000	$ 3,500	$ -	$ -	$ -	$ 13,000	$ -	$ -	$ -	$ 6,500	$ -
8	General Conditions	$ 2,000	$ 16,000	$ 2,500	$ -	$ -	$ -	$ 9,000	$ -	$ -	$ -	$ 4,500	$ -
9	Consulting & Engineering Fees	$ 2,500	$ 23,000	$ 3,500	$ -	$ -	$ -	$ 13,000	$ -	$ -	$ -	$ 6,500	$ -
10	Opinion of Annual Budget (2005 Dollars)	$ 28,000	$ 248,000	$ 35,500	$ -	$ -	$ -	$ 143,000	$ -	$ -	$ -	$ 69,500	$ -
11	Opinion of Annual Budget (Adjusted Future Value)		$ 294,000	$ 36,600	$ -	$ -	$ -	$ 165,800	$ -	$ -	$ -	$ 90,700	$ -

RECOMMENDATIONS

The following recommendations have been developed based on our on-site review of the Police Headquarters Garage and review of available documentation. Our recommendations are divided into three types: Immediate, Recommended, and Maintenance. Each of these is described below.

SUMMARY OF IMMEDIATE REPAIRS

Immediate Repairs address conditions of immediate concern related to structure and/or patron safety.

No safety or structural integrity conditions requiring immediate repairs were found in this facility.

SUMMARY OF RECOMMENDED CURRENT REPAIRS

We recommend the following repairs be implemented to address current deterioration in this structure:

1. Repair spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Seal leaking cracks and joints.

SUMMARY OF MAINTENANCE

We recommend the following repairs be implemented on a scheduled basis to address on-going maintenance requirements for this structure:

1. Repair miscellaneous spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Repair or replace damaged or leaking expansion joints.
3. Repair and/or recoat traffic topping at second level.
4. Re-seal cracks and joints.
5. Repair concrete stair treads and/or landings.
6. Maintain / replace PARCS equipment as needed.
7. Repair / replace light fixtures as needed.
8. Re-lamp light fixtures bi-annually.
9. Re-paint traffic markings and maintain graphics as needed.

ENHANCEMENT OPTIONS

No enhancement options were identified for this garage.

SUMMARY DISCUSSION

The following sections provide a summary of the basis and reasoning used to develop our recommendations as well as a general discussion of observations made during the on-site review and testing results.

RECOMMENDATIONS

The recommendations have been separated into four categories based on urgency of implementation.

- **Immediate repairs** address structural integrity and/or personal safety. Immediate Repairs are considered to be urgent in nature, potentially requiring temporary shoring, barricading, and/or closing portions of a structure to reduce risk of damage or injury. These items should be implemented as soon as is practical to reduce potential for injury and liability exposure.
- **Current repairs** address existing structural, architectural, functional, and/or aesthetic conditions that need to be corrected, but can be implemented in a scheduled or phased approach.
- **Enhancements** are items identified for improvement of the structure versus return to original design. These are usually optional items for Owner consideration.
- **Maintenance** is long-term scheduled work to prolong the service life of the structure. This work is based on typical useful life of component materials and is intended to allow the materials to be replaced before general material failure occurs.

Our review of this structure did not reveal any conditions which warranted classification as "Immediate Repair", however; it did reveal other less urgent conditions which should be addressed. Small, concrete spalls and delaminations were found at scattered locations throughout the structure. These typically occurred at tee-to-tee connetctions, at shear walls, and at tee-to-column or tee-to-beam connections. These are likely due to a combination of shallow reinforcement was present in floors or at beam and column locations and high stresses from thermal expansion and contraction of the structure. Tee-to-tee joints are typically sealed, but parallel cracks and spalls at the joints allow water to bypass the sealant. These existing conditions are included with the "Recommended Current Repairs".

Maintenance aims to prevent or reduce deterioration before it becomes a significant problem. It is based on typical service life of sealants, coatings, and similar elements. Most preventive maintenance is directed at controlling moisture access into the structure. Although

exposure conditions differ from those in northern climates, materials still degrade over time due to traffic wear, UV exposure, and temperature cycling. Typical maintenance needs that can be anticipated in this structure include:

- **Expansion Joints** –
  Expansion joint seals typically require a replacement cycle of 8 – 12 years. Limited repairs to joint seals or nosing to correct localized leakage may be anticipated on a 3-4 year cycle.

- **Re-Lamping and Lens Maintenance** –
  High intensity lamps can continue to operate while exhibiting significantly reduced light output long before the lamp actually burns out.

  High Pressure Sodium and Fluorescent lamps should be scheduled for replacement every 2 – 3 years. Metal Halide lamps should be replaced every 1-1/2 to 2 years.

  Light fixtures should be cleaned to remove accumulated dirt and insects. Lenses should be checked for yellowing and replaced as needed to prevent reduction in light output. This should be coordinated with scheduled re-lamping.

- **Parking Access and Revenue Control System** -

  PARCS equipment is exposed to heavy use (and abuse) on a daily basis. Equipment needs to be checked and worn or broken parts replaced for efficient operation.

OBSERVATIONS

Deterioration is very minor in this structure. Rain during our review confirmed that heavy leakage occurs through the roof level. Review of the roof level revealed small spalls or delaminations of the floor surface adjacent to joints and frequent occurance of cracks parallel to the tooled joints.

Lighting, mechanical, and PARCS systems all seem to be functioning well.

TESTING

Testing at the Police Headquarters Garage included Petrographic Analysis of concrete cores, compressive strength testing, and chloride ion content testing. The results of the testing are summarized below. Refer to Appendix F for detailed testing results

Compressive strength test results ranged from 3,730 to 3,980 psi, with an average of 3,855 psi. Typical design compressive strengths for floor slabs in this type of structure are in the 4,000 to 5,000 psi range.

Chloride contents from samples taken throughout the structure ranged from a low of 20 ppm at a 3" depth in all samples to a high of 130 ppm in the top inch of one sample. The chloride content in all samples was below that required for chloride to be the primary driver of corrosion activity.

Petrographic analysis found the concrete to be marginally air-entrained with 4.8% air content and an air void structure rated as coarse, but acceptable. The w/c ratio was found to be 0.45 with an estimated 610 lbs of cement per cubic yard. W/C ratios less than 0.45 (0.40 in northern climates) are recommended for durable concrete.

Test results indicate that the concrete in this structure is marginally air-entrained, well compacted, and meets ACI recommended parameters for acceptable concrete.

CONVENTION CENTER GARAGE

YEAR BUILT:

PARKING CAPACITY: 450 Vehicles

The Convention Center Garage is located within and under the Convention Center complex. This two level garage primarily serves event parking at the Center.

The combined slab-on-grade parking plus supported level provide a total parking area of approximately 205,000 square feet to accommodate 450 parking spaces.

The vehicular entrance/exit to the upper parking level is located on the north side of the garage near the intersection of Tampa and Brorein streets. A separate vehicular entrance/exit to the lower parking level is located on the southwest side along Ashley Drive. Both floors of the structure are essentially flat and two internal ramps are provided for vehicle circulation between floors.

The structural system consists of cast-in-place concrete joists at 6 feet on center supported by cast-in-place concrete columns, beams, and walls. The joists span typical bay widths of approximately 30 feet.

FACILITY DESCRIPTION AND BACKGROUND INFORMATION

CAPITAL IMPROVEMENT COSTS

The Convention Center Garage is in generally good condition. Although no repair or maintenance information was available at the time of this report, the fully enclosed facility exhibited minimal deterioration. Projected capital improvement and long-term protection (maintenance) developed in the following table are summarized below.

CURRENT REPAIR COSTS

Estimated current repair costs were identified in this report to address currently identifiable, existing deterioration conditions. These costs are based on assumptions that all work will be completed in a single construction season. De-mobilization, re-mobilization, loss of efficiency, and similar factors are not included in these costs.

Current repair needs in the Convention Center Garage are minimal at this time and focus primarily on waterproofing issues on the upper level. Repair cost for the current conditions in this garage is expected to be approximately $15,000.

PHASING AND MAINTENANCE COSTS

We anticipate that limited work in the Convention Center Garage will be performed in years 2006, 2008, and 2010.

Over the next ten years, normal maintenance will be required in addition to the phased work previously discussed. This report anticipates maintenance repair costs related to normal aging of materials and equipment to assist in budgeting for annual funding. Costs for recommended enhancements, if applicable have also been included in this report.

The following table "Individual Structure Summary – 10 Year Budget Forecast" has been developed to recognize the additional costs associated with dividing and spreading out the work and also to include predictable maintenance costs that are likely to be incurred over the selected ten-year time period.

The total forecasted ten year cost for this structure is $413,000. This represents $398,000 in addition to the current repair costs. This additional cost is primarily due to maintenance over the next ten years.

Painting of the ceiling in the upper parking level is recommended to brighten the appearance of this area.

The last line "Opinion of Annual Budget (Adjusted Future Value)" of the following Table, factors in an average 3% annual cost escalation to show the approximate dollar value in a given year with normal economic inflation.

Individual Structure Summary
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	CURRENT REPAIRS	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Convention Center Garage													
1	Concrete Repairs	$ 2,000	$ 9,500	$ -	$ -	$ -	$ -	$ 5,500	$ -	$ -	$ 4,000	$ -	$ -
2	Waterproofing	$ 8,500	$ 94,000	$ -	$ 7,500	$ -	$ -	$ -	$ -	$ -	$ 86,500	$ -	$ -
3	Stair/Elevator Tower Repair	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4	Mechanical/Electrical/Plumbing	$ -	$ 63,500	$ -	$ 20,500	$ -	$ -	$ 22,500	$ -	$ -	$ 20,500	$ -	$ -
5	Architectural/Miscellaneous	$ -	$ 8,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 8,000	$ -	$ -
6	Enhancements	$ -	$ 136,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 136,500	$ -	$ -
7	Contingency	$ 1,500	$ 38,000	$ -	$ 3,500	FALSE	$ -	$ 3,500	$ -	$ -	$ 31,000	$ -	$ -
8	General Conditions	$ 1,000	$ 25,500	$ -	$ 2,500	$ -	$ -	$ 2,500	$ -	$ -	$ 20,500	$ -	$ -
9	Consulting & Engineering Fees	$ 1,500	$ 38,000	$ -	$ 3,500	$ -	$ -	$ 3,500	$ -	$ -	$ 31,000	$ -	$ -
10	Opinion of Annual Budget (2005 Dollars)	$ 15,000	$ 413,000	$ -	$ 37,500	$ -	$ -	$ 37,500	$ -	$ -	$ 338,000	$ -	$ -
11	Opinion of Annual Budget (Adjusted Future Value)		$ 512,000	$ -	$ 39,800	$ -	$ -	$ 43,500	$ -	$ -	$ 428,200	$ -	$ -

RECOMMENDATIONS

The following recommendations have been developed based on our on-site review of the Convention Center Garage and review of available documentation. Our recommendations are divided into four types: Immediate, Recommended, Maintenance, and Enhancement. Each of these categories is described below.

SUMMARY OF IMMEDIATE REPAIRS

Immediate Repairs address conditions of immediate concern related to structure and/or patron safety.

No safety or structural integrity conditions requiring immediate repairs were found in this facility.

SUMMARY OF RECOMMENDED CURRENT REPAIR

We recommend the following repairs be implemented to address current deterioration in this structure:

1. Repair spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Repair or replace damaged or leaking expansion joints.
3. Seal leaking cracks and joints.
4. Chemical grout injection at lower level wall expansion joint.

SUMMARY OF MAINTENANCE

We recommend the following repairs be implemented on a scheduled basis to address on-going maintenance requirements for this structure:

1. Repair miscellaneous spalled or delaminated concrete on floor, column, beam, wall, and ceiling surfaces.
2. Repair or replace damaged or leaking expansion joints.
3. Re-seal cracks and joints.
4. Maintain / replace PARCS equipment as needed.
5. Repair / replace light fixtures as needed.
6. Re-lamp light fixtures bi-annually.
7. Re-paint traffic markings and maintain graphics as needed.

ENHANCEMENT OPTIONS

We recommend that the City of Tampa give consideration to implementation of the following enhancements to improve conditions in this structure:

- Paint or stain ceiling in upper level parking area.

SUMMARY DISCUSSION

The following sections provide a summary of the basis and reasoning used to develop our recommendations as well as a general discussion of observations made during the on-site review and testing results.

RECOMMENDATIONS

The recommendations have been separated into four categories based on urgency of implementation.

- **Immediate repairs** address structural integrity and/or personal safety. Immediate Repairs are considered to be urgent in nature, potentially requiring temporary shoring, barricading, and/or closing portions of a structure to reduce risk of damage or injury. These items should be implemented as soon as is practical to reduce potential for injury and liability exposure.
- **Base repairs** address existing structural, architectural, functional, and/or aesthetic conditions that need to be corrected, but can be implemented in a scheduled or phased approach.
- **Enhancements** are items identified for improvement of the structure versus return to original design. These are usually optional items for Owner consideration.
- **Preventive maintenance** is long-term scheduled work to prolong the service life of the structure. This work is based on typical useful life of component materials and is intended to allow the materials to be replaced before general material failure occurs.

Our review of this structure did not reveal any conditions which warranted classification as "Immediate Repair", however; it did reveal other minor conditions which should be addressed. Small, concrete spalls and delaminations were found at scattered locations throughout the upper level floor. These typically occurred aadjacent to expansion joints. These existing conditions are included with the "Recommended Current Repairs".

Maintenance aims to prevent or reduce deterioration before it becomes a significant problem. It is based on typical service life of sealants, coatings, and similar elements. Most preventive maintenance is directed at controlling moisture access into the structure. Although exposure conditions differ from those in northern climates, materials still degrade over time due to traffic wear, UV exposure, and temperature cycling. Although this is an enclosed parking area, some typical maintenance needs can still be anticipated, including:

- **Expansion Joints** –
  Expansion joint seals typically require a replacement cycle of 8 – 12 years. Limited repairs to joint seals or nosing to correct localized leakage may be anticipated on a 3-4 year cycle.

- **Re-Lamping and Lens Maintenance** –
  High intensity lamps can continue to operate while exhibiting significantly reduced light output long before the lamp actually burns out.

  High Pressure Sodium and Fluorescent lamps should be scheduled for replacement every 2 – 3 years. Metal Halide lamps should be replaced every 1-1/2 to 2 years.

  Light fixtures should be cleaned to remove accumulated dirt and insects. Lenses should be checked for yellowing and replaced as needed to prevent reduction in light output. This should be coordinated with scheduled re-lamping.

- **Parking Access and Revenue Control System** -

  PARCS equipment is exposed to heavy use (and abuse) on a daily basis. Equipment needs to be checked and worn or broken parts replaced for efficient operation.

OBSERVATIONS

The lower level of this garage is in very good condition. No deterioration of the ceiling or beam surfaces was found. Soil infiltration was found at a wall expansion joint.

Upper level floor surfaces are in generally good condition also. Minor concrete spalls and cracks in the nosing were found in a few locations along expansion joints.

TESTING

No testing was performed in this structure.

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INTRODUCTION

The following discussion provides information describing typical types of reinforced concrete deterioration. Concrete deterioration generally falls into one of several major categories: corrosion induced spalling, scaling, cracking, and leaching. Concrete deterioration caused by corrosion of reinforcement steel is prevalent throughout the country. The information regarding scaling deterioration due to freeze-thaw cycling is most applicable to the northern tier states, whereas weathering deterioration due to moisture and temperature cycling is applicable in the southern or mild climate states. Joint deterioration is also included in this discussion because it generally contributes to concrete distress. These deterioration mechanisms are, to varying degrees, the cause of the durability problems experienced by many of today's parking structures.

REFER TO PARKING STRUCTURE DETERIORATION CURVE, PAGE A-12

ELEMENT	ATOMIC NO.	ATOMIC RADIUS	IONIC RADIUS
Cl^-	17	0.99Å	1.81Å
Ca^+	20	1.97Å	0.99Å
Na^+	11	1.86Å	0.95Å

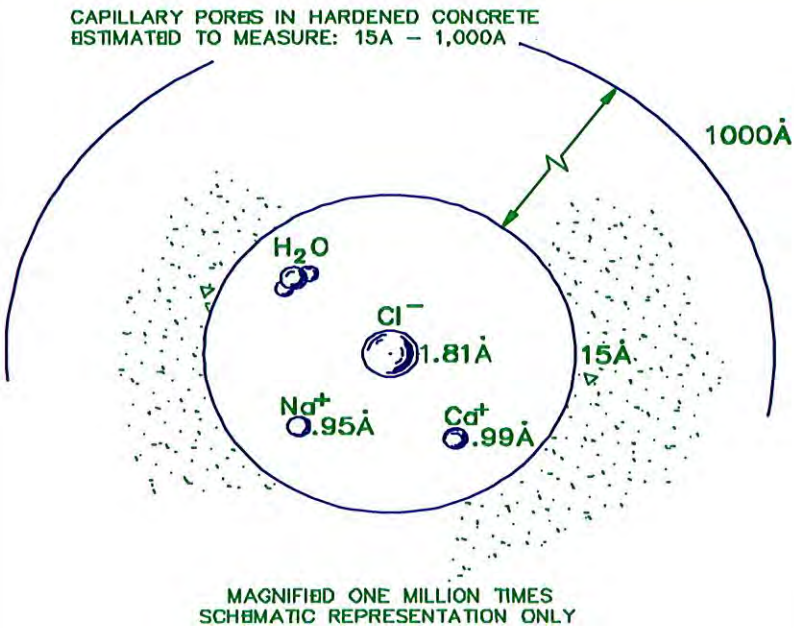


FIGURE A1 – CHLORIDE IONS AND CAPILLARIES

CORROSION-INDUCED CONCRETE SPALLING

Spalls in reinforced concrete surfaces are usually dish shaped cavities with varying depths and surface areas. Spalls can occur individually or in-groups covering several hundred square feet.

Spalling is preceded by fractures called delaminations. Delaminations are horizontal splitting, cracking or separation of the concrete slab in a plane roughly parallel to, and generally near the upper surface of the concrete. Delaminations are found frequently in bridge deck and parking facilities. The delamination is generally caused by the corrosion of reinforcing steel or by freezing and thawing. Fractures originate at corrosion damaged reinforcement or other embedded metal and migrate to the nearest surface. Freeze-thaw, traffic action and additional corrosion influence the rate of fracture migration and spall development.

STEEL REINFORCEMENT RUSTING THROUGH CONCRETE BEAM

CONTAMINATION

Concrete is a naturally porous material. Excess water, not required for hydration, eventually dries leaving behind an interconnected network of pores. Concrete pores have diameters ranging from 15 to 1,000 Angstroms. See Figure A-1.

The chloride ion diameter is less than 2 Angstroms. Penetration of chloride ions into concrete, and subsequent accumulation, occurs readily on surfaces exposed to deicing salts, wetting and drying and freeze-thaw cycles. Essentially all concrete is susceptible to chloride ion contamination by virtue of its natural porosity.

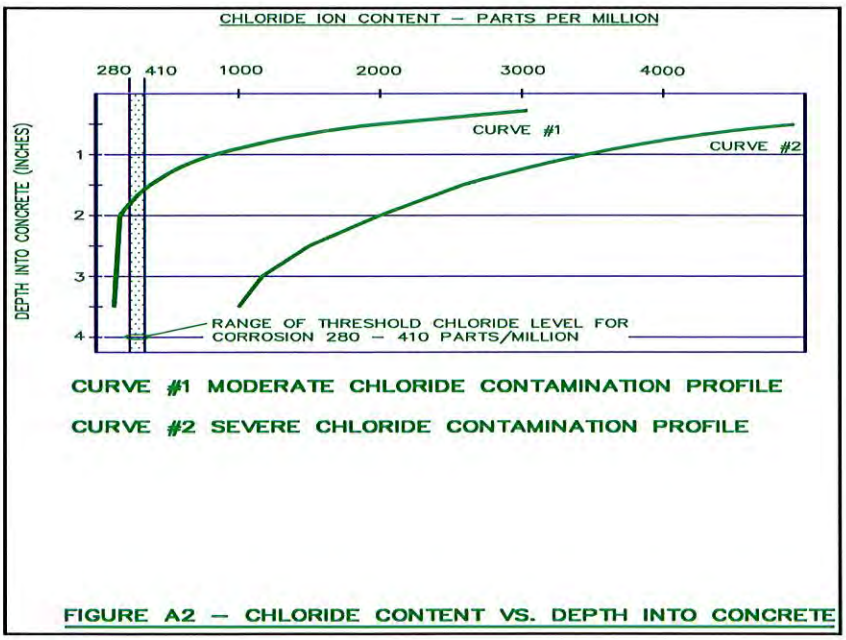
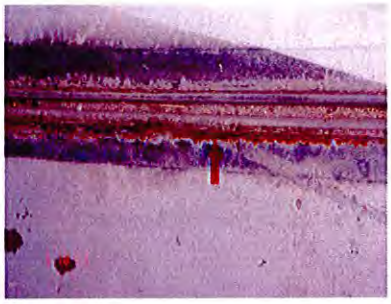


FIGURE A2 – CHLORIDE CONTENT VS. DEPTH INTO CONCRETE



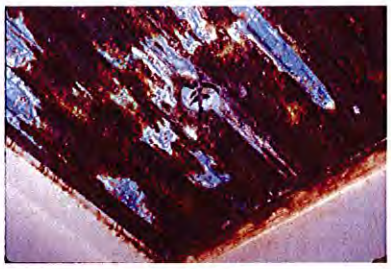
EXPANSION JOINT CORROSION

A thin oxide film remaining after manufacturing and the passive effect of highly alkaline concrete usually protects reinforcement embedded in concrete. Chloride ions can penetrate all types of concrete and accumulate in sufficient quantities to initiate corrosion of embedded reinforcement. Research indicates that corrosion begins when chloride accumulation exceeds 280 to 410 parts per million in the concrete. See Figure A-2.

UNDERSIDE SLAB LEACHING

CORROSION

Metallic corrosion is a dynamic electro-chemical process and induces progressive deterioration. Corrosion by-products (rust) occupy a volume at least 2.5 times that of the parent metal. The expansion causes high tensile stress, which cracks ("delaminates") the surrounding concrete. Initial cracking can occur when section loss of the parent metal is five percent or less. Cracks first appear vertically over the reinforcement nearest the exposed surface. These cracks allow direct access of moisture and additional chloride to the reinforcement, causing accelerated corrosion and subsequent delamination.



METAL DECK CORROSION

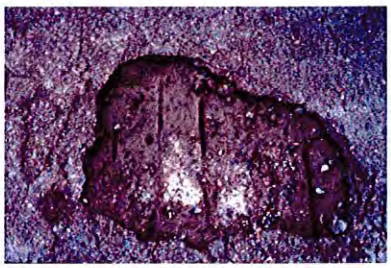
CORROSION INDUCED DISTRESS

The impact that corrosion has on a structural member is variable. Three things happen, all of which are detrimental to the structural integrity:

a. Surface spalling causes maintenance and serviceability problems. See Figure A-3.

b. The reinforcement loses significant cross-section and stress redistribution occurs throughout the remaining reinforcement. It is also typical that concrete cross-section loss, in addition to reduction in reinforcement area, impairs the load carrying capacity of individual floor, slab, beam and column systems.

c. The reinforcement debonds from the concrete causing loss of monolithic interaction. The progressive movement of reinforcement as a result of corrosion induced jacking, especially on columns, can reduce load carrying capacity. See Figure A-4



FLOOR SLAB SPALLING

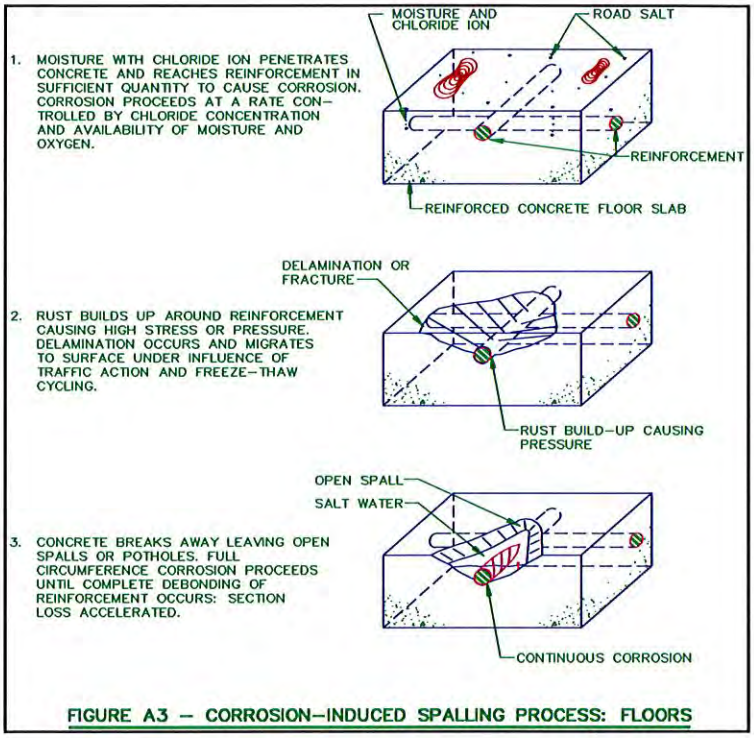


FIGURE A3 – CORROSION–INDUCED SPALLING PROCESS: FLOORS

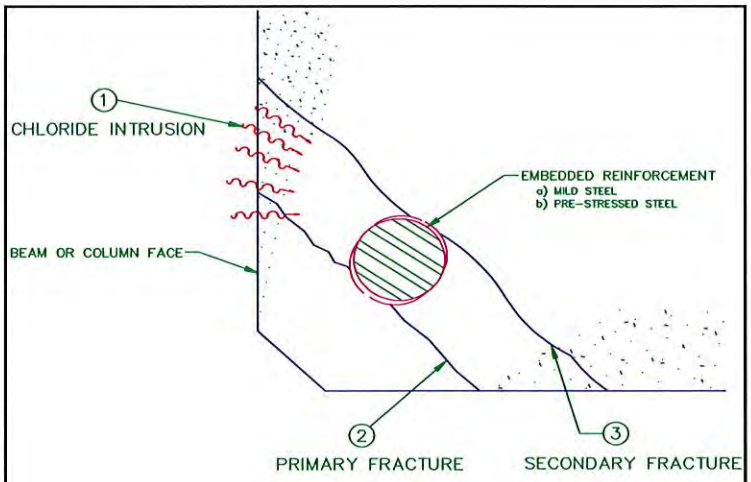


FIGURE A4 – SPALL DEVELOPMENT–BEAMS/COLUMNS

The bottom reinforcement corrodes similar to the top. Surface spalling near mid-span reduces the concrete section as a function of spall depth. Concrete section reduction at mid-span can significantly reduce the structural capacity of the concrete member. At the same time, severe corrosion of bottom reinforcement can result in over stressing and possible reinforcement yielding or failure.

SCALING

Scaling is characterized by progressive deterioration of the concrete surface through paste (sand/cement) failure. It results from the disruptive forces generated in the paste when the concrete freezes. Scaling is common in those areas of the continent subject to freeze/thaw cycling.

Scaling begins with a slight surface flaking, which becomes deeper with continuing exposure. Initially, only the surface texture and small amounts of paste are eroded. Eventually, however, coarse aggregate is exposed, and larger surface areas are affected.
See Figure A-5.

Scaling can significantly impair the serviceability of concrete intended as driving or walking surfaces.

Concrete is naturally porous. Excess water not required for hydration (hardening), but needed for workability during mixing, placement, consolidation and finishing eventually dries, leaving behind a continuous network of pores and capillaries. This network gives concrete its porosity. Porosity, or "permeability" is generally high for concrete mixes with a high water/cement ratio and low for mixes with a low water/ cement ratio.

High porosity allows the concrete to absorb significant free water during exposure to rain or snow. If concrete becomes saturated during a freeze cycle, ice accumulates in the pore structure.

The destructive mechanism is not ice accumulation itself, but rather pressure generated during ice development. Water migration through the pore network exerts significant pressures during freezing. It has been substantiated that water pressures cause the paste failure.

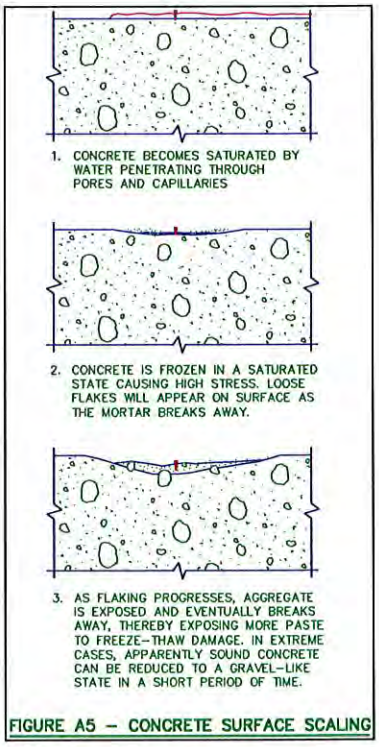


FIGURE A5 – CONCRETE SURFACE SCALING

INFLUENCING FACTORS

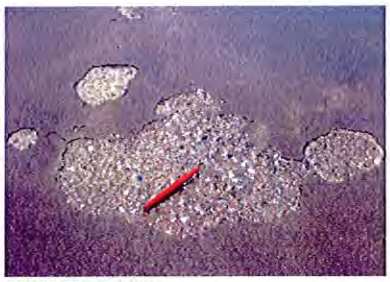
There are a number of factors that influence the nature and extent of scaling on concrete surfaces. The following discussion is not intended to convey any particular order of importance for the factors reviewed. There are two categories of influencing factors.

The first category defines and describes those factors related to the service environment. Factors associated with the environment are number and intensity of freeze-thaw cycles, presence of deicer chemicals and degree of saturation.

NUMBER AND INTENSITY OF FREEZE-THAW CYCLES

As previously discussed, freezing is the principal cause of scaling. If there were no freeze-thaw cycles, scaling could not occur. It has been established that the number of freeze-thaw cycles directly influences the deterioration rate. For similar concretes subjected to equivalent degrees of saturation, concrete exposed to the higher number of freeze-thaw cycles will disintegrate earlier and more severely than concrete subjected to fewer freeze-thaw cycles.

In addition to the number of cycles, the rate or cycle intensity is also significant. Rapid freeze-thaw cycling is far more destructive to concrete than slow freeze-thaw cycling owing to redistribution of pressures in the concrete matrix. Concrete surfaces exposed to direct sunlight during winter periods are subject to more frequent and rapid cycling than concrete that is exposed to ambient temperatures, but shaded from direct sunlight.



SURFACE SCALING

PRESENCE OF DEICER CHEMICALS

The impact which deicer chemicals (salt) have on scaling is both mechanical and chemical. High concentrations of salt depress the pore water freezing point and increase the osmotic pressures that cause paste failure. In addition, high salt concentrations can set up a counter system of pressures caused by the alkaline/acid relationships between the concrete and pore water, respectively. It has also been speculated that desiccation of the salt water occurs. In a typical freezing cycle, the fresher (less salty) water tends to rise toward the surface of the concrete and freezes first, trapping the more heavily salted water below the surface, where it freezes later. Because it is trapped, the salt water exerts increased pressure when it does freeze.

HEAVY SURFACE SCALING

DEGREE OF SATURATION

As previously discussed, excess water is required within the pore network during freezing to induce disruptive pressures. Concrete that is relatively dry and subject to freeze-thaw cycling experiences minimal disruption. Continually moist concrete will disintegrate rapidly during freeze-thaw cycling because the water cannot escape without generating disruptive pressures.

The second category of influencing factors is that associated with the particular concrete and its design features. Material properties that greatly influence the susceptibility of concrete to scaling are air entrainment, strength, water/cement ratio and the mix design.

AIR ENTRAINMENT

Air entrainment has been used successfully for the past 40 years to protect concrete against scaling. Air entrainment consists of a uniform dispersion of small bubbles in the paste matrix. These bubbles compete with the pore network for water during freezing and thus relieve the destructive pressures. Research has shown that the bubbles must have a particular size and spacing to be effective at protecting concrete.

STRENGTH

In addition to air entrainment, the development of minimum strength prior to the first frost exposure is needed to insure adequate resistance against freeze-thaw damage. Concrete strength must be at least 3500 psi prior to exposure to the freezing cycle if it is to remain durable in service. Properly air entrained concrete that has not gained sufficient strength before freezing will be subject to premature freeze-thaw deterioration.

WATER-CEMENT RATIO

As previously discussed the water-cement ratio directly influences concrete porosity (permeability). Highly permeable concretes are more susceptible to rapid saturation than are those of lower permeability. Concrete has a certain tolerance for moisture. Moisture diffusion within a relatively dry matrix can influence the concentrations of water and can minimize saturation, thus preventing premature deterioration.

MIX DESIGN

Design of the concrete mix, especially the cement factor, water-cement ratio and use of maximum size coarse aggregate fraction can enhance long term durability. The mix design should be tested prior to concrete placement in order to insure that the air system specified is achieved during construction. It is common to find differences between the

specified and measured air entrainment in the plastic concrete and in the air content of the finished hardened slab.

Concrete design details and concepts also influence susceptibility to scaling. Concrete floor surfaces or pavements subjected to frequent freezing and deicer chemical application can be designed to drain rapidly, minimizing critical saturation potential. Parking facility floor slabs designed with a minimum one-and-one-half percent grade will rapidly drain and will be inherently less susceptible to scaling due to the limited potential for saturation. Well designed gradients for drainage and an adequate number of surface drains will eliminate excess water and keep the pavement fairly dry. Floor slabs that are unusually flat or have few drains will experience rapid destruction due to their high potential for saturation.

The above discussion is intended to provide an overview of the scaling process and familiarize the reader with those conditions which impact upon this distress mechanism and its influence on structural members. A more detailed discussion is provided in the American Concrete Institute (ACI) Committee Report entitled "Guide to Durable Concrete", ACI 201.2R-77. Please refer to that document for additional information.

CRACKING

Concrete cracking is caused by stress. This stress is either construction or service related. Cracking commonly attributed to construction is caused by improper concrete placement, consolidation, and/or curing; premature removal of forms; or by plastic shrinkage of the concrete. Service related cracking is usually due to the temperature changes, load, settlement, or internal stresses. Corrosion of reinforcement and aggregate chemical reaction are common causes of internal stress.

Not all cracking is detrimental to the concrete member. In many cases, cracks are anticipated and reinforcement is provided to transfer stress across the cracks. Properly positioned reinforcement arrests crack development by keeping cracks short and tightly closed. Cracking can be detrimental when it occurs to an extent and with a frequency not expected. If this happens, steps are necessary to minimize the effect cracking has on long-term structure durability.

LEACHING

Leaching is caused by frequent water migration through cracks. As water migrates through, it carries along part of the cementing constituents, depositing them as a white film, stain, or in extreme cases, stalactites on the ceiling below. This process will weaken the concrete over a period of years and is accelerated by porous or perpetually moist concrete. Leaching frequently occurs from cracks at gutter lines.

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JOINT DETERIORATION

The two most common provisions made for crack control (relief of restraint) in concrete slabs are control joints and expansion joints. Such joints have long been a cause of maintenance problems. Joints on supported floor slabs must be sealed against water leakage and against intrusion of sand and dirt. Both situations are damaging to the joint system.

Construction joints deteriorate for several reasons, which are usually associated with failure of the sealant or the adjacent concrete. Joint sealants may not have the required degree of flexibility, bond, strength, or durability for a particular application. If concrete adjacent to the joint is not sufficient durable, then local scaling will cause joint sealant adhesion failure.

EXPANSION JOINT

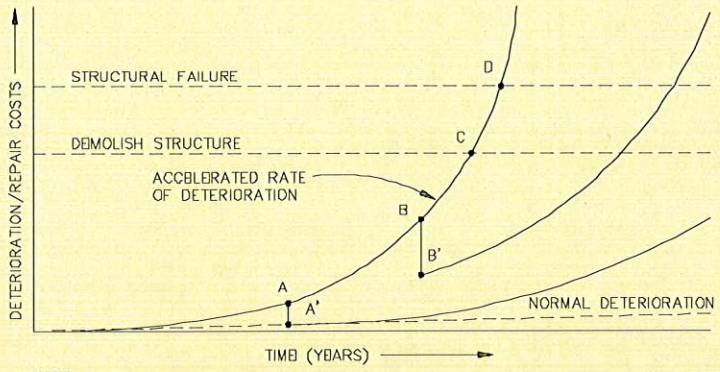
Expansion joints are also susceptible to premature deterioration. The most common causes of early deterioration are: joint design or sealant material selection, incorrect installation of the expansion device, and/or in-service damage from traffic, snowplows or vandalism.

Parking structures are somewhat similar to the human body in that if they are properly constructed and cared for from the beginning, they will with few exceptions, provide a long and useful service life. The figure below illustrates this point.

The first curve illustrates the difference between a parking structure's normal life span if no maintenance/repair is done versus a parking structure that receives proper and appropriate maintenance/repair over the course of its life span (normal deterioration). Points A and B represent the affect that an effective program of maintenance and repair has on a parking structure's useful service life. points C and D represent the extreme results of the absence of an appropriate maintenance/repair program.

JOINT ON SUPPORTED FLOOR SLAB

Parking Structure Deterioration Curve



NOTE:

1. Points A – D represent stages of accelerated deterioration in parking structures.
2. Structures repaired at point A cost less overall and last longer than structures repaired at point B. [Compare curve A' to B']

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

AIR ENTRAINMENT: The inclusion of air in the form of minute bubbles, (generally smaller than 1 mm), during the mixing of concrete to help prevent scaling.

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

CORROSION: Disintegration or deterioration of concrete 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.

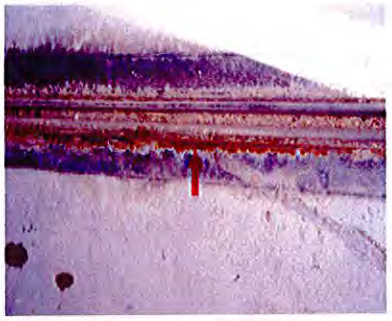
DETERIORATION: Disintegration or chemical decomposition of a material during service exposure.

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.

DURABILITY: The ability of concrete to resist weathering action, chemical attack, abrasion, and other conditions of service.

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

ENTRAINED AIR: Microscopic air bubbles intentionally incorporated in concrete during mixing by the use of chemical agents or specialty cement.



EXPANSION JOINT CORROSION

CONCRETE WAFFLE SLAB CORROSION

CRACKING

ENTRAPPED AIR: Air voids in concrete that are not purposely entrained and which are significantly larger and less useful than those of entrained air.

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

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.

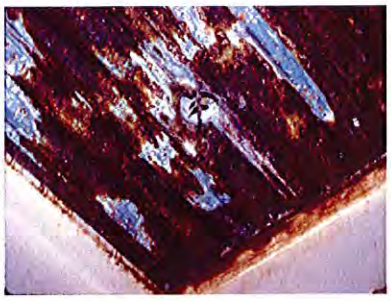
PACHOMETER: Instrument for nondestructively locating and estimating concrete cover and/or diameter of embedded reinforcement.

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.

PITTING: Development of relatively small cavities in a surface, due to phenomena such as corrosion or cavitation, or, in concrete, localized disintegration. (See also POPOUT)

PLASTIC CRACKING: Cracking that occurs in the surface of fresh concrete soon after it is placed and while it is still plastic.



METAL DECK CORROSION

POPOUT

POPOUT: The breaking away of small portions of concrete surface due to internal pressure which leaves a shallow, typically conical, depression.

PRECAST CONCRETE: Concrete cast elsewhere than in its final position.

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.

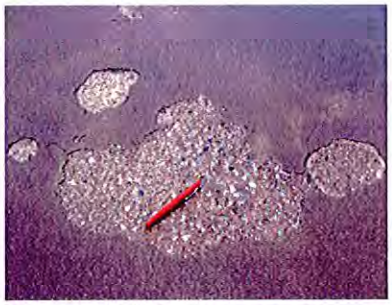
REINFORCEMENT: Bars, (smooth or deformed), wires, strands, tendons and other elements that are embedded in concrete in such a manner that reinforcement and concrete act together to resist applied forces.

> *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.

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

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.).



SURFACE SCALING

HEAVY SURFACE SCALING

SHORT SPAN: A structural system that doesn't span the full parking module, resulting in columns between parked vehicles.

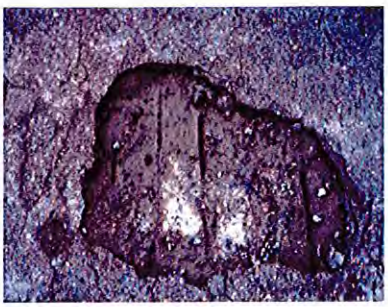
SHOTCRETE: Process in which all ingredients, including mixing water, are mixed before introduction into the delivery hose; it may be pneumatically conveyed or moved by displacement.

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.

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.

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.

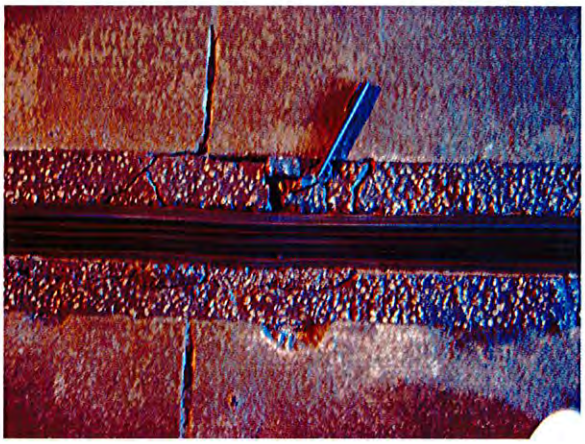


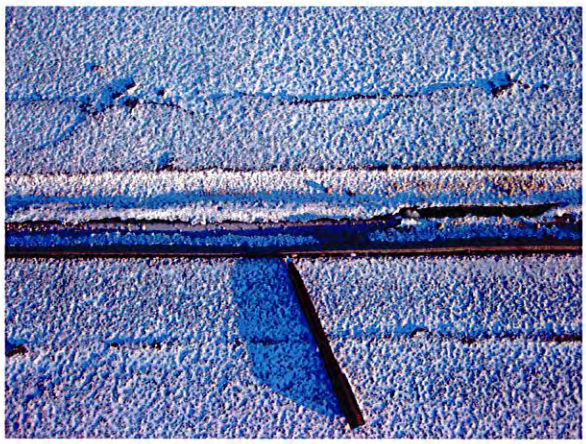
FLOOR SLAB SPALLING

FORT BROOKE GARAGE

EXTERIOR VIEWS

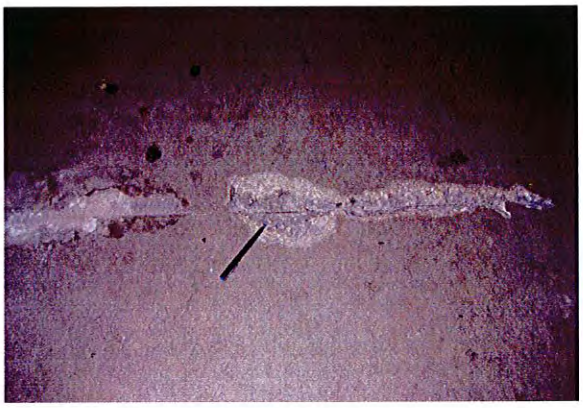
FORT BROOKE GARAGE





DAMAGED / DETERIORATED EXPANSION JOINTS

FORT BROOKE GARAGE



MISCELLANEOUS CONCRETE DETERIORATION

TWIGGS STREET GARAGE

FLOOR SCALING

DEBONDED TOPPING

SPALLING OVER SHALLOW REINFORCEMENT

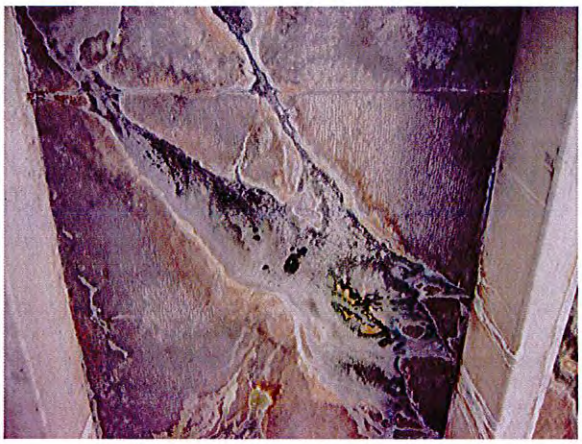
CONCRETE SURFACE DETERIORATION

TWIGGS STREET GARAGE

PERIMETER BEAM DETERIORATION

PERIMETER HANDRAIL

TWIGGS STREET GARAGE

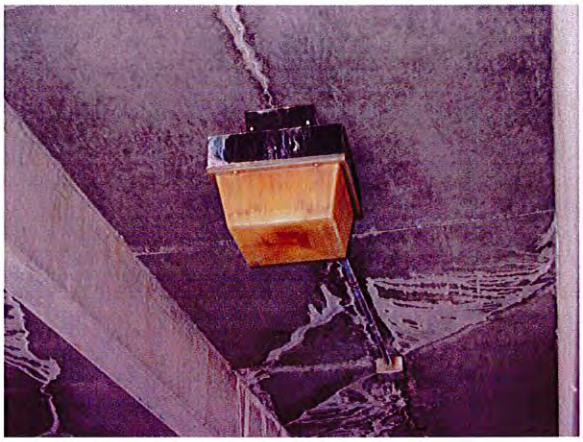


THROUGH-SLAB LEAKAGE

TWIGGS STREET GARAGE

EXPANSION JOINT NOSING DETERIORATION

DOOR FRAME CORROSION



DISCOLORED LIGHT FIXTURE LENS

MISCELLANEOUS CONDITIONS

TWIGGS STREET GARAGE

BROKEN DRAIN GRATE

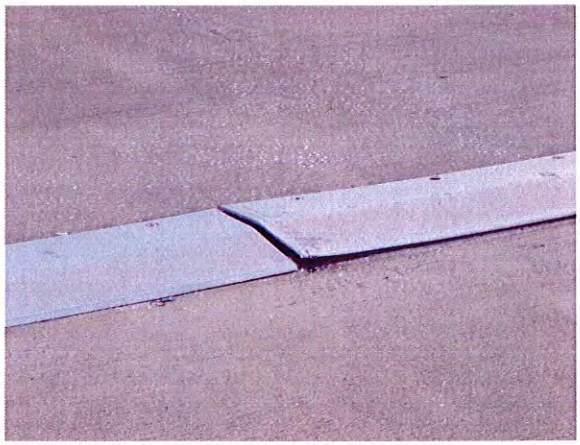
ACCUMULATED DEBRIS AND VEGETATION

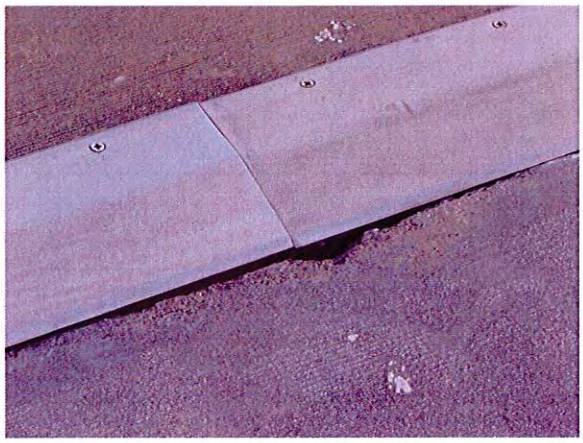
DRAIN CONDITIONS

SOUTH REGIONAL GARAGE

EXTERIOR VIEWS

SOUTH REGIONAL GARAGE





JOINT COVER DAMAGE AND LEAKAGE AT EXPANSION JOINTS

WILLIAM F. POE GARAGE

CASS STREET

CASS STREET

ASHLEY DRIVE

EXTERIOR VIEWS

WILLIAM F. POE GARAGE

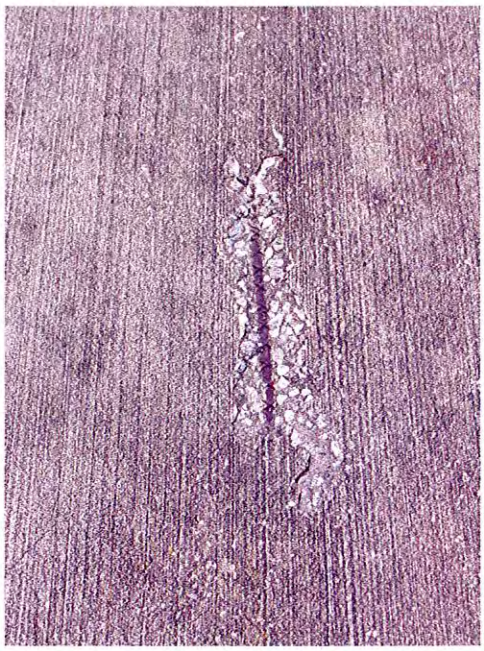
STEEL COLLARS AND CONCRETE SPALLING AT CAZALY HANGERS

WILLIAM F. POE GARAGE

ROOF LEVEL OVERVIEW

NEW EXPANSION JOINT

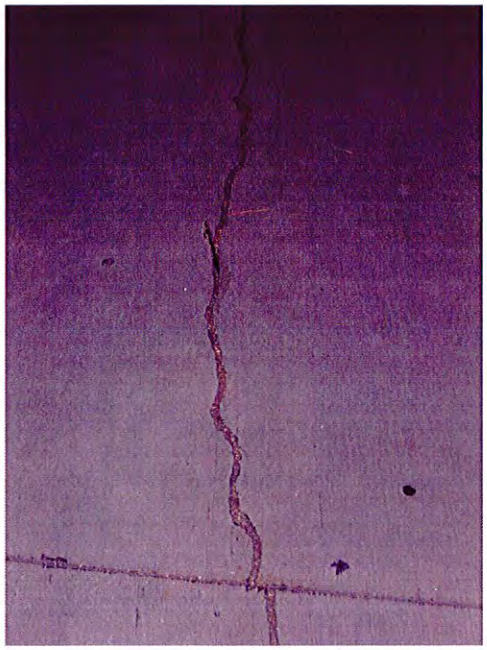
SAWN TOPPING JOINTS

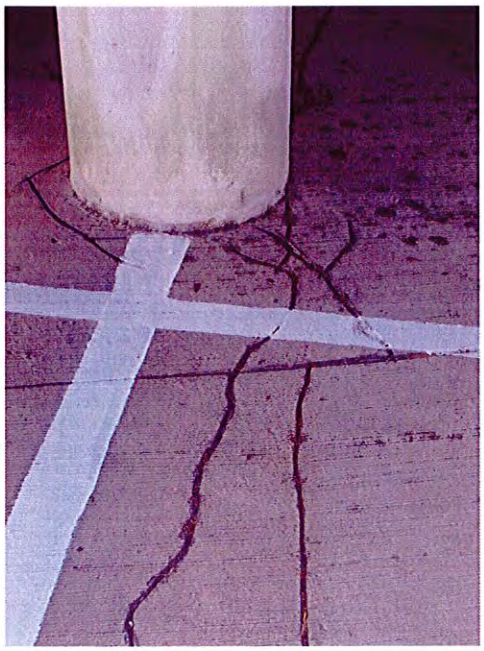


SHALLOW DELAMINATION

ROOF LEVEL CONDITIONS

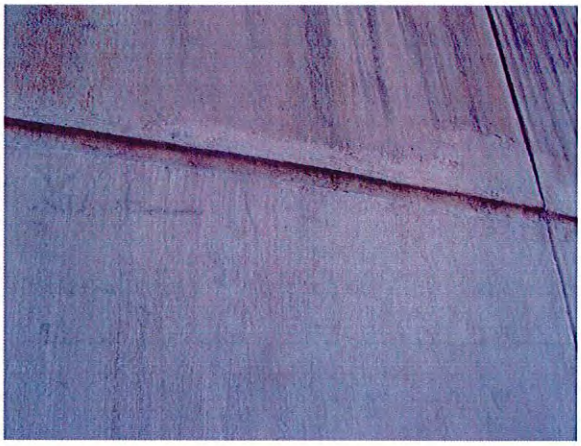
WILLIAM F. POE GARAGE





FLOOR SLAB CRACKING

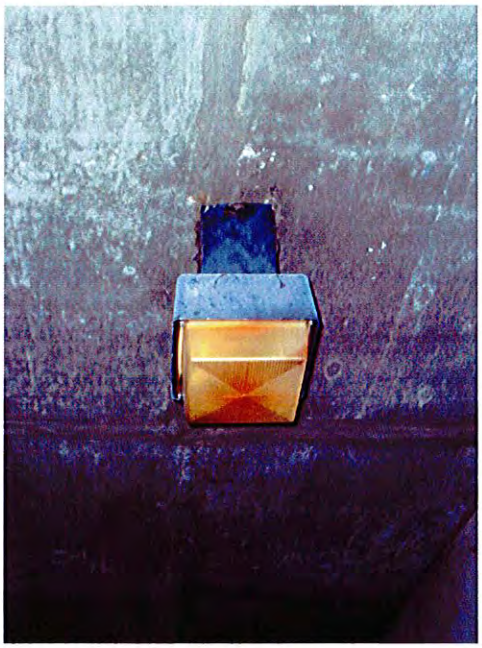
WILLIAM F. POE GARAGE



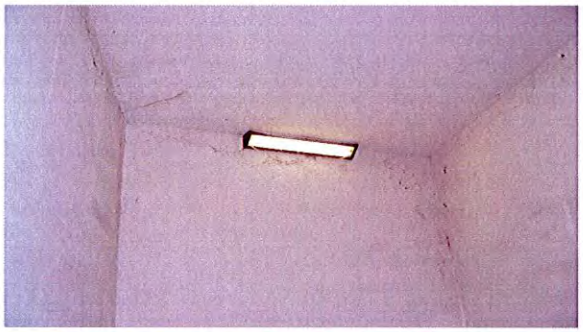
FAÇADE STAINING

WILLIAM F. POE GARAGE

ROOF LEVEL POLE LIGHTS



INTERIOR LIGHTS



STAIR TOWER LIGHTS

TYPICAL LIGHTING

WILLIAM F. POE GARAGE

HEAVY CORROSION ON DRAIN PIPING

PONDING WATER @ STAIRTOWER LANDINGS

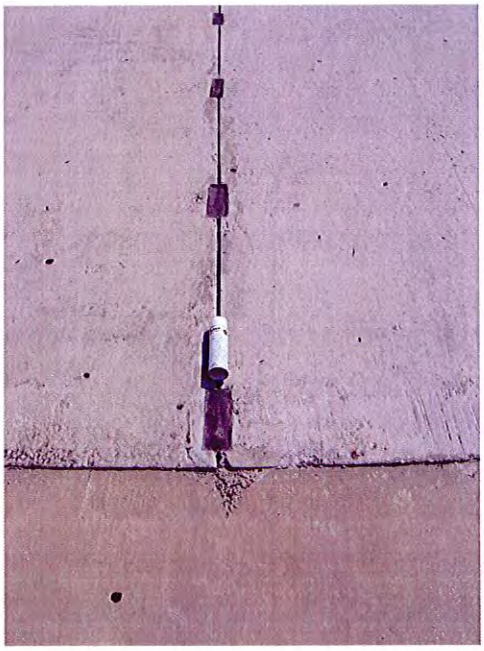
TYPICAL SIGNAGE

MISCELLANEOUS CONDITIONS

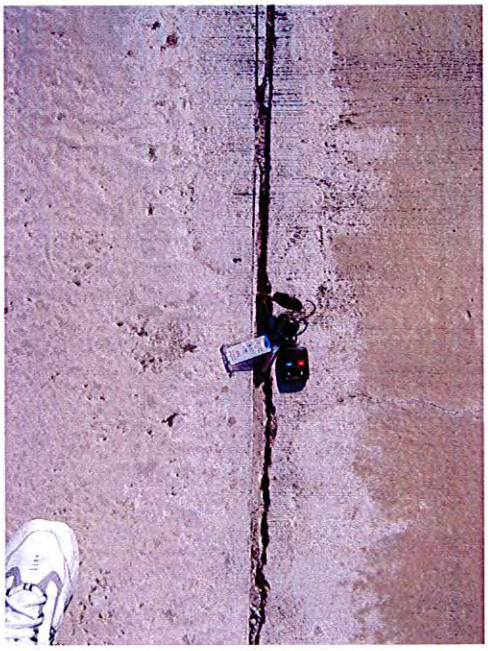
CENTRO YBOR GARAGE

EXTERIOR VIEWS

CENTRO YBOR GARAGE



TEE-TEE CONNECTIONS AT PRE-TOPPED TEES

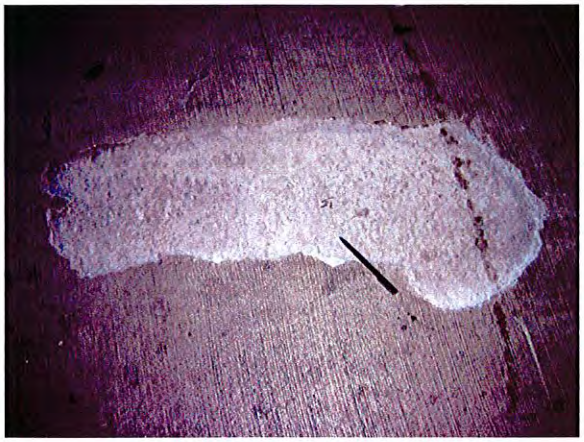


FAILED SEALANT AT FLOOR CRACKS AND JOINTS

CENTRO YBOR GARAGE

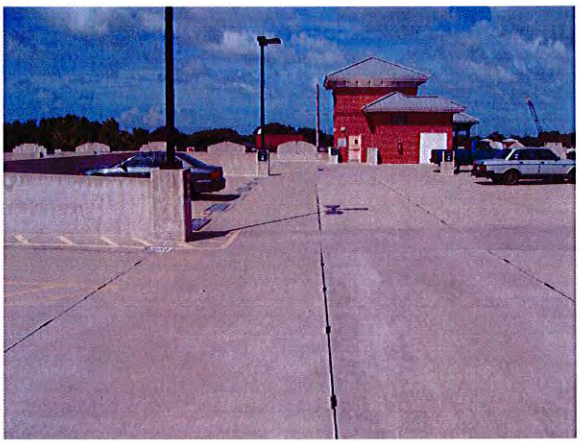
SPALLED FLOOR SLAB CONNECTIONS AT COLUMNS AND SHEAR WALLS

CENTRO YBOR GARAGE



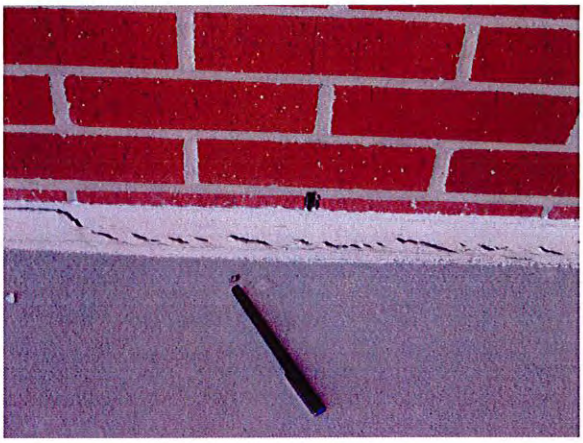
MINOR SPALLING AT CONCRETE WALLS AND FLOOR SURFACES

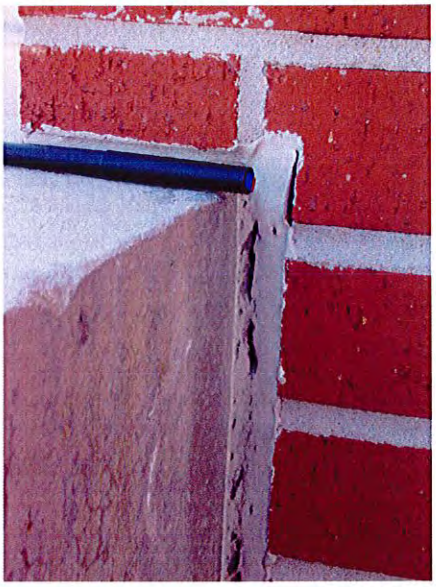
PALM AVENUE GARAGE

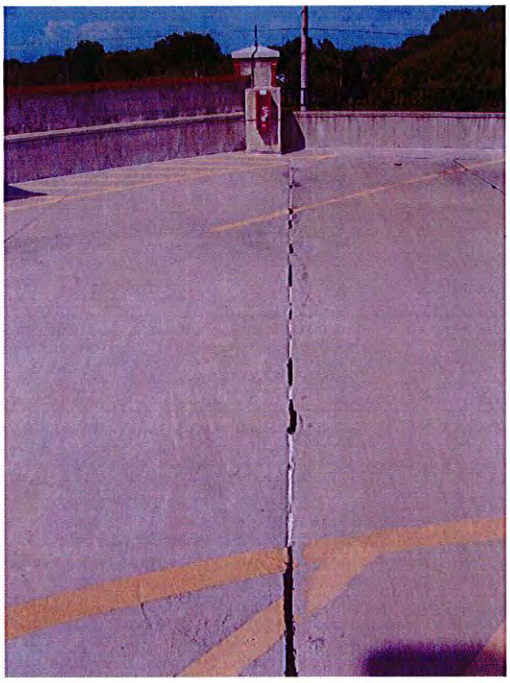


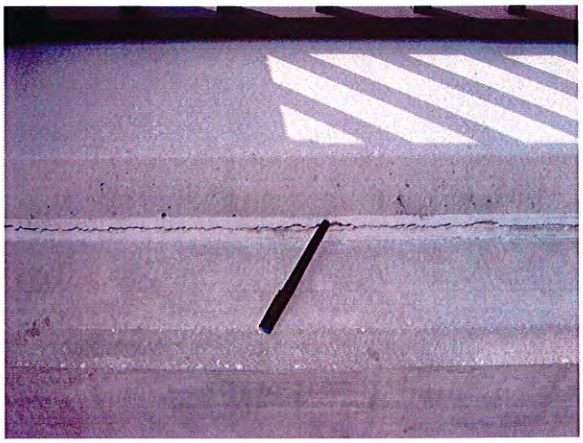
EXTERIOR AND ROOF LEVEL VIEWS

PALM AVENUE GARAGE



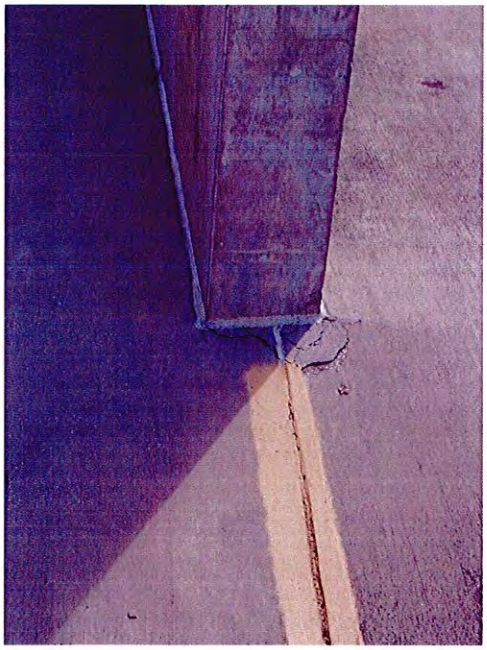


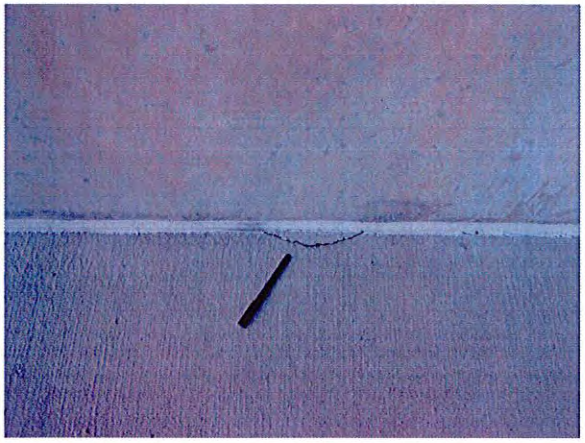




SEALANT FAILURE AT FACADE JOINTS, FLOORS, AND CURBS

PALM AVENUE GARAGE



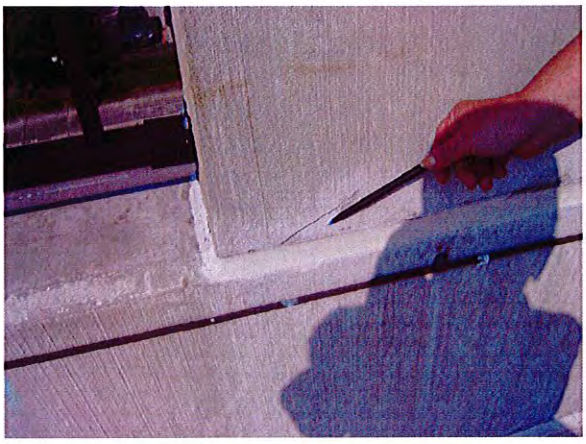


CONCRETE FLOOR DETERIORATION AT CONNECTIONS

PALM AVENUE GARAGE

CRACKING @ MORTAR JOINTS

SPALLING @ HANDRAIL SUPPORT



CRACKING @ FAÇADE PANEL

SPALLED BRICK FACE

TYPICAL FAÇADE DETERIORATION

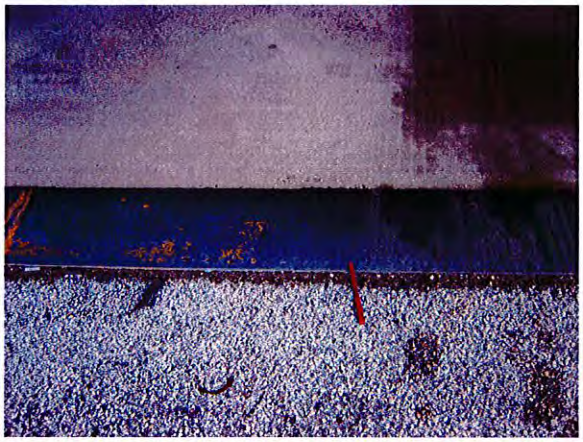
WHITING STREET GARAGE

EXTERIOR AND INTERIOR VIEWS

WHITING STREET GARAGE

ROOF LEVEL FLOOR SURFACE DETERIORATION

WHITING STREET GARAGE



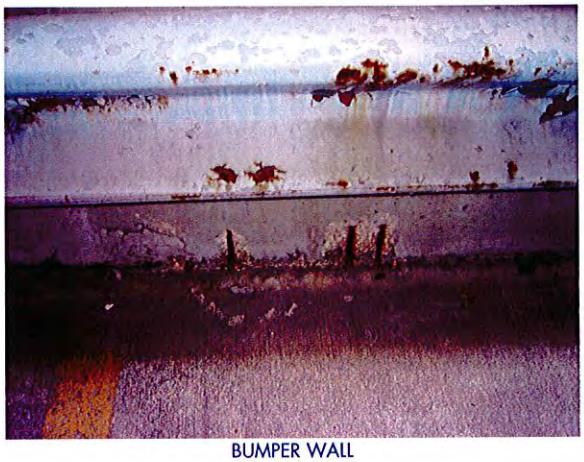
EXPANSION JOINT DETERIORATION

WHITING STREET GARAGE

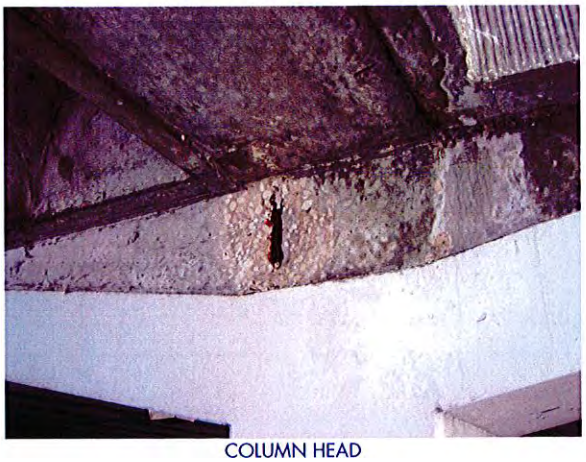
PONDING WATER AND THROUGH-SLAB LEAKS

WHITING STREEET GARAGE

BEAM SOFFIT



BUMPER WALL



COLUMN HEAD

SHALLOW CONCRETE SPALLING

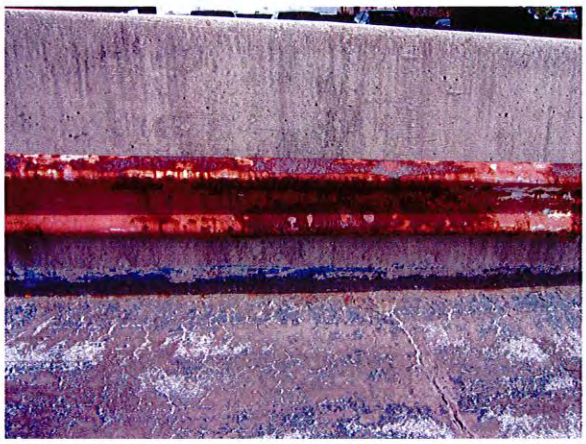
WHITING STREET GARAGE

LOW BARRIER WALL / RAILING CONDITIONS

WHITING STREET GARAGE

TYPICAL DEFECTIVE LIGHTING FIXTURE

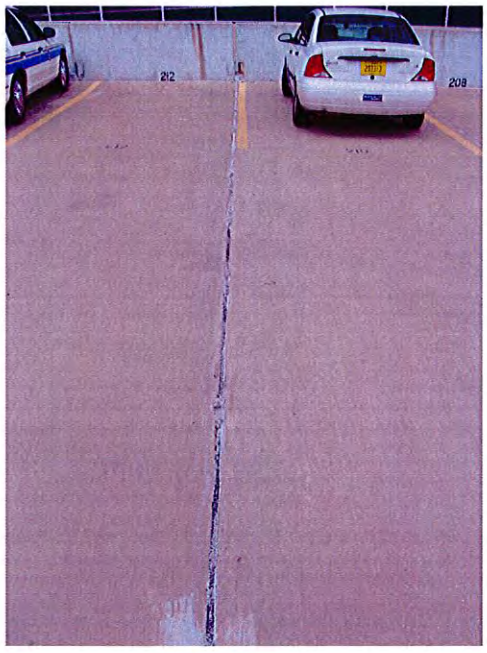
WASH AT EXPANSION JOINT



CORRODED BUMPER RAIL

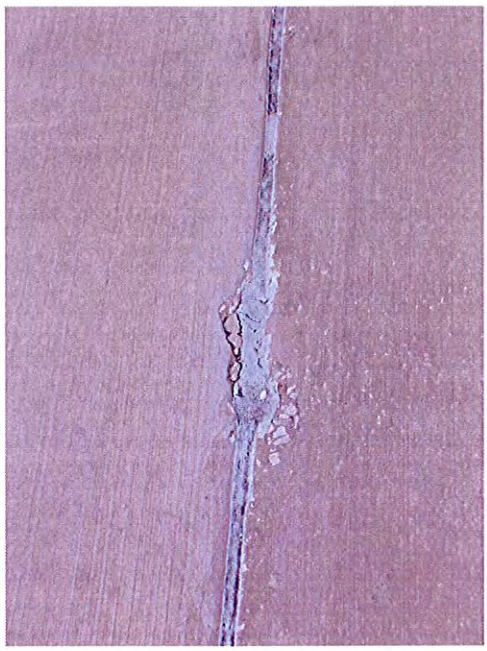
MISCELLANEOUS CONDITIONS

POLICE HEADQUARTERS GARAGE



EXTERIOR AND ROOF LEVEL VIEWS

POLICE HEADQUARTERS GARAGE



JOINT EDGE AND SEALANT DETERIORATION

POLICE HEADQUARTERS GARAGE

TYPICAL LIGHT FIXTURES AND HANDRAILS

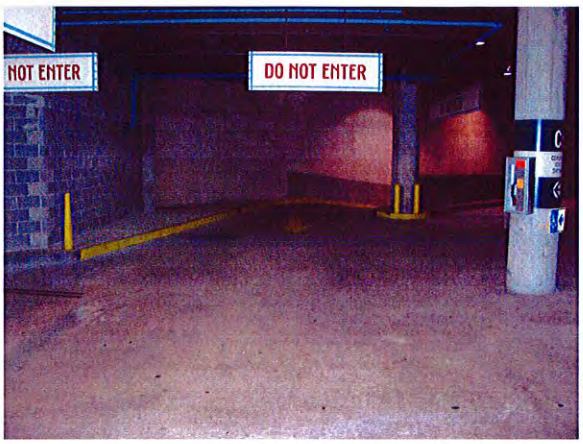
CONVENTION CENTER GARAGE

LOWER LEVEL VEHICLE ENTRY / EXIT

CONVENTION CENTER GARAGE

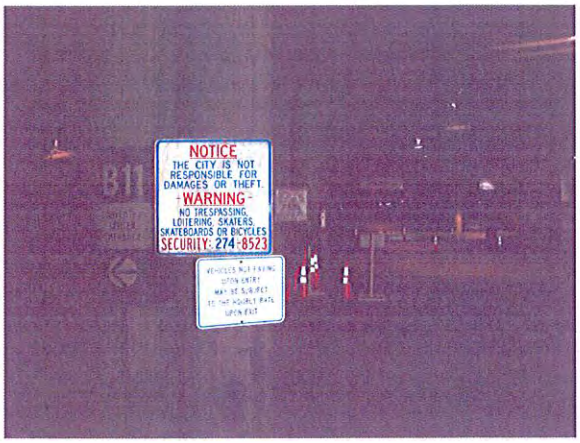
LOWER LEVEL PARKING & UPPER LEVEL FRAMING

CONVENTION CENTER GARAGE



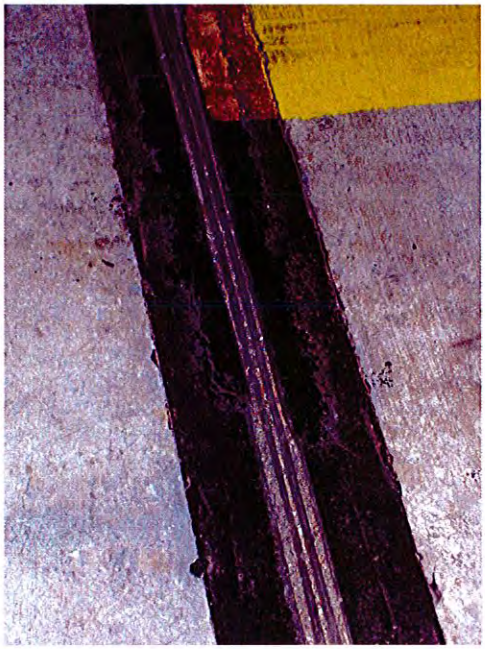
INTERIOR RAMPS FOR VEHICULAR CIRCULATION

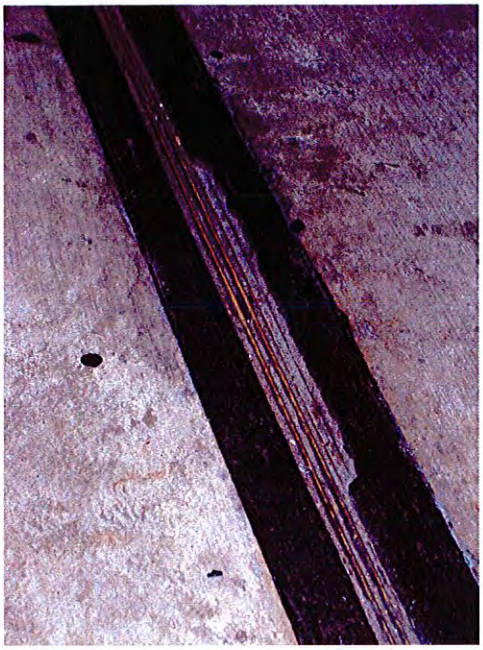
CONVENTION CENTER GARAGE

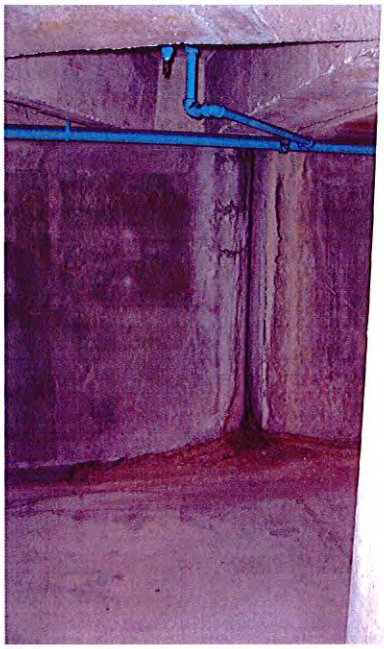


TYPICAL INTERIOR GRAPHICS

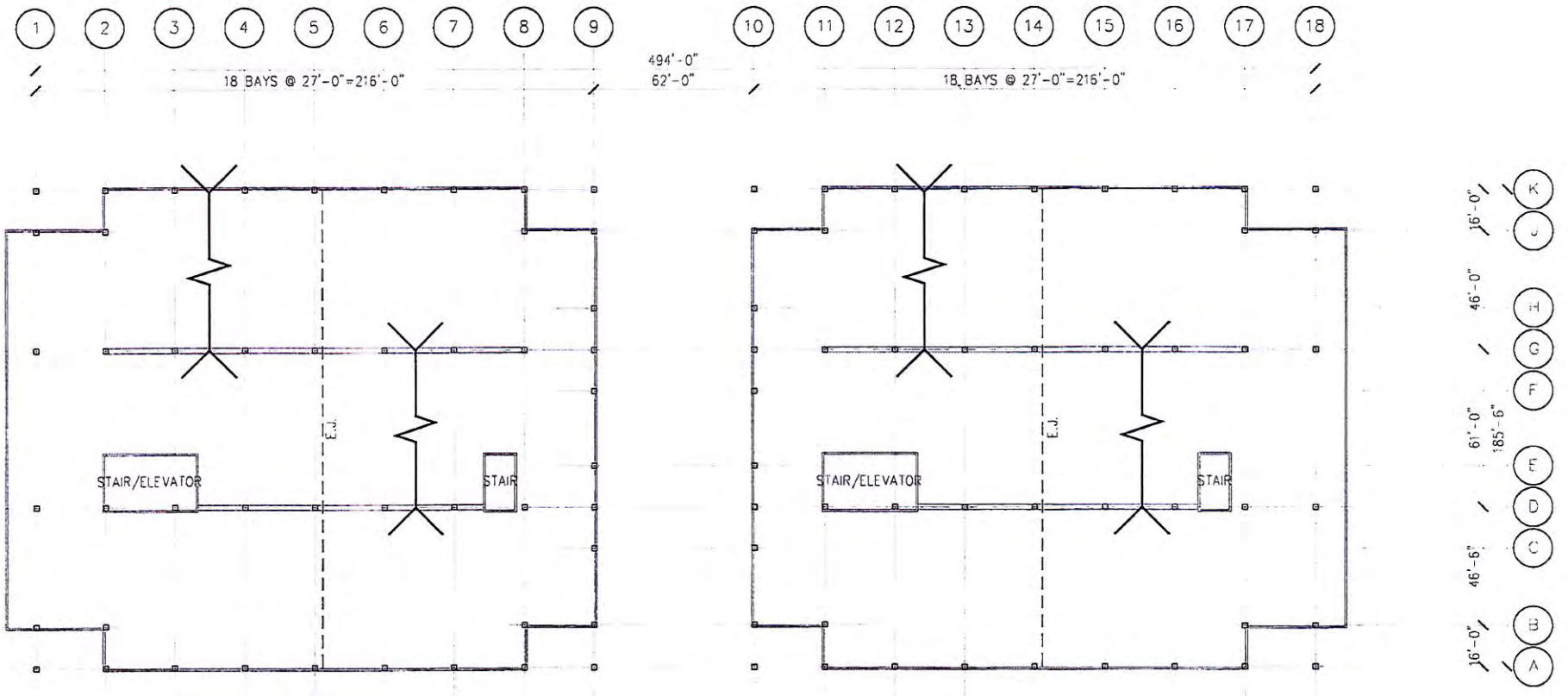
CONVENTION CENTER GARAGE







EXPANSION JOINT DAMAGE AND LEAKAGE



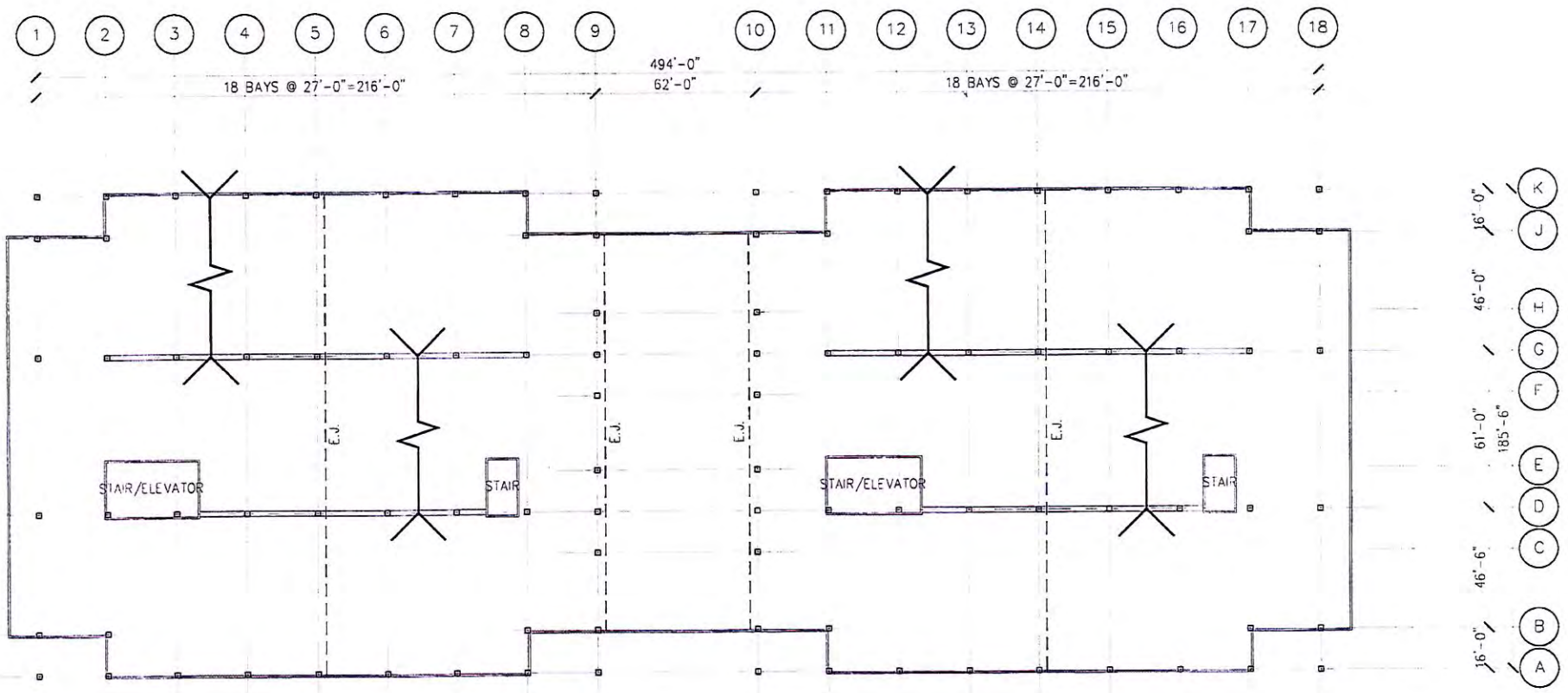
LEVEL 2 PLAN

OLD FORT BROOKE PARKING GARAGE

0 40 80

1" = 40'

NORTH



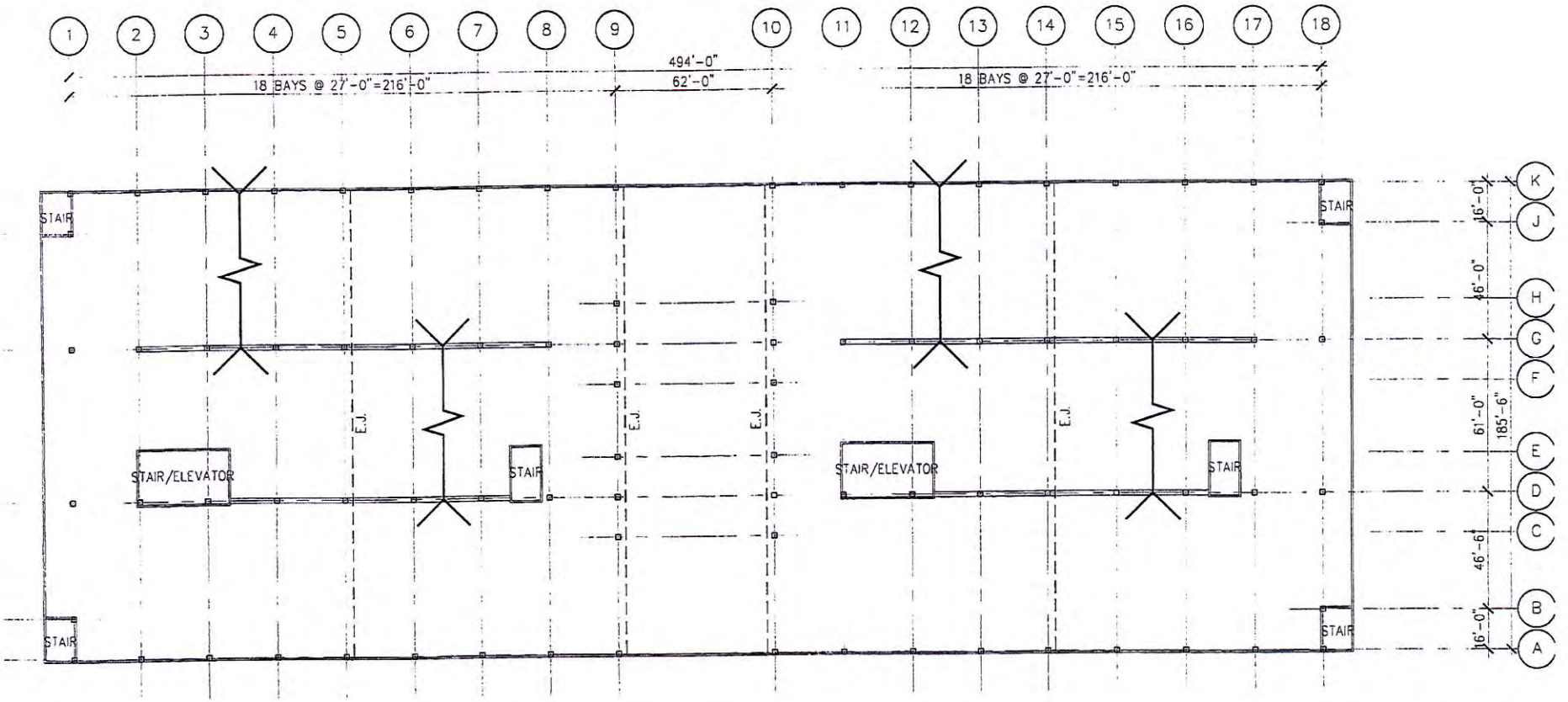
LEVEL 3 PLAN

OLD FORT BROOKE PARKING GARAGE

0 40 80

1" = 40'

NORTH



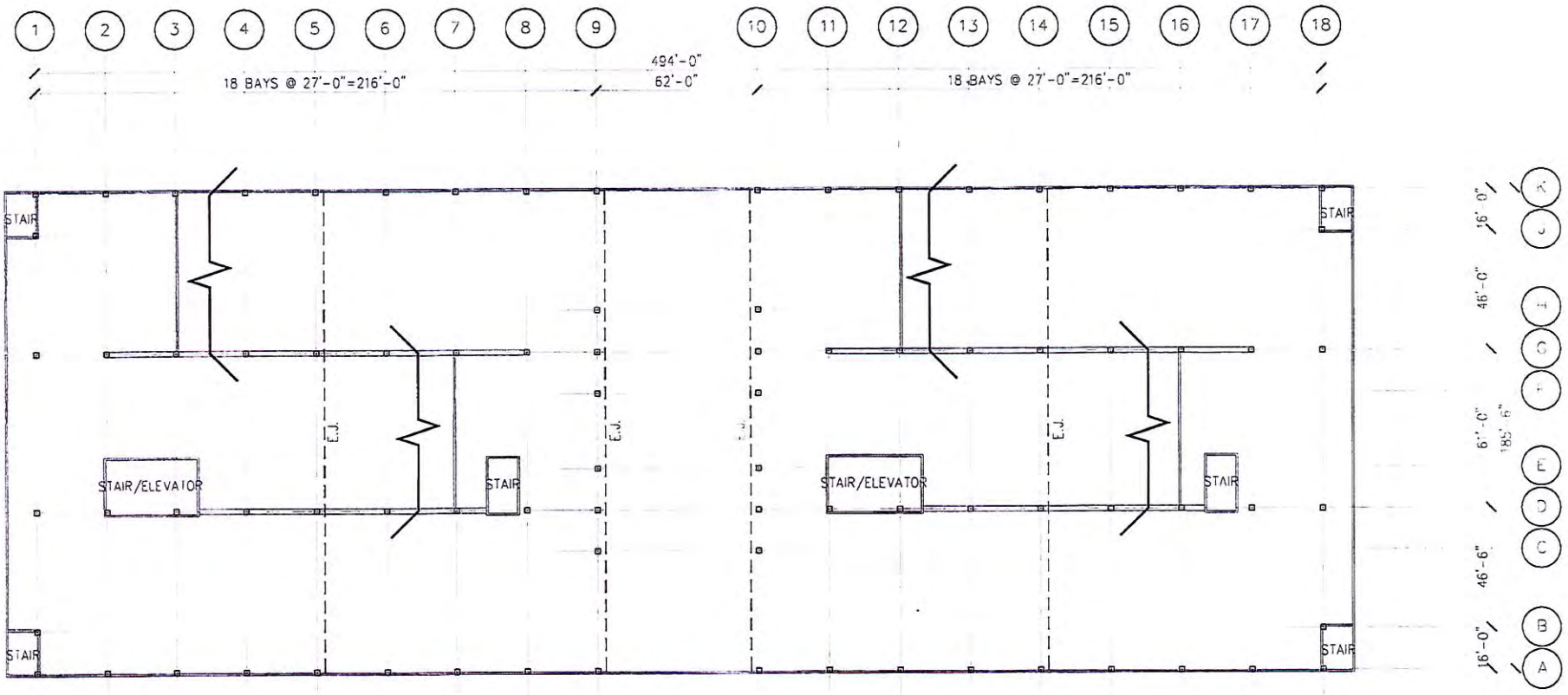
LEVEL 4 & 5 PLANS

OLD FORT BROOKE PARKING GARAGE

0 40 80

1" = 40'

NORTH



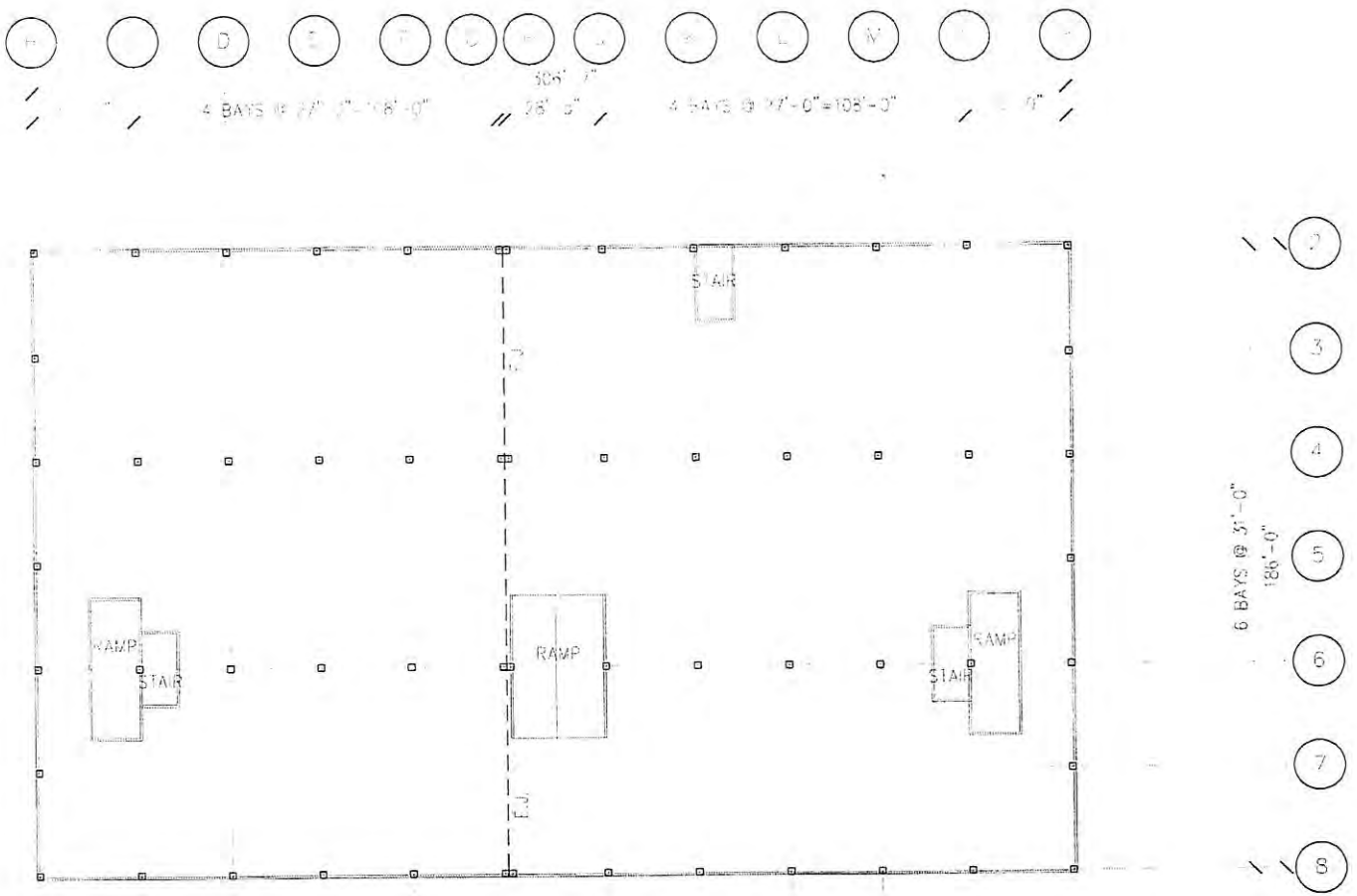
LEVEL 6 PLAN

OLD FORT BROOKE PARKING GARAGE

0 40 80

1" = 40'

NORTH



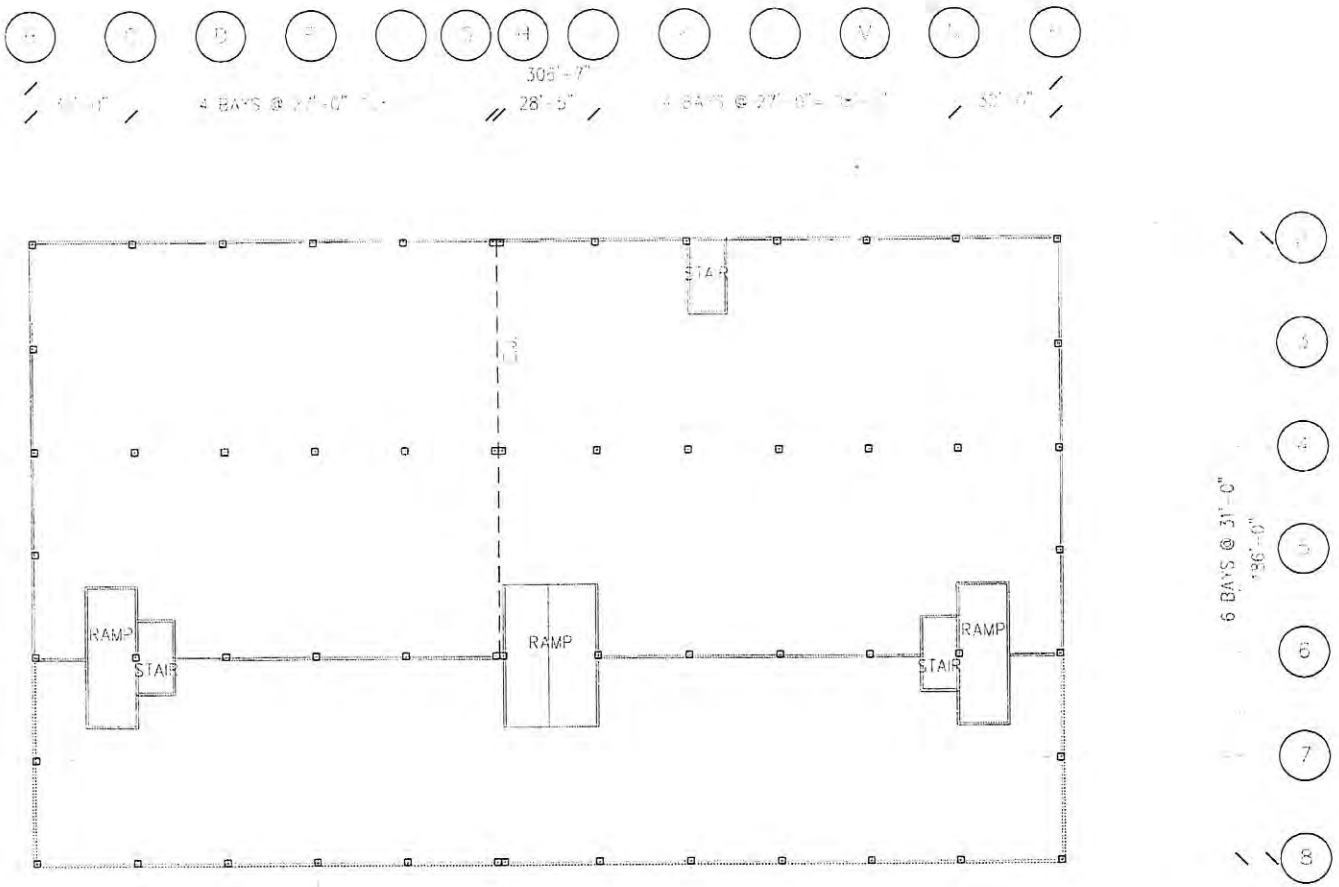
2ND, 3RD, 4TH LEVEL PLANS

TWIGGS STREET PARKING GARAGE

0 40 80

1" = 40'

NORTH



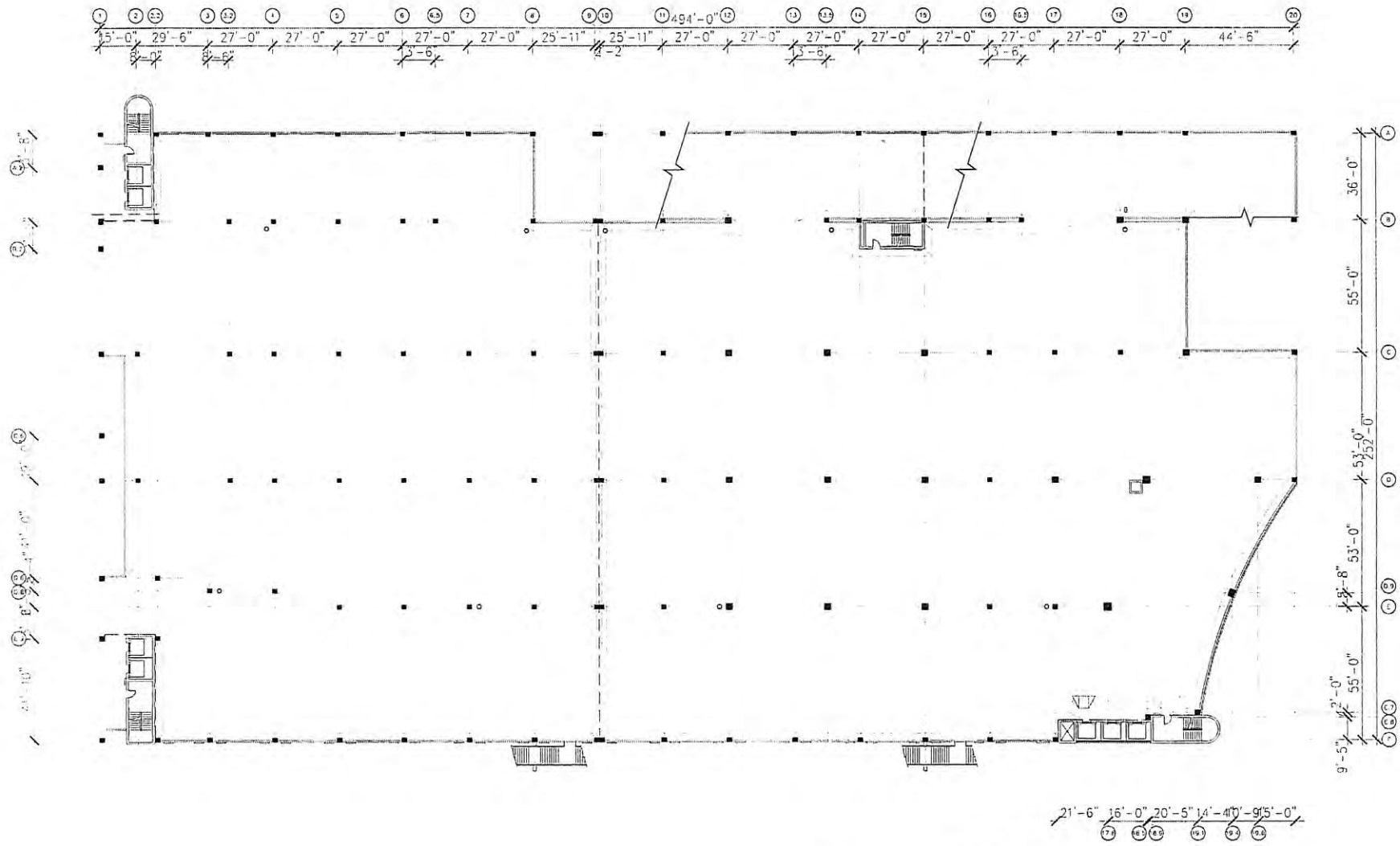
ROOF LEVEL PLAN

TWIGGS STREET PARKING GARAGE

0 40 80

1" = 40'

NORTH



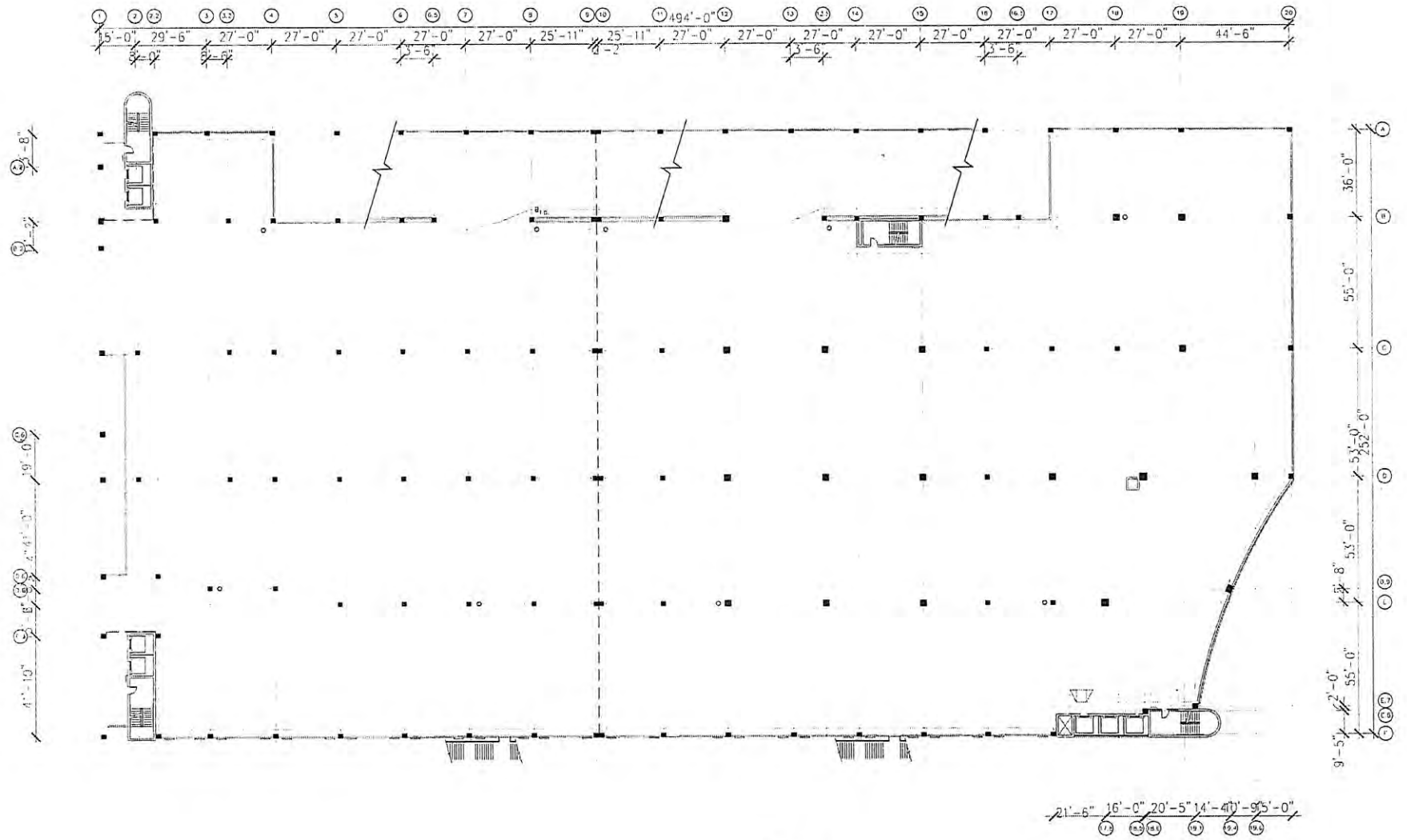
2ND LEVEL PLAN

SOUTH REGIONAL PARKING GARAGE

0 40 80

1" = 40'

NORTH



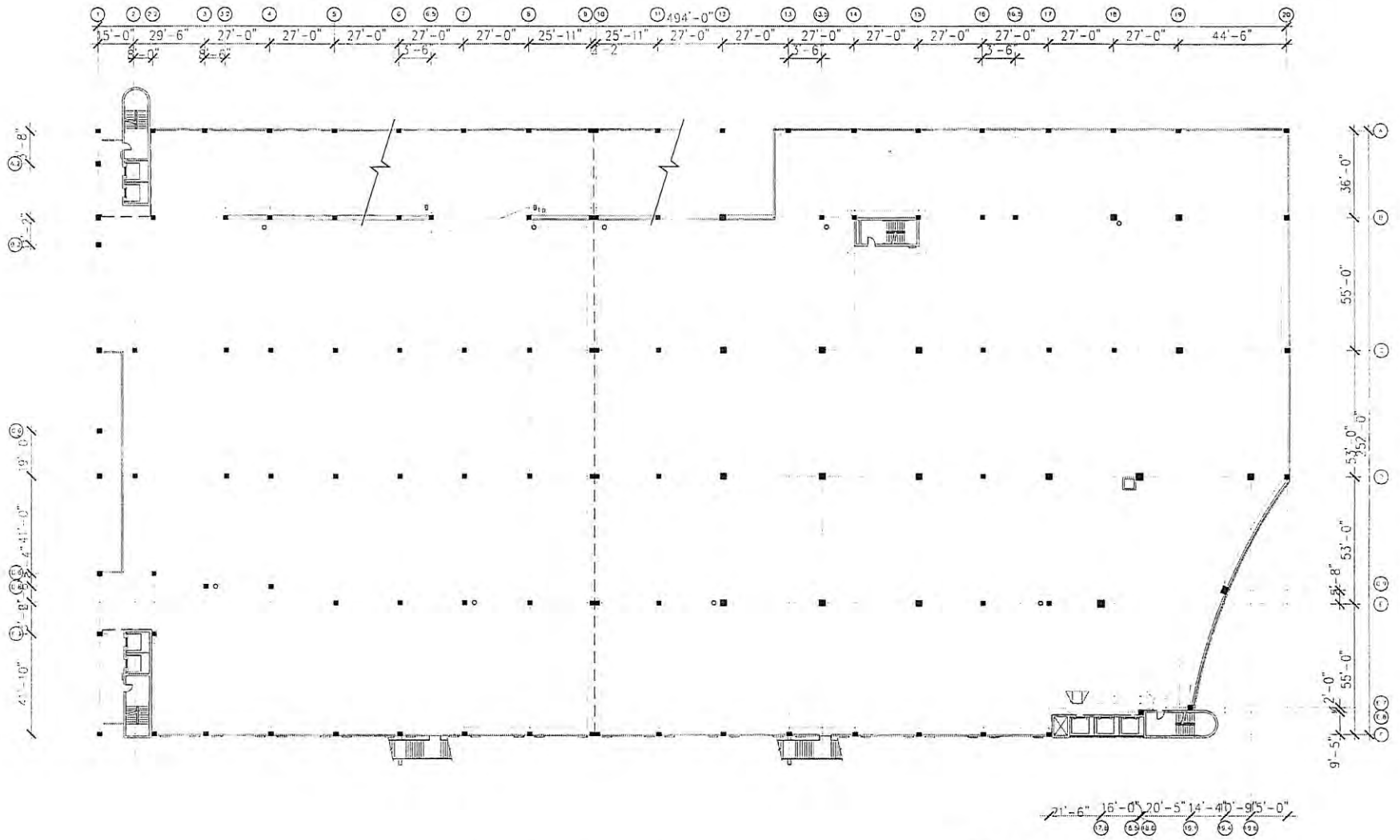
3RD LEVEL PLAN

SOUTH REGIONAL PARKING GARAGE

0 40 80

1" = 40'

NORTH



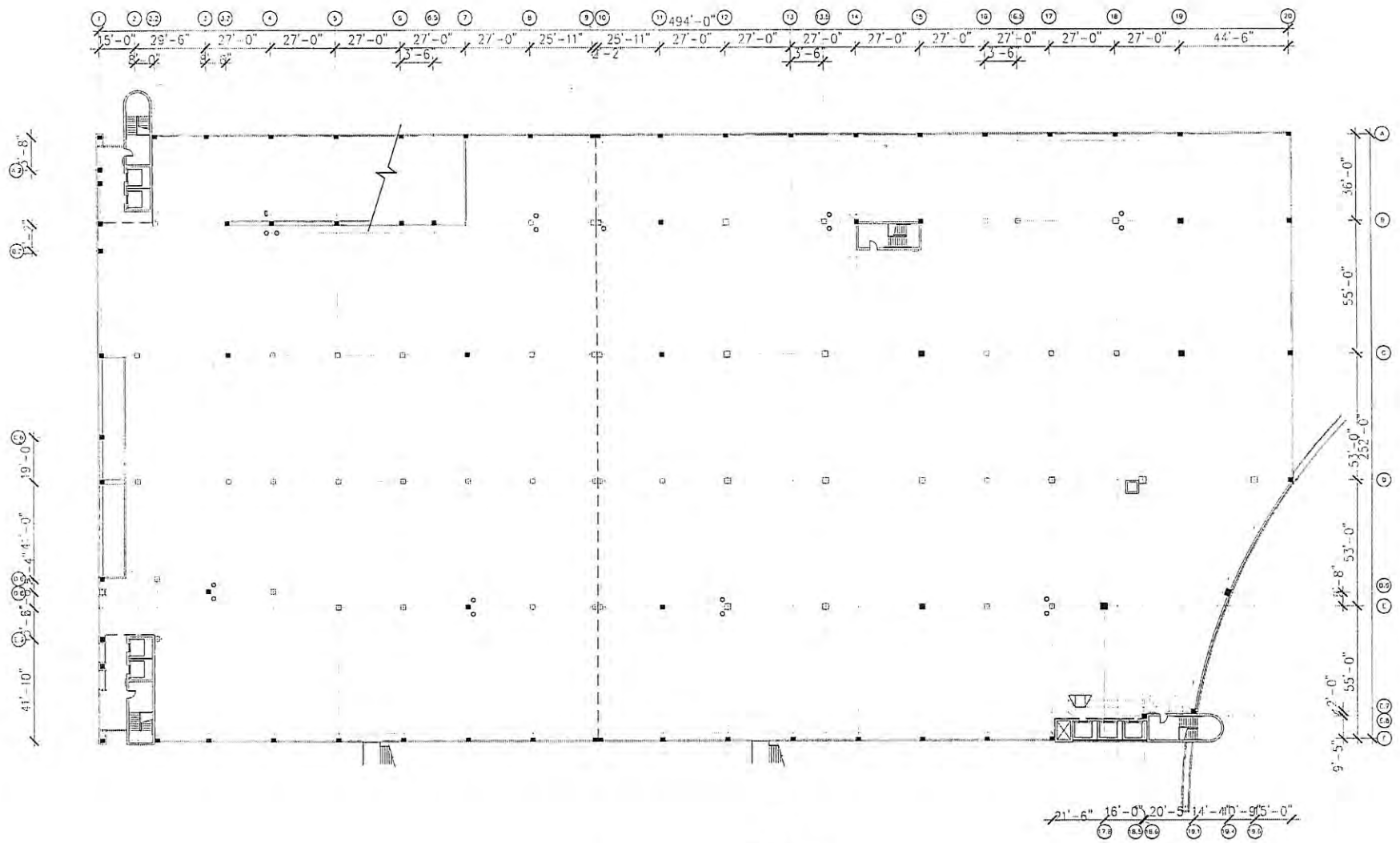
4TH LEVEL PLAN

SOUTH REGIONAL PARKING GARAGE

0 40 80

1" = 40'

NORTH

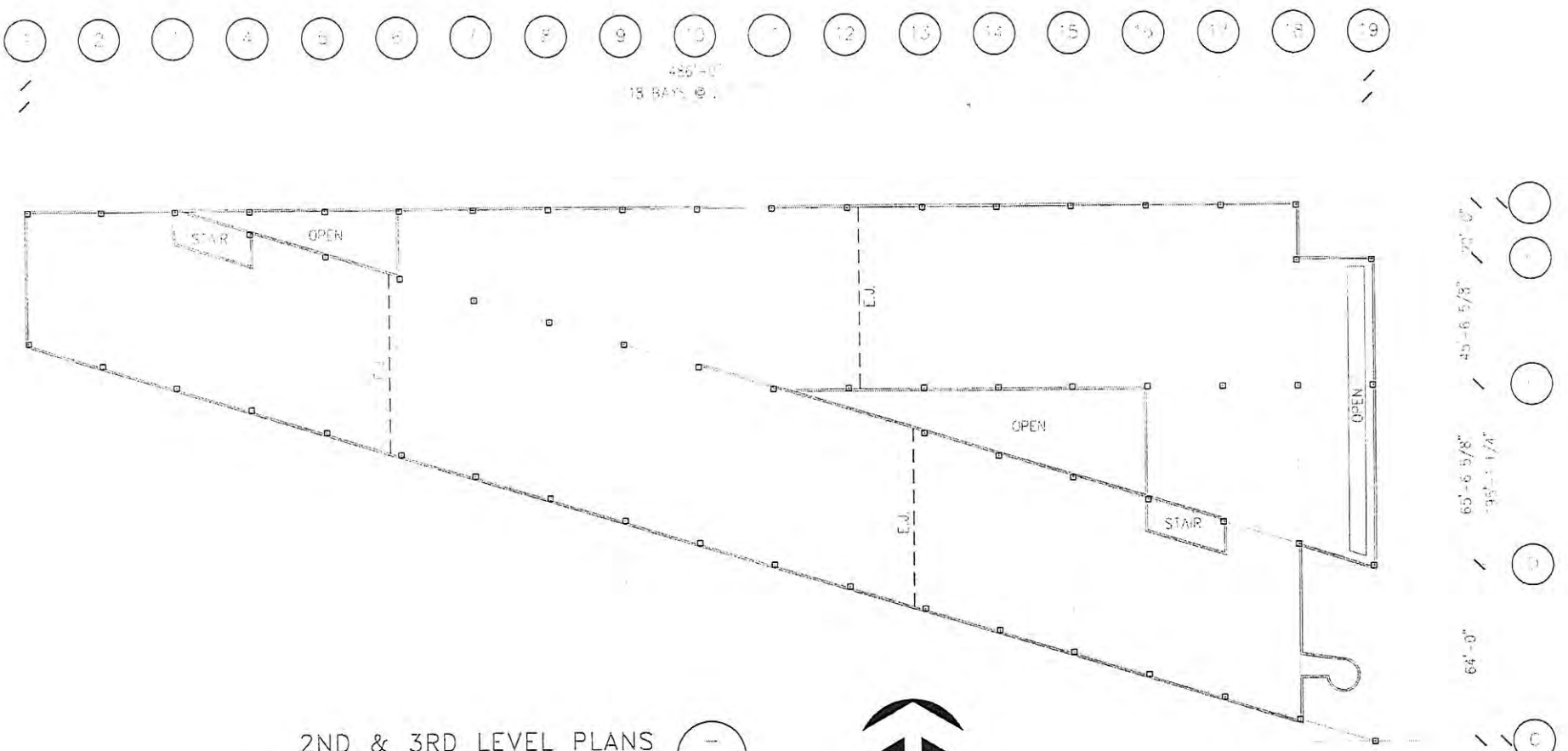


TOP LEVEL PLAN

SOUTH REGIONAL PARKING GARAGE

0 40 80

NORTH



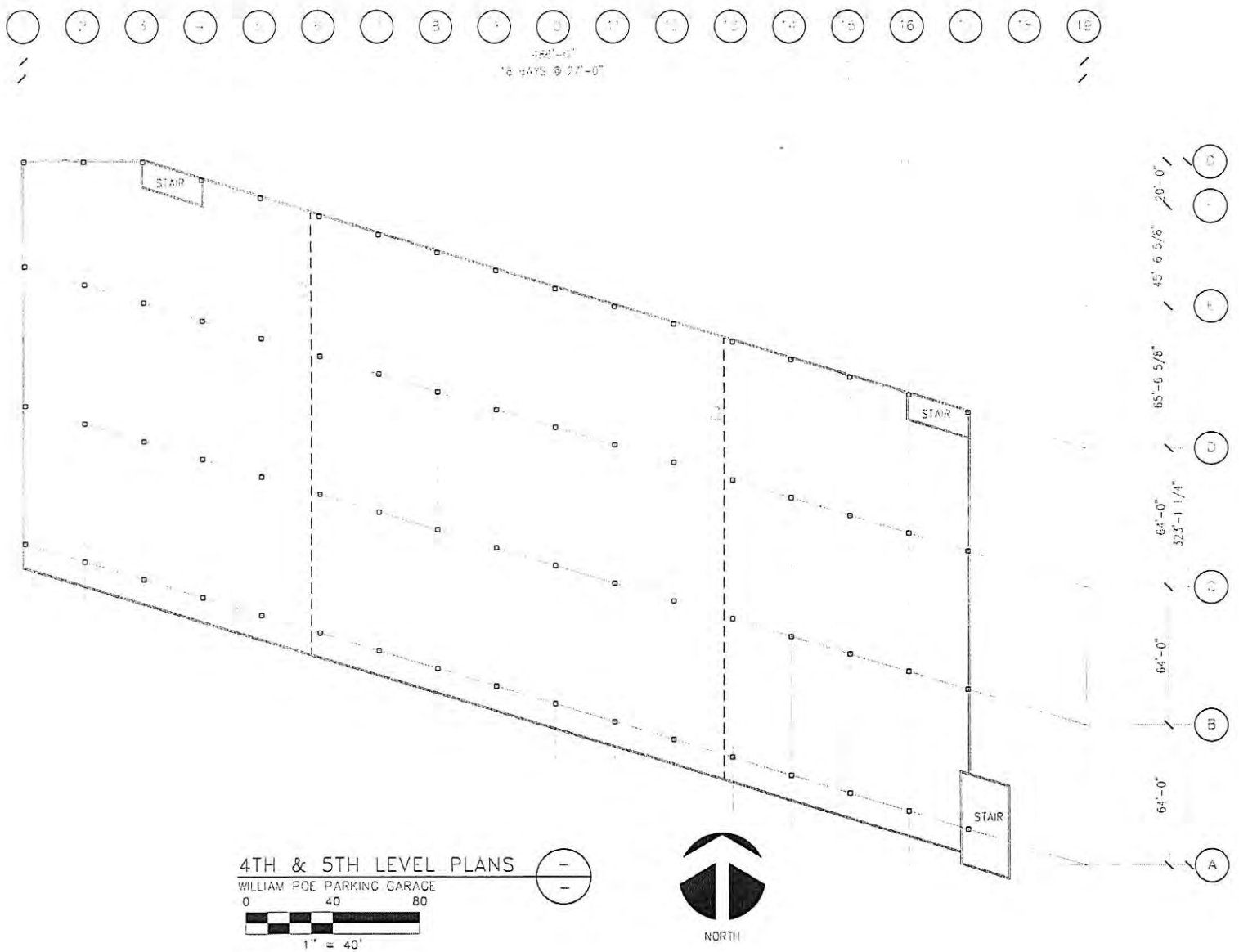
2ND & 3RD LEVEL PLANS

WILLIAM POE PARKING GARAGE

0 40 80

1" = 40'

NORTH

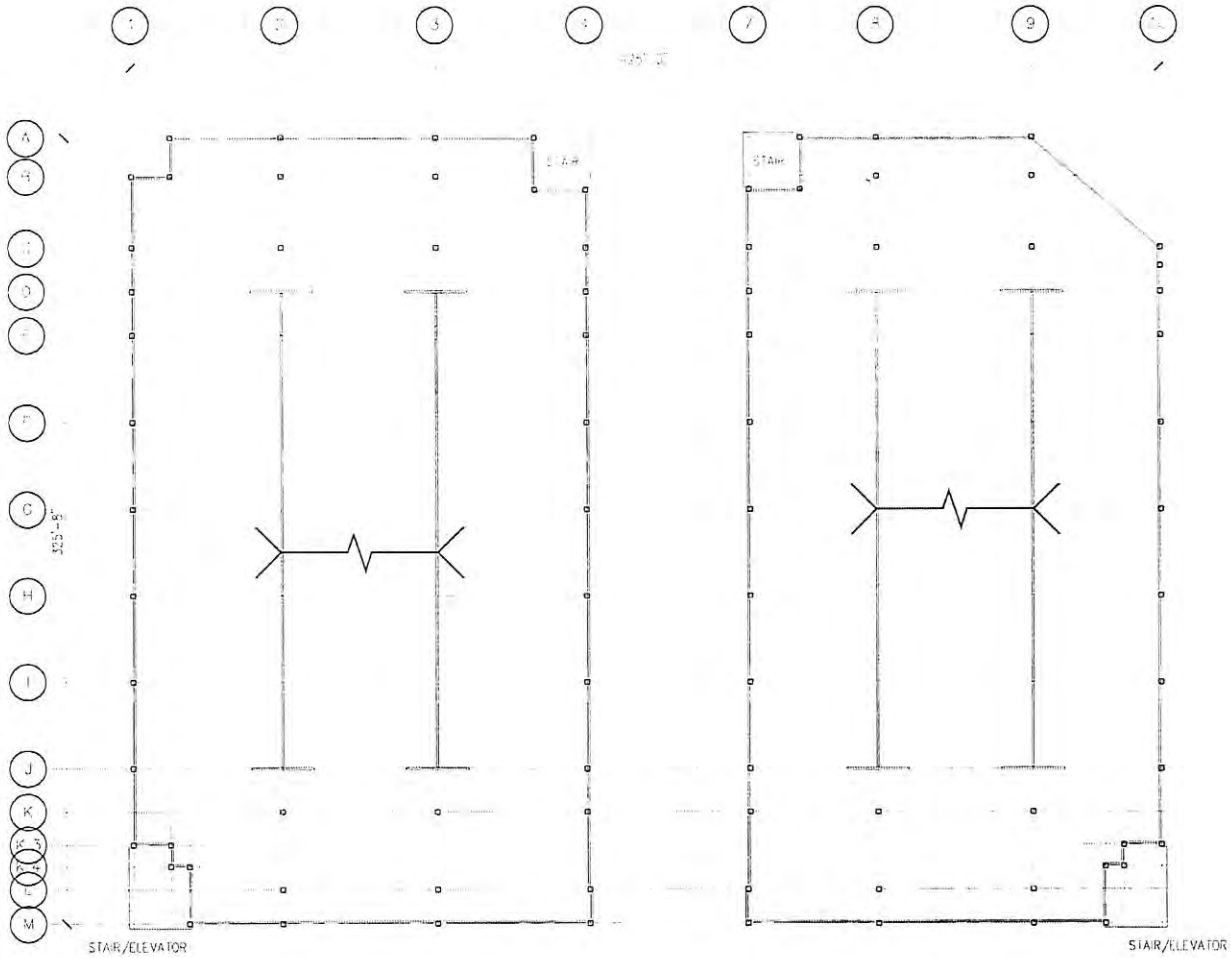


4TH & 5TH LEVEL PLANS

WILLIAM POE PARKING GARAGE

0 40 80

1" = 40'

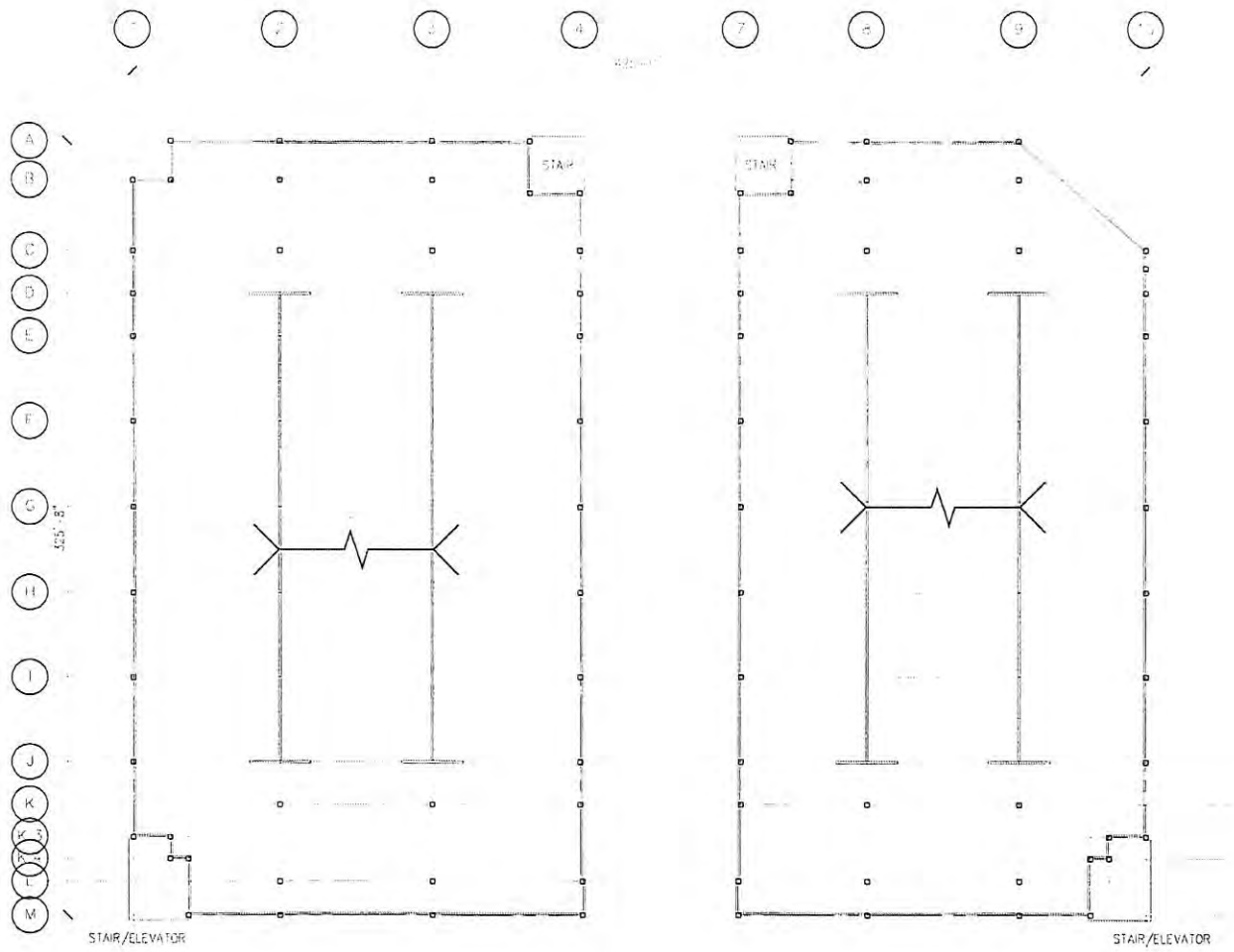


LEVEL 2 PLAN

PALM AVENUE PARKING STRUCTURE

0 40 80

1" = 40'



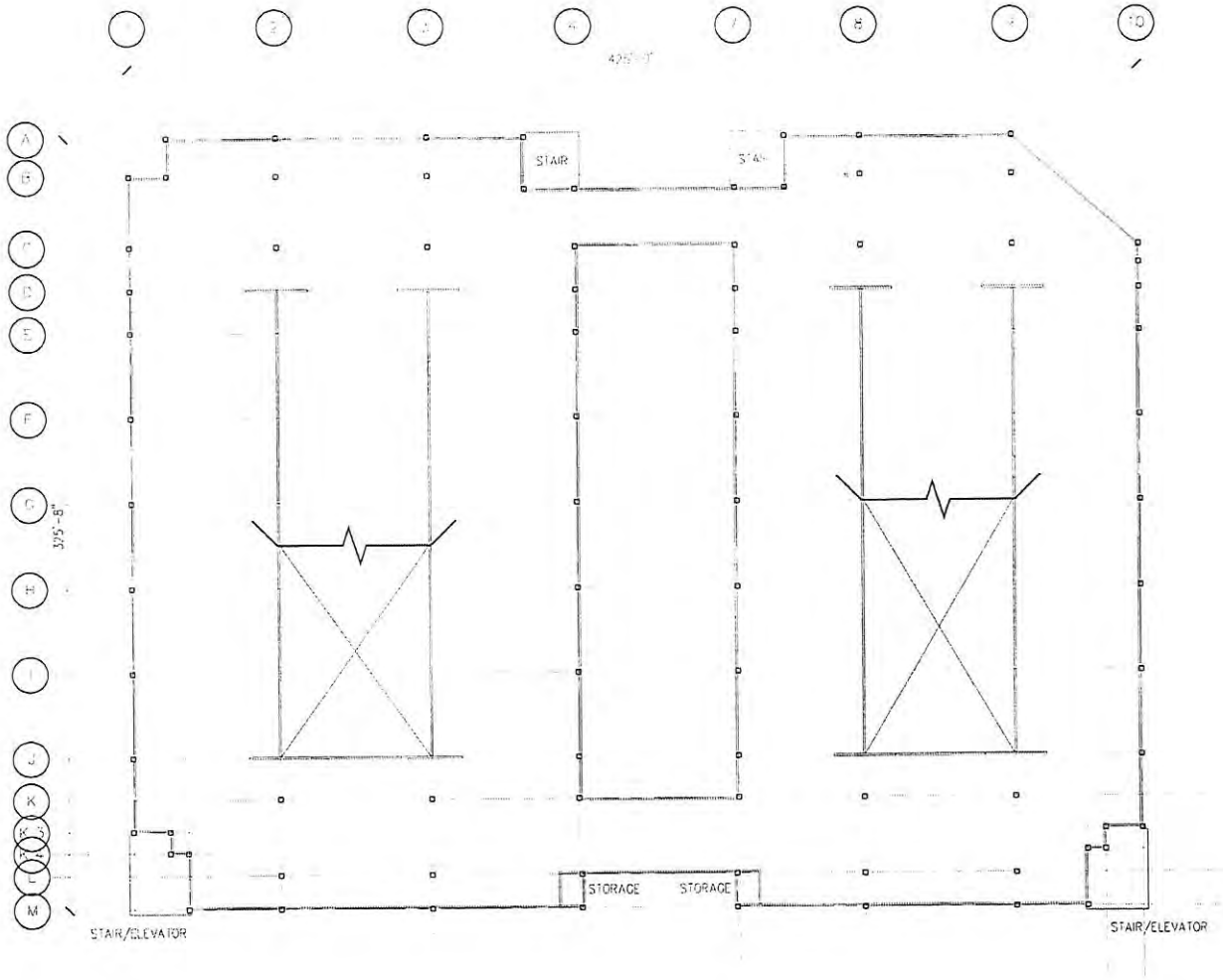
LEVEL 3 PLAN

PALM AVENUE PARKING STRUCTURE

0 40 80

1" = 40'

NORTH

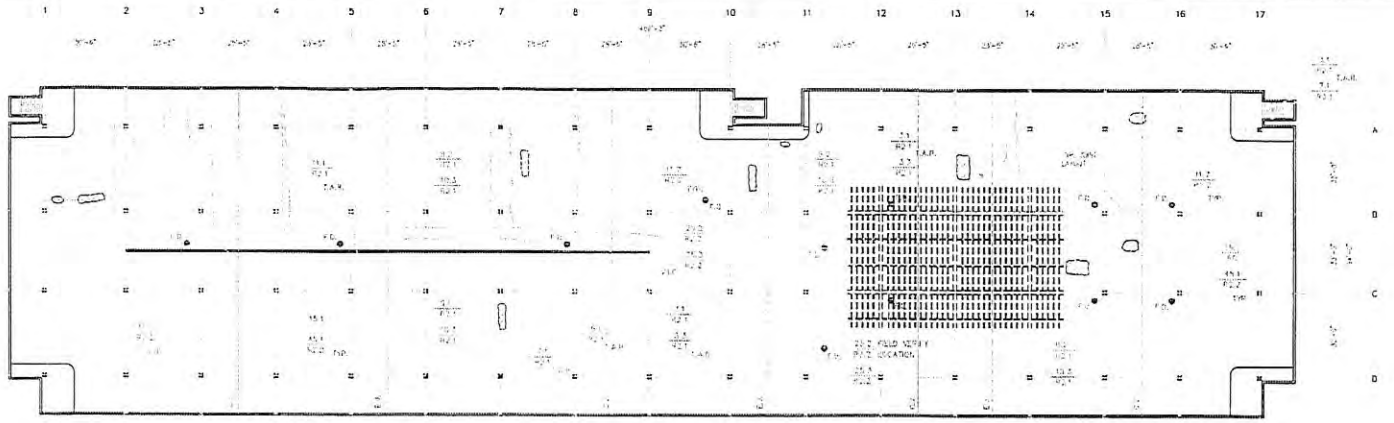


LEVEL 4 PLAN

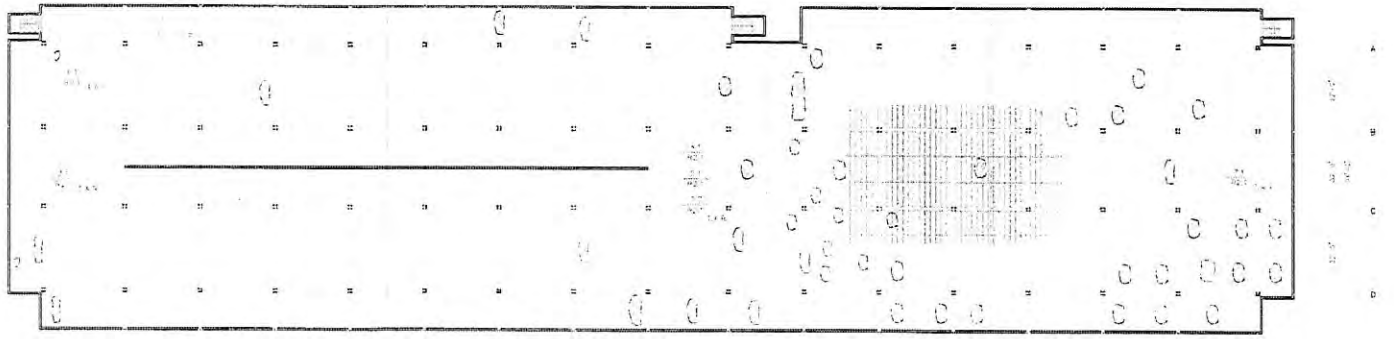
PALM AVENUE PARKING STRUCTURE

0 40 80

1" = 40'



LEVEL TWO FLOOR PLAN



LEVEL ONE CEILING PLAN

WALKER
PARKING CONSULTANTS
4901 Eisenhower Blvd
Suite 251
Tampa, FL 33634
813 888 0400 Ph
813 888 5872 Fax
PE-0003940

OWNER'S AND/OR SUB'S LOGO

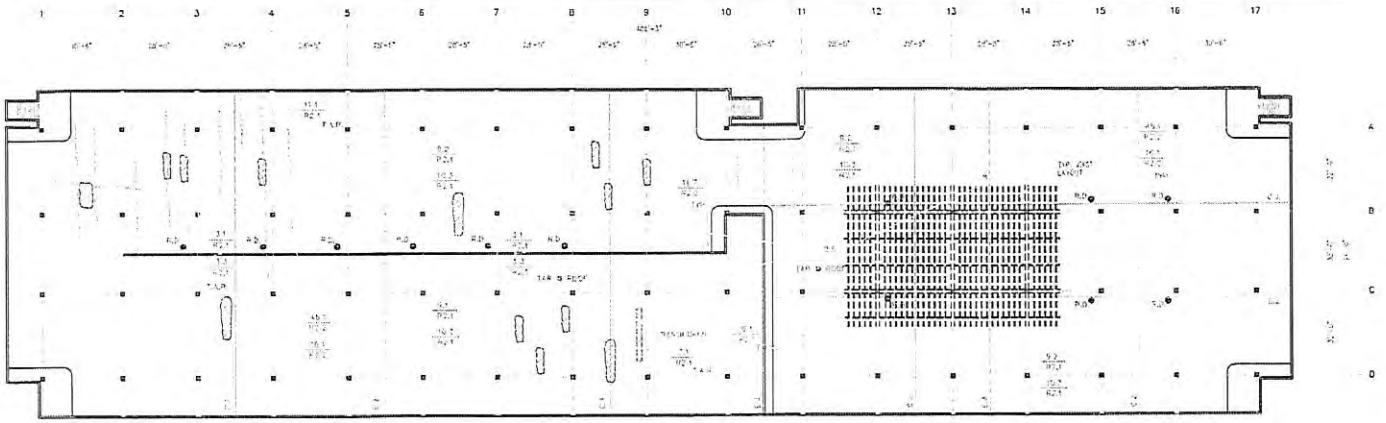
ISSUED				
NO	DESCRIPTION	DATE	DRAWN	CHECKED
1	CLIENT SET			

WHITING STREET GARAGE
CITY OF TAMPA
TAMPA FLORIDA

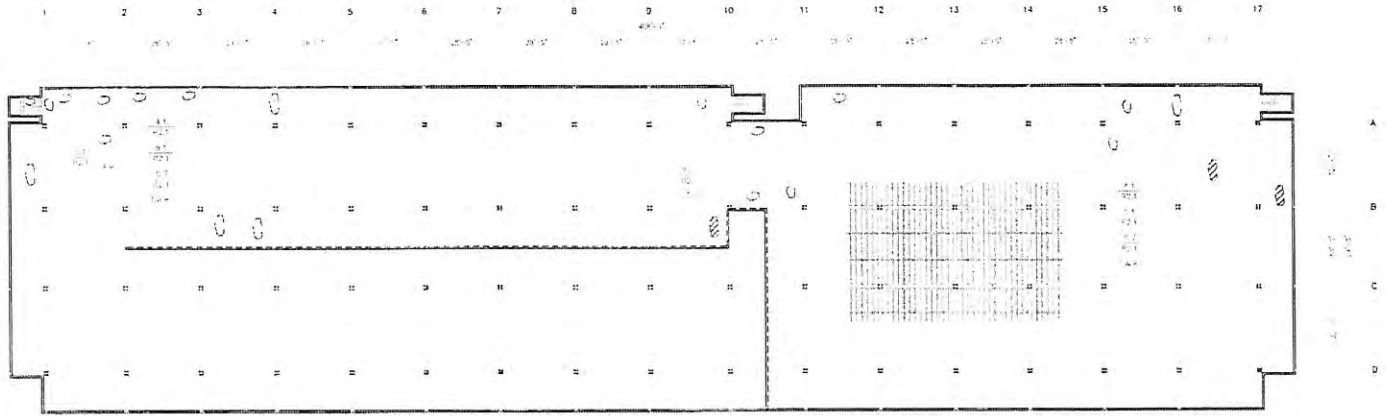
SEAL

SHEET TITLE
LEVEL TWO FLOOR PLAN
LEVEL ONE CEILING PLAN

Issue
Project No.
Sheet No.
R1.1



LEVEL THREE FLOOR PLAN



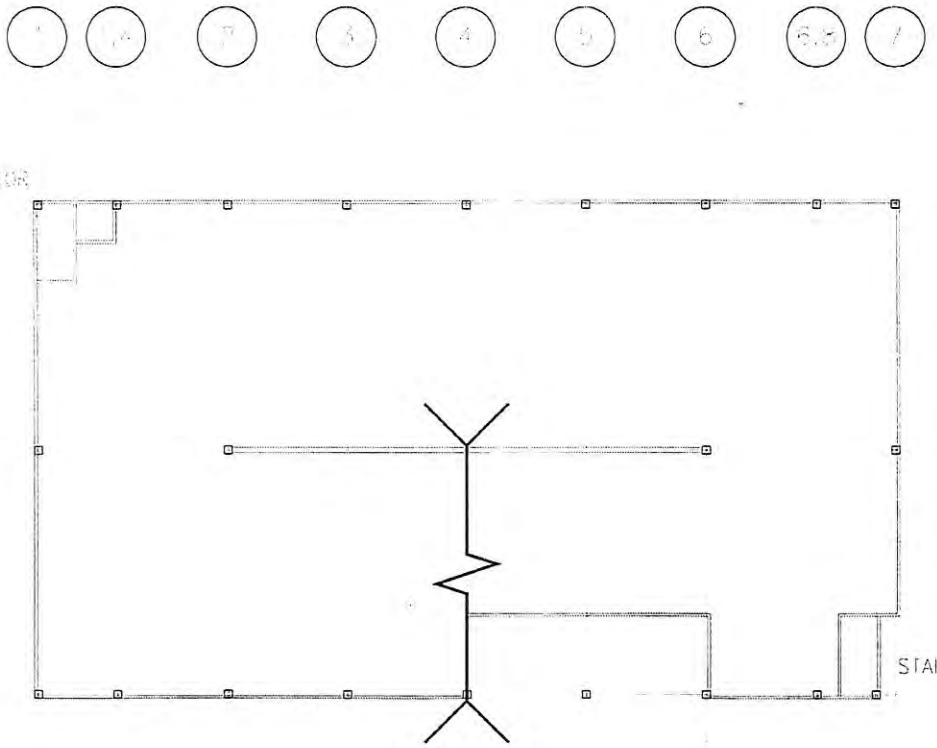
LEVEL TWO CEILING PLAN

WALKER
PARKING CONSULTANTS

WHITING STREET GARAGE

CITY OF TAMPA

R-2



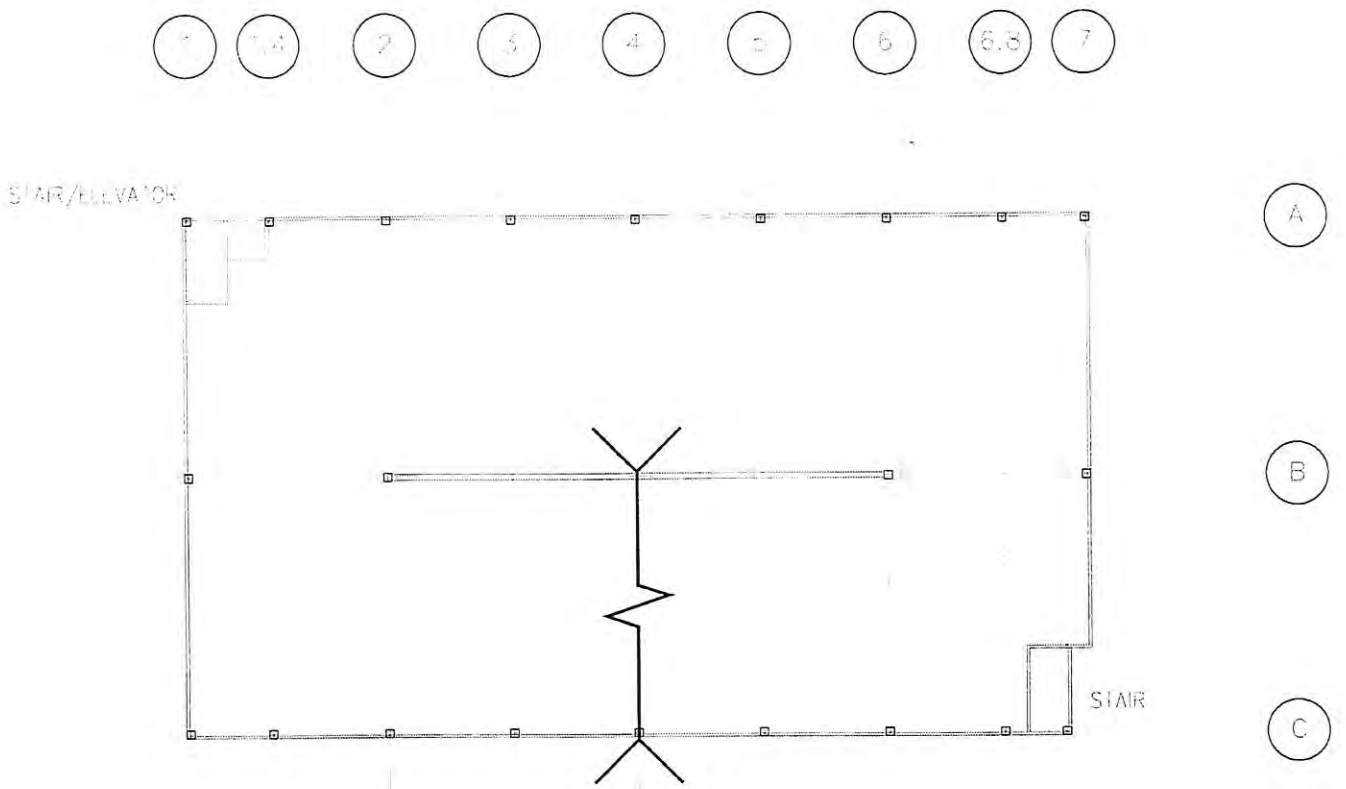
LEVEL 2 PLAN

POLICE HQ PARKING GARAGE

0 40 80

1" = 40'

NORTH



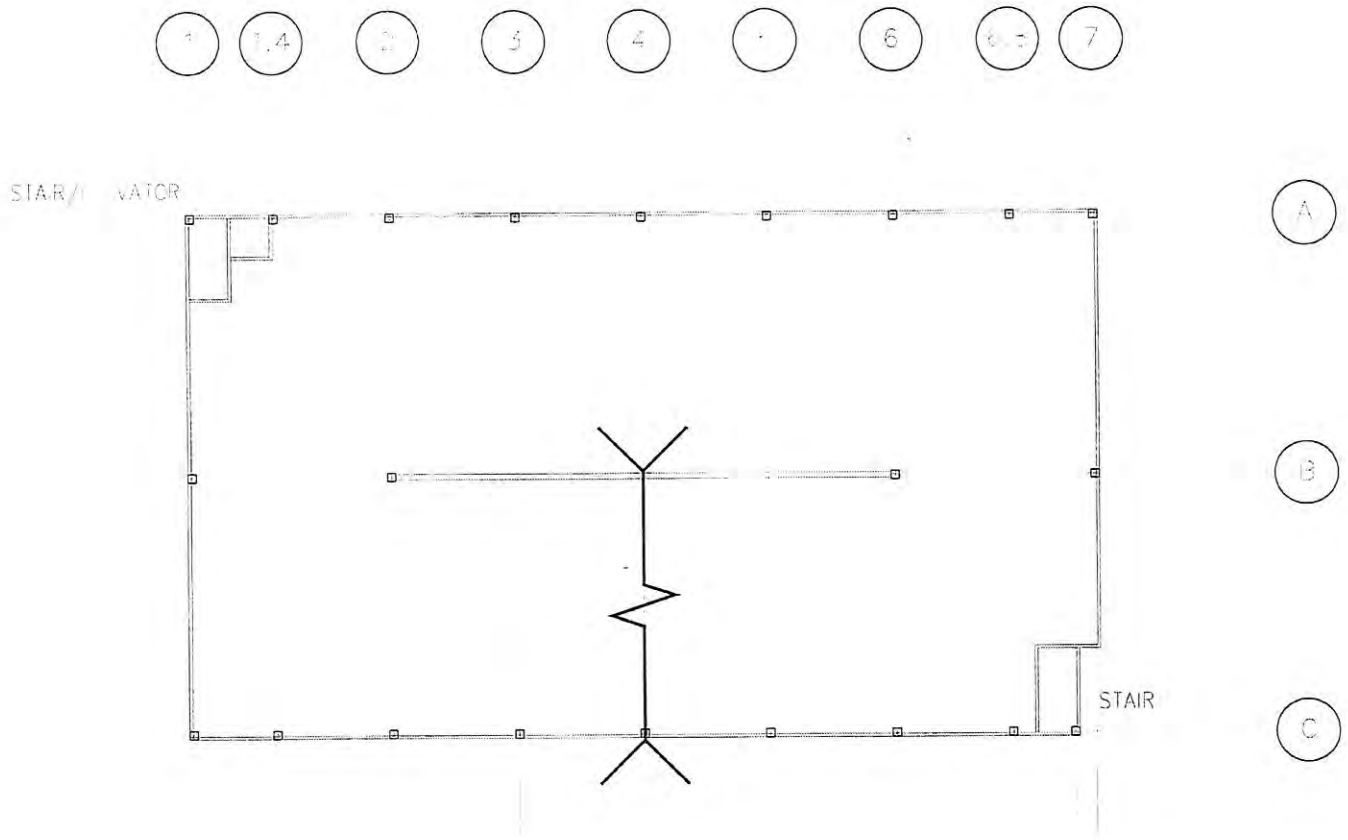
LEVEL 3 PLAN

POLICE HQ PARKING GARAGE

0 40 80

1" = 40'

NORTH



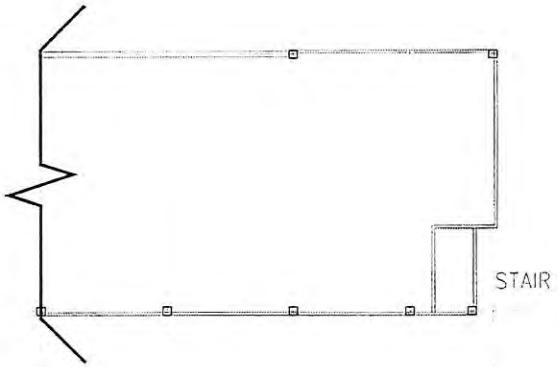
LEVEL 4 PLAN

POLICE HQ PARKING GARAGE

0 40 80

1" = 40'

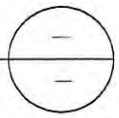
NORTH



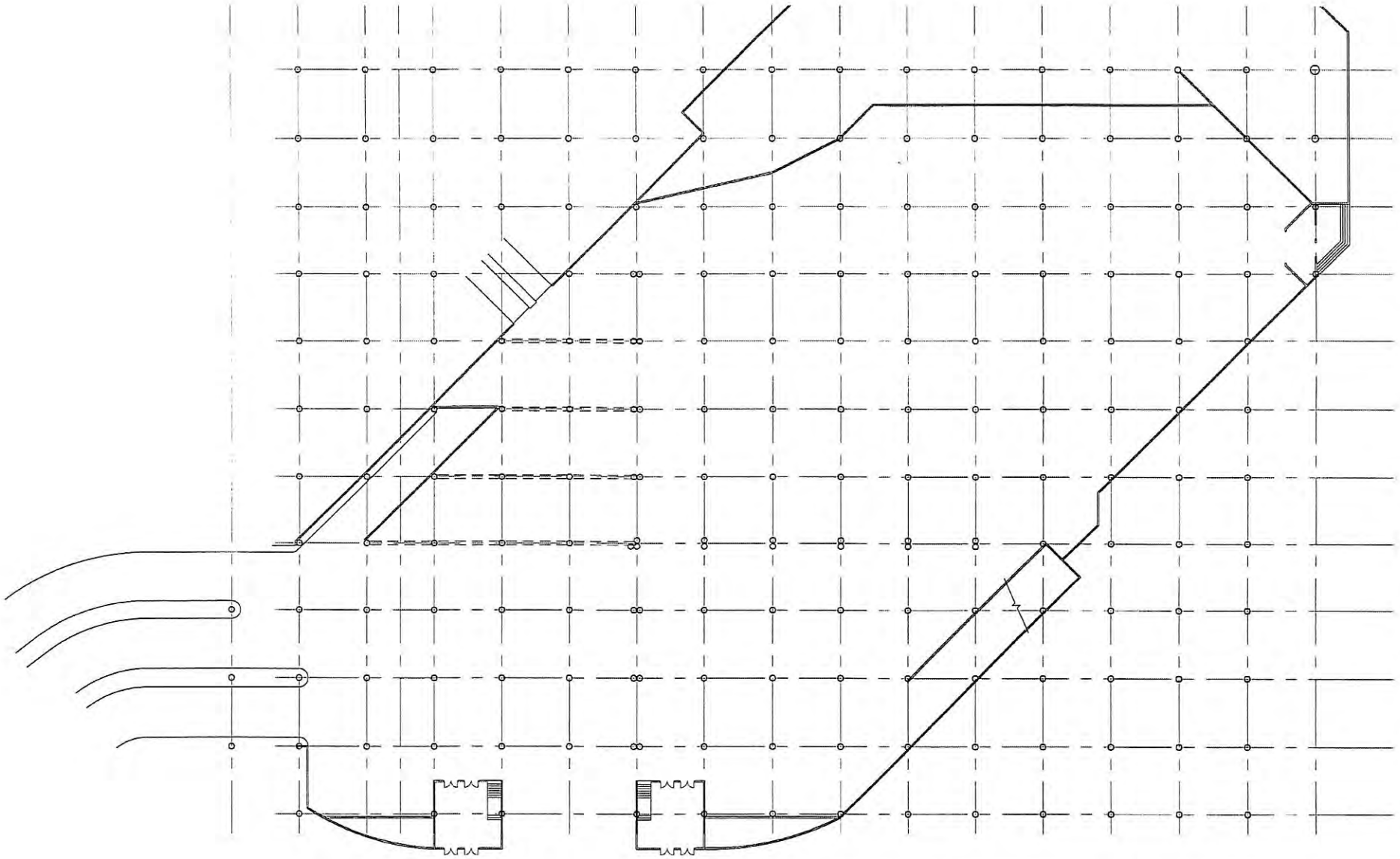
ROOF LEVEL PLAN

POLICE HQ PARKING GARAGE

1" = 40'



NORTH



CONVENTION CENTER GARAGE

WALKER
PARKING CONSULTANTS

4902 Eisenhower Blvd
Suite 281
Tampa, FL 33634
813.888.5800 Ph
813.888.5822 Fax
BE-0003840

Job: 15-1340.40

Job No: XX

Date:

No.

Fort Brooke Garage and Expansion
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	Current Repairs	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Construction Date: 1980 / 1999													
1	**Concrete Repairs**	**$ 7,000**	**$ 10,500**	**$ -**	**$ -**	**$ 7,000**	**$ -**	**$ -**	**$ -**	**$ 3,500**	**$ -**	**$ -**	**$ -**
1.1	Floor	3,500	$ 7,000			3,500				3,500			
1.2	Column, Beam, Ceiling	3,500	$ 3,500			3,500							
2	**Waterproofing**	**$ 89,500**	**$ 862,500**	**$ -**	**$ -**	**$ 186,500**	**$ -**	**$ -**	**$ -**	**$ 302,500**	**$ 133,500**	**$ 124,500**	**$ 115,500**
2.1	Expansion Joint Repair (Seal and/or Cover Plate)	16,000	$ 16,000			16,000							
2.2	Expansion Joint Replacement	44,000	$ 499,000			67,000				117,000	117,000	99,000	99,000
2.4	Traffic Topping Repair (Roof Level)		$ 3,000			3,000							
2.5	Traffic Topping Recoat		$ 160,000							160,000			
2.6	Rout/Seal Cracks	24,000	$ 30,000			24,000				3,000		3,000	
2.7	Seal Construction / Control Joints	4,500	$ 17,500			5,500				6,000		6,000	
2.8	Sealer		$ 70,000			70,000							
2.9	Cove Sealant	1,000	$ 67,000			1,000				16,500	16,500	16,500	16,500
3	**Stair/Elevator Tower Repair**	**$ 1,000**	**$ 2,000**	**$ -**	**$ -**	**$ 1,000**	**$ -**	**$ -**	**$ -**	**$ 1,000**	**$ -**	**$ -**	**$ -**
3.1	Concrete Stair Tread Repairs	1,000	$ 2,000			1,000				1,000			
4	**Mechanical/Electrical/Plumbing**	**$ -**	**$ 162,000**	**$ -**	**$ -**	**$ 54,000**	**$ -**	**$ -**	**$ 54,000**	**$ -**	**$ -**	**$ 54,000**	**$ -**
4.1	PARCS Maintenance/Replacement		$ 15,000			5,000			5,000			5,000	
4.2	Light Fixture Repair / Replacement		$ 10,500			3,500			3,500			3,500	
4.3	Relamp Light Fixtures		$ 136,500			45,500			45,500			45,500	
5	**Architectural/Miscellaneous**	**$ -**	**$ 15,000**	**$ -**	**$ -**	**$ 6,000**	**$ -**	**$ -**	**$ -**	**$ 5,000**	**$ -**	**$ 4,000**	**$ -**
5.4	Repaint Traffic Markings		$ 13,000			5,000				5,000		3,000	
5.5	Materials Testing		$ 2,000			1,000						1,000	
6	**Enhancements**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Sub Total		$ 97,500	$ 1,052,000	$ -	$ -	$ 254,500	$ -	$ -	$ 54,000	$ 312,000	$ 133,500	$ 182,500	$ 115,500
Contingency		$ 12,000	$ 127,500	$ -	$ -	$ 31,000	$ -	$ -	$ 6,500	$ 37,500	$ 16,500	$ 22,000	$ 14,000
General Conditions		$ 8,000	$ 85,500	$ -	$ -	$ 20,500	$ -	$ -	$ 4,500	$ 25,000	$ 11,000	$ 15,000	$ 9,500
Consulting & Engineering Fees		$ 12,000	$ 127,500	$ -	$ -	$ 31,000	$ -	$ -	$ 6,500	$ 37,500	$ 16,500	$ 22,000	$ 14,000
Opinion of Annual Budget (2005 Dollars)		**$ 130,000**	**$ 1,393,000**	**$ -**	**$ -**	**$ 337,000**	**$ -**	**$ -**	**$ 71,500**	**$ 412,000**	**$ 177,500**	**$ 241,500**	**$ 153,000**
Opinion of Annual Budget (Adjusted Future Value)			**$ 1,707,000**	**$ -**	**$ -**	**$ 368,300**	**$ -**	**$ -**	**$ 85,400**	**$ 506,800**	**$ 224,900**	**$ 315,200**	**$ 205,700**
	Current / Annualized Cost =	**$ 130,000**	**$ 139,300**										
	Current / Annualized Cost/square foot =	**$ 0.14**	**$ 0.15**										
	Current / Annualized Cost/Space =	**$ 52**	**$ 55**										

NOTES:

Note 1: Contingency based on 12% of Sub Total rounded up to the nearest $500.
Note 2: General Conditions based on 8% of Sub Total rounded up to the nearest $500.
Note 3: Consulting & Engineering Fees based on 12% of Sub Total rounded up to the nearest $500.
Note 4: Inflated Future Value (based on 3% annual discount rate) accounts for general inflation of the U.S. Dollar and does not include an increase for material or labor.

Twiggs Street Garage
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	Current Repairs	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Construction Date: 1972													
1	**Concrete Repairs**	**$ 184,500**	**$ 215,500**	**$ -**	**$ 193,000**	**$ -**	**$ -**	**$ -**	**$ 22,500**	**$ -**	**$ -**	**$ -**	**$ -**
1.1	Floor	168,000	$ 189,000		175,000				14,000				
1.2	Column, Beam, Ceiling	3,000	$ 6,500		3,500				3,000				
1.3	Curb	1,000	$ 1,500		1,000				500				
1.4	Wall	12,500	$ 18,500		13,500				5,000				
2	**Waterproofing**	**$ 213,000**	**$ 336,500**	**$ -**	**$ 214,000**	**$ -**	**$ -**	**$ -**	**$ 122,500**	**$ -**	**$ -**	**$ -**	**$ -**
2.1	Expansion Joint Repair (Seal, Nosing, and/or Cover Plate)	19,000	$ 20,000		20,000								
2.2	Expansion Joint Replacement		$ 61,500						61,500				
2.3	Traffic Topping Installation (Roof Level)	104,500	$ 156,500		104,500				52,000				
2.4	Traffic Topping Repair		$ 3,000						3,000				
2.6	Rout/Seal Cracks	10,500	$ 13,500		10,500				3,000				
2.8	Sealer (Lower Supported Floors)	59,500	$ 59,500		59,500								
2.9	Cove Sealant	19,500	$ 22,500		19,500				3,000				
3	**Stair/Elevator Tower Repair**	**$ 19,500**	**$ 23,000**	**$ -**	**$ 19,500**	**$ -**	**$ -**	**$ -**	**$ 3,500**	**$ -**	**$ -**	**$ -**	**$ -**
3.1	Concrete Stair Tread Repairs	1,500	$ 2,000		1,500				500				
3.2	Paint Hand Railings	3,000	$ 6,000		3,000				3,000				
3.3	Paint / Stain Interior of Stair Tower	15,000	$ 15,000		15,000								
4	**Mechanical/Electrical/Plumbing**	**$ 65,500**	**$ 100,500**	**$ -**	**$ 67,500**	**$ -**	**$ -**	**$ 16,500**	**$ -**	**$ -**	**$ 16,500**	**$ -**	**$ -**
4.1	PARCS Maintenance/Replacement	2,000	$ 6,000		2,000			2,000			2,000		
4.2	Light Fixture Repair / Replacement	2,000	$ 4,000		2,000			1,000			1,000		
4.3	Relamp Light Fixtures	11,500	$ 40,500		13,500			13,500			13,500		
4.4	Drain Repair/Replacement	41,000	$ 41,000		41,000								
4.5	Supplemental Floor Drains & Piping	9,000	$ 9,000		9,000								
5	**Architectural/Miscellaneous**	**$ 42,000**	**$ 80,000**	**$ -**	**$ 42,000**	**$ -**	**$ -**	**$ -**	**$ 28,000**	**$ -**	**$ -**	**$ -**	**$ 10,000**
5.1	Exterior Joint Sealant	10,000	$ 15,000		10,000				5,000				
5.2	CMU/Brick Replacement/Tuckpointing	20,000	$ 30,000		20,000				10,000				
5.4	Repaint Traffic Markings	2,000	$ 4,000		2,000				2,000				
5.5	Materials Testing		$ 1,000						1,000				
5.6	Paint Perimeter Handrails	10,000	$ 30,000		10,000				10,000				10,000
6	**Enhancements**	**$ -**	**$ 782,500**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 782,500**	**$ -**	**$ -**	**$ -**	**$ -**
6.1	Replace Lighting System		$ 498,000						498,000				
6.2	Paint / Stain Ceilings		$ 284,500						284,500				
Sub Total		$ 524,500	$ 1,538,000	$ -	$ 536,000	$ -	$ -	$ 16,500	$ 959,000	$ -	$ 16,500	$ -	$ 10,000
Contingency		$ 63,000	$ 185,500	$ -	$ 64,500	$ -	$ -	$ 2,000	$ 115,500	$ -	$ 2,000	$ -	$ 1,500
General Conditions		$ 42,000	$ 124,000	$ -	$ 43,000	$ -	$ -	$ 1,500	$ 77,000	$ -	$ 1,500	$ -	$ 1,000
Consulting & Engineering Fees		$ 63,000	$ 185,500	$ -	$ 64,500	$ -	$ -	$ 2,000	$ 115,500	$ -	$ 2,000	$ -	$ 1,500
Opinion of Annual Budget (2005 Dollars)		**$ 693,000**	**$ 2,033,000**	**$ -**	**$ 708,000**	**$ -**	**$ -**	**$ 22,000**	**$ 1,267,000**	**$ -**	**$ 22,000**	**$ -**	**$ 14,000**
Opinion of Annual Budget (Adjusted Future Value)			**$ 2,337,000**	**$ -**	**$ 751,200**	**$ -**	**$ -**	**$ 25,600**	**$ 1,512,900**	**$ -**	**$ 27,900**	**$ -**	**$ 18,900**
	Current / Annualized Cost =	**$ 693,000**	**$ 203,300**										
	Current / Annualized Cost/square foot =	**$ 2.62**	**$ 0.77**										
	Current / Annualized Cost/Space =	**$ 825**	**$ 242**										

NOTES:

Note 1: Contingency based on 12% of Sub Total rounded up to the nearest $500.
Note 2: General Conditions based on 8% of Sub Total rounded up to the nearest $500.
Note 3: Consulting & Engineering Fees based on 12% of Sub Total rounded up to the nearest $500.
Note 4: Inflated Future Value (based on 3% annual discount rate) accounts for general inflation of the U.S. Dollar and does not include an increase for material or labor.

South Regional Garage
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	Current Repairs	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Construction Date: 1996													
1	**Concrete Repairs**	**$ 13,000**	**$ 19,500**	**$ -**	**$ -**	**$ -**	**$ 14,500**	**$ -**	**$ -**	**$ -**	**$ 5,000**	**$ -**	**$ -**
1.1	Floor	7,000	$ 12,000				8,500				3,500		
1.2	Column, Beam, Ceiling	1,500	$ 3,000				1,500				1,500		
1.5	Concrete Washes at Stairways	4,500	$ 4,500				4,500						
2	**Waterproofing**	**$ 137,500**	**$ 223,000**	**$ -**	**$ -**	**$ -**	**$ 170,500**	**$ -**	**$ -**	**$ -**	**$ 52,500**	**$ -**	**$ -**
2.1	Expansion Joint Repair (Seal and/or Cover Plate)	10,000	$ 8,000				4,000				4,000		
2.2	Expansion Joint Replacement		$ 88,000				42,500				45,500		
2.5	Traffic Topping Recoat	63,500	$ 60,000				60,000						
2.8	Sealer (Roof Level)	42,000	$ 42,000				42,000						
2.9	Cove Sealant	22,000	$ 25,000				22,000				3,000		
3	**Stair/Elevator Tower Repair**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
4	**Mechanical/Electrical/Plumbing**	**$ -**	**$ 123,000**	**$ -**	**$ -**	**$ 41,000**	**$ -**	**$ -**	**$ 41,000**	**$ -**	**$ -**	**$ 41,000**	**$ -**
4.1	HVAC Maintenance/Replacement		$ 3,000			1,000			1,000			1,000	
4.3	PARCS Maintenance/Replacement		$ 15,000			5,000			5,000			5,000	
4.4	Light Fixture Repair / Replacement		$ 6,000			2,000			2,000			2,000	
4.5	Relamp Light Fixtures		$ 90,000			30,000			30,000			30,000	
4.6	Drain Repair/Replacement		$ 9,000			3,000			3,000			3,000	
5	**Architectural/Miscellaneous**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
6	**Enhancements**	**$ -**	**$ 20,000**	**$ -**	**$ -**	**$ -**	**$ 20,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
6.1	Install Exterior Illuminated Garage Identification Sign(s)		$ 20,000				20,000						
Sub Total		$ 150,500	$ 385,500	$ -	$ -	$ 41,000	$ 205,000	$ -	$ 41,000	$ -	$ 57,500	$ 41,000	$ -
Contingency		$ 18,500	$ 47,000	$ -	$ -	$ 5,000	$ 25,000	$ -	$ 5,000	$ -	$ 7,000	$ 5,000	$ -
General Conditions		$ 12,500	$ 32,000	$ -	$ -	$ 3,500	$ 16,500	$ -	$ 3,500	$ -	$ 5,000	$ 3,500	$ -
Consulting & Engineering Fees		$ 18,500	$ 47,000	$ -	$ -	$ 5,000	$ 25,000	$ -	$ 5,000	$ -	$ 7,000	$ 5,000	$ -
Opinion of Annual Budget (2005 Dollars)		**$ 200,000**	**$ 512,000**	**$ -**	**$ -**	**$ 54,500**	**$ 271,500**	**$ -**	**$ 54,500**	**$ -**	**$ 76,500**	**$ 54,500**	**$ -**
Opinion of Annual Budget (Adjusted Future Value)			**$ 599,000**	**$ -**	**$ -**	**$ 59,600**	**$ 305,600**	**$ -**	**$ 65,100**	**$ -**	**$ 97,000**	**$ 71,200**	**$ -**
	Current / Annualized Cost =	**$ 200,000**	**$ 51,200**										
	Current / Annualized Cost/square foot =	**$ 0.33**	**$ 0.09**										
	Current / Annualized Cost/Space =	**$ 137**	**$ 35**										

NOTES:

Note 1: Contingency based on 12% of Sub Total rounded up to the nearest $500.
Note 2: General Conditions based on 8% of Sub Total rounded up to the nearest $500.
Note 3: Consulting & Engineering Fees based on 12% of Sub Total rounded up to the nearest $500.
Note 4: Inflated Future Value (based on 3% annual discount rate) accounts for general inflation of the U.S. Dollar and does not include an increase for material or labor.

William F. Poe Garage
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	Current Repairs	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Construction Date: 1981													
1	**Concrete Repairs**	**$ 14,000**	**$ 25,000**	**$ 5,000**	**$ -**	**$ -**	**$ 11,000**	**$ -**	**$ -**	**$ -**	**$ 9,000**	**$ -**	**$ -**
1.1	Floor	3,500	$ 8,000				4,500				3,500		
1.2	Column, Beam, Ceiling	3,000	$ 6,500				3,500				3,000		
1.4	Wall	2,500	$ 5,500				3,000				2,500		
1.5	Precast Joist Bearing repairs	5,000	$ 5,000	5,000									
2	**Waterproofing**	**$ 11,500**	**$ 159,000**	**$ -**	**$ -**	**$ -**	**$ 56,500**	**$ -**	**$ -**	**$ -**	**$ 102,500**	**$ -**	**$ -**
2.1	Expansion Joint Repair (Seal and/or Cover Plate)		$ 16,000				8,000				8,000		
2.2	Expansion Joint Replacement		$ 17,500								17,500		
2.4	Traffic Topping Repair	3,000	$ 3,000				3,000						
2.5	Traffic Topping Recoat		$ 70,000								70,000		
2.6	Rout/Seal Cracks		$ 12,000				6,000				6,000		
2.8	Sealer (Roof level)		$ 31,000				31,000						
2.9	Cove Sealant	8,500	$ 9,500				8,500				1,000		
3	**Stair/Elevator Tower Repair**	**$ -**	**$ 15,000**	**$ -**	**$ -**	**$ -**	**$ 12,500**	**$ -**	**$ -**	**$ -**	**$ 2,500**	**$ -**	**$ -**
3.1	Concrete Stair Tread Repairs		$ 1,000				500				500		
3.2	Paint Hand Railings		$ 4,000				2,000				2,000		
3.3	Paint Interior of Stair Tower		$ 10,000				10,000						
4	**Mechanical/Electrical/Plumbing**	**$ -**	**$ 61,500**	**$ -**	**$ 20,500**	**$ -**	**$ -**	**$ 20,500**	**$ -**	**$ -**	**$ 20,500**	**$ -**	**$ -**
4.4	PARCS Maintenance/Replacement		$ 9,000		3,000			3,000			3,000		
4.5	Light Fixture Repair / Replacement		$ 7,500		2,500			2,500			2,500		
4.6	Relamp Light Fixtures		$ 42,000		14,000			14,000			14,000		
4.7	Drain Repair/Replacement		$ 3,000		1,000			1,000			1,000		
5	**Architectural/Miscellaneous**	**$ 10,000**	**$ 23,000**	**$ -**	**$ -**	**$ -**	**$ 12,000**	**$ -**	**$ -**	**$ -**	**$ 11,000**	**$ -**	**$ -**
5.1	Exterior Joint Sealant	10,000	$ 20,000				10,000				10,000		
5.4	Repaint Traffic Markings		$ 2,000				1,000				1,000		
5.5	Materials Testing		$ 1,000				1,000						
6	**Enhancements**	**$ 92,000**	**$ 582,000**	**$ -**	**$ -**	**$ -**	**$ 92,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 490,000**
6.1	Replace Lighting System		$ 490,000										490,000
6.2	Clean / Stain Façade	92,000	$ 92,000				92,000						
Sub Total		$ 127,500	$ 865,500	$ 5,000	$ 20,500	$ -	$ 184,000	$ 20,500	$ -	$ -	$ 145,500	$ -	$ 490,000
Contingency		$ 15,500	$ 105,000	$ 1,000	$ 2,500	$ -	$ 22,500	$ 2,500	$ -	$ -	$ 17,500	$ -	$ 59,000
General Conditions		$ 10,500	$ 71,000	$ 500	$ 2,000	$ -	$ 15,000	$ 2,000	$ -	$ -	$ 12,000	$ -	$ 39,500
Consulting & Engineering Fees		$ 15,500	$ 105,000	$ 1,000	$ 2,500	$ -	$ 22,500	$ 2,500	$ -	$ -	$ 17,500	$ -	$ 59,000
Opinion of Annual Budget (2005 Dollars)		**$ 169,000**	**$ 1,147,000**	**$ 7,500**	**$ 27,500**	**$ -**	**$ 244,000**	**$ 27,500**	**$ -**	**$ -**	**$ 192,500**	**$ -**	**$ 647,500**
Opinion of Annual Budget (Adjusted Future Value)			**$ 1,458,000**	**$ 7,800**	**$ 29,200**	**$ -**	**$ 274,700**	**$ 31,900**	**$ -**	**$ -**	**$ 243,900**	**$ -**	**$ 870,200**
	Current / Annualized Cost =	**$ 169,000**	**$ 114,700**										
	Current / Annualized Cost/square foot =	**$ 0.60**	**$ 0.41**										
	Current / Annualized Cost/Space =	**$ 181**	**$ 123**										

NOTES:

Note 1: Contingency based on 12% of Sub Total rounded up to the nearest $500.
Note 2: General Conditions based on 8% of Sub Total rounded up to the nearest $500.
Note 3: Consulting & Engineering Fees based on 12% of Sub Total rounded up to the nearest $500.
Note 4: Inflated Future Value (based on 3% annual discount rate) accounts for general inflation of the U.S. Dollar and does not include an increase for material or labor.

Centro Ybor Garage
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	Current Repairs	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Construction Date: 2000													
1	**Concrete Repairs**	**$ 4,000**	**$ 12,500**	**$ -**	**$ -**	**$ 5,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 7,500**	**$ -**
1.1	Floor	4,000	$ 8,000			4,500						3,500	
1.2	Column, Beam, Ceiling		$ 3,000									3,000	
1.4	Wall		$ 1,500			500						1,000	
2	**Waterproofing**	**$ 72,500**	**$ 159,500**	**$ -**	**$ -**	**$ 21,500**	**$ -**	**$ -**	**$ 72,500**	**$ -**	**$ -**	**$ 65,500**	**$ -**
2.1	Expansion Joint Repair (Seal and/or Cover Plate)		$ 2,500			500						2,000	
2.2	Expansion Joint Replacement		$ 2,000									2,000	
2.6	Rout/Seal Cracks	3,000	$ 6,000			3,000						3,000	
2.7	Tee-to-Tee Joint Sealant	54,000	$ 108,000			18,000			36,000			54,000	
2.8	Sealer		$ 21,000						21,000				
2.9	Cove Sealant	15,500	$ 20,000						15,500			4,500	
3	**Stair/Elevator Tower Repair**	**$ -**	**$ 25,000**	**$ -**	**$ -**	**$ 5,000**	**$ -**	**$ -**	**$ 20,000**	**$ -**	**$ -**	**$ -**	**$ -**
3.3	Paint Steel Stair Tower		$ 25,000			5,000			20,000				
4	**Mechanical/Electrical/Plumbing**	**$ -**	**$ 61,000**	**$ -**	**$ -**	**$ 20,500**	**$ -**	**$ -**	**$ 17,000**	**$ -**	**$ -**	**$ 23,500**	**$ -**
4.4	PARCS Maintenance/Replacement		$ 6,000			2,000			2,000			2,000	
4.5	Light Fixture Repair / Replacement		$ 4,500			1,500						3,000	
4.6	Relamp Light Fixtures		$ 45,000			15,000			15,000			15,000	
4.7	Drain Repair/Replacement		$ 5,500			2,000						3,500	
5	**Architectural/Miscellaneous**	**$ -**	**$ 21,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 2,000**	**$ -**	**$ -**	**$ 19,000**	**$ -**
5.1	Exterior Joint Sealant		$ 5,000									5,000	
5.2	CMU/Brick Replacement/Tuckpointing		$ 10,000									10,000	
5.4	Repaint Traffic Markings		$ 5,000						2,000			3,000	
5.5	Materials Testing		$ 1,000									1,000	
6	**Enhancements**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Sub Total		$ 76,500	$ 279,000	$ -	$ -	$ 52,000	$ -	$ -	$ 111,500	$ -	$ -	$ 115,500	$ -
Contingency		$ 9,500	$ 34,000	$ -	$ -	$ 6,500	$ -	$ -	$ 13,500	$ -	$ -	$ 14,000	$ -
General Conditions		$ 6,500	$ 23,000	$ -	$ -	$ 4,500	$ -	$ -	$ 9,000	$ -	$ -	$ 9,500	$ -
Consulting & Engineering Fees		$ 9,500	$ 34,000	$ -	$ -	$ 6,500	$ -	$ -	$ 13,500	$ -	$ -	$ 14,000	$ -
Opinion of Annual Budget (2005 Dollars)		**$ 102,000**	**$ 370,000**	**$ -**	**$ -**	**$ 69,500**	**$ -**	**$ -**	**$ 147,500**	**$ -**	**$ -**	**$ 153,000**	**$ -**
Opinion of Annual Budget (Adjusted Future Value)			**$ 452,000**	**$ -**	**$ -**	**$ 76,000**	**$ -**	**$ -**	**$ 176,200**	**$ -**	**$ -**	**$ 199,700**	**$ -**
	Current / Annualized Cost =	**$ 102,000**	**$ 37,000**										
	Current / Annualized Cost/square foot =	**$ 0.31**	**$ 0.11**										
	Current / Annualized Cost/Space =	**$ 85**	**$ 31**										

NOTES:

Note 1: Contingency based on 12% of Sub Total rounded up to the nearest $500.
Note 2: General Conditions based on 8% of Sub Total rounded up to the nearest $500.
Note 3: Consulting & Engineering Fees based on 12% of Sub Total rounded up to the nearest $500.
Note 4: Inflated Future Value (based on 3% annual discount rate) accounts for general inflation of the U.S. Dollar and does not include an increase for material or labor.

Palm Avenue Garage
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	Current Repairs	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Construction Date: 2002													
1	**Concrete Repairs**	**$ 10,500**	**$ 18,500**	**$ -**	**$ -**	**$ 12,500**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 6,000**	**$ -**
1.1	Floor	7,000	$ 11,500			8,000						3,500	
1.2	Column, Beam, Ceiling	3,000	$ 5,000			3,500						1,500	
1.3	Curb		$ 500									500	
1.4	Wall	500	$ 1,500			1,000						500	
2	**Waterproofing**	**$ 9,000**	**$ 187,000**	**$ -**	**$ -**	**$ 1,500**	**$ -**	**$ 114,000**	**$ -**	**$ -**	**$ -**	**$ 71,500**	**$ -**
2.1	Expansion Joint Repair (Seal and/or Cover Plate)		$ 5,000					2,500				2,500	
2.2	Expansion Joint Replacement		$ 36,000					18,000				18,000	
2.6	Rout/Seal Cracks & Joints	6,000	$ 9,000			1,500		4,500				3,000	
2.7	Tee-to-Tee Joint Sealant		$ 90,000					45,000				45,000	
2.8	Sealer		$ 41,000					41,000					
2.9	Cove Sealant	3,000	$ 6,000					3,000				3,000	
3	**Stair/Elevator Tower Repair**	**$ -**	**$ 12,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 6,000**	**$ -**	**$ -**	**$ -**	**$ 6,000**	**$ -**
3.2	Paint Hand Railings		$ 12,000					6,000				6,000	
4	**Mechanical/Electrical/Plumbing**	**$ -**	**$ 85,000**	**$ -**	**$ 27,000**	**$ -**	**$ -**	**$ 27,000**	**$ -**	**$ -**	**$ 27,000**	**$ 4,000**	**$ -**
4.4	PARCS Maintenance/Replacement		$ 16,000		4,000			4,000			4,000	4,000	
4.5	Light Fixture Repair / Replacement		$ -										
4.6	Relamp Light Fixtures		$ 69,000		23,000			23,000			23,000		
5	**Architectural/Miscellaneous**	**$ 20,000**	**$ 37,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 23,000**	**$ -**	**$ -**	**$ -**	**$ 14,000**	**$ -**
5.1	Exterior Joint Sealant	10,000	$ 16,000					10,000				6,000	
5.2	CMU/Brick Replacement/Tuckpointing	10,000	$ 18,000					10,000				8,000	
5.4	Repaint Traffic Markings		$ 2,000					2,000					
5.5	Materials Testing		$ 1,000					1,000					
6	**Enhancements**	**$ -**	**$ 20,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 20,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
6.1	Graphics / Wayfinding		$ 20,000					20,000					
Sub Total		$ 39,500	$ 359,500	$ -	$ 27,000	$ 14,000	$ -	$ 190,000	$ -	$ -	$ 27,000	$ 101,500	$ -
Contingency		$ 5,000	$ 44,500	$ -	$ 3,500	$ 2,000	$ -	$ 23,000	$ -	$ -	$ 3,500	$ 12,500	$ -
General Conditions		$ 3,500	$ 30,500	$ -	$ 2,500	$ 1,500	$ -	$ 15,500	$ -	$ -	$ 2,500	$ 8,500	$ -
Consulting & Engineering Fees		$ 5,000	$ 44,500	$ -	$ 3,500	$ 2,000	$ -	$ 23,000	$ -	$ -	$ 3,500	$ 12,500	$ -
Opinion of Annual Budget (2005 Dollars)		**$ 53,000**	**$ 479,000**	**$ -**	**$ 36,500**	**$ 19,500**	**$ -**	**$ 251,500**	**$ -**	**$ -**	**$ 36,500**	**$ 135,000**	**$ -**
Opinion of Annual Budget (Adjusted Future Value)			**$ 575,000**	**$ -**	**$ 38,800**	**$ 21,400**	**$ -**	**$ 291,600**	**$ -**	**$ -**	**$ 46,300**	**$ 176,200**	**$ -**
	Current / Annualized Cost =	**$ 53,000**	**$ 47,900**										
	Current / Annualized Cost/square foot =	**$ 0.11**	**$ 0.10**										
	Current / Annualized Cost/Space =	**$ 43**	**$ 39**										

NOTES:

Note 1: Contingency based on 12% of Sub Total rounded up to the nearest $500.
Note 2: General Conditions based on 8% of Sub Total rounded up to the nearest $500.
Note 3: Consulting & Engineering Fees based on 12% of Sub Total rounded up to the nearest $500.
Note 4: Inflated Future Value (based on 3% annual discount rate) accounts for general inflation of the U.S. Dollar and does not include an increase for material or labor.

Whiting Street Garage and Expansion
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	Current Repairs	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Construction Date(s): 1963 &1979													
1	**Concrete Repairs**	**$ 154,500**	**$ 171,500**	**$ 154,500**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 8,500**	**$ -**	**$ 8,500**	**$ -**
1.1	Floor	23,500	$ 31,500	23,500						4,000		4,000	
1.2	Column, Beam, Ceiling	20,500	$ 27,500	20,500						3,500		3,500	
1.4	Wall	12,500	$ 14,500	12,500						1,000		1,000	
1.5	Concrete Washes at Expansion Joints	98,000	$ 98,000	98,000									
2	**Waterproofing**	**$ 373,500**	**$ 503,000**	**$ 373,500**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 129,500**	**$ -**	**$ -**	**$ -**
2.1	Expansion Joint Repair (Seal and/or Cover Plate)		$ 2,000							2,000			
2.2	Expansion Joint Replacement	44,500	$ 44,500	44,500									
2.3	Traffic Topping Installation	162,000	$ 162,000	162,000									
2.4	Traffic Topping Repair		$ 18,000							18,000			
2.5	Traffic Topping Recoat		$ 103,000							103,000			
2.6	Rout/Seal Cracks	16,000	$ 19,500	16,000						3,500			
2.7	Bituminous Topping Removal	118,000	$ 118,000	118,000									
2.8	Sealer (2nd Level)	20,000	$ 20,000	20,000									
2.9	Cove Sealant	13,000	$ 16,000	13,000						3,000			
3	**Stair/Elevator Tower Repair**	**$ 5,500**	**$ 10,500**	**$ 5,500**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 5,000**	**$ -**	**$ -**	**$ -**
3.1	Concrete Stair Tread Repairs	1,500	$ 2,500	1,500						1,000			
3.2	Paint Hand Railings	4,000	$ 8,000	4,000						4,000			
4	**Mechanical/Electrical/Plumbing**	**$ 329,000**	**$ 369,500**	**$ 329,000**	**$ -**	**$ -**	**$ 13,500**	**$ -**	**$ -**	**$ 13,500**	**$ -**	**$ -**	**$ 13,500**
4.3	Replace Lighting System	309,000	$ 309,000	309,000									
4.4	PARCS Maintenance/Replacement	8,000	$ 20,000	8,000			4,000			4,000			4,000
4.5	Light Fixture Repair / Replacement		$ 1,500				500			500			500
4.6	Relamp Light Fixtures		$ 27,000				9,000			9,000			9,000
4.7	Drain Repair/Replacement	4,500	$ 4,500	4,500									
4.8	Supplemental Floor Drains & Piping	7,500	$ 7,500	7,500									
5	**Architectural/Miscellaneous**	**$ 16,500**	**$ 16,500**	**$ 16,500**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
5.3	Repaint Traffic Markings	3,000	$ 3,000	3,000									
5.5	Repaint Steel Guardrail Bumpers	11,500	$ 11,500	11,500									
5.6	Clean / Paint Storm Drain Leaders	1,500	$ 1,500	1,500									
5.7	Clean / Paint Fire Protection Standpipes	500	$ 500	500									
6	**Enhancements**	**$ 260,500**	**$ 260,500**	**$ 260,500**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
6.2	Clean Façade Panels	52,500	$ 52,500	52,500									
6.3	Clean/Paint/Stain Ceilings	143,500	$ 143,500	143,500									
6.4	Supplemental Exterior Railing at Stair Landings	3,000	$ 3,000	3,000									
6.5	Supplemental Perimeter Handrail	61,500	$ 61,500	61,500									
Sub Total		$ 1,139,500	$ 1,331,500	$ 1,139,500	$ -	$ -	$ 13,500	$ -	$ -	$ 156,500	$ -	$ 8,500	$ 13,500
Contingency		$ 114,000	$ 134,000	$ 114,000	$ -	$ -	$ 1,500	$ -	$ -	$ 16,000	$ -	$ 1,000	$ 1,500
General Conditions		$ 91,500	$ 108,500	$ 91,500	$ -	$ -	$ 1,500	$ -	$ -	$ 13,000	$ -	$ 1,000	$ 1,500
Consulting & Engineering Fees		$ 82,500	$ 107,000	$ 82,500	$ -	$ -	$ 2,000	$ -	$ -	$ 19,000	$ -	$ 1,500	$ 2,000
Opinion of Annual Budget (2005 Dollars)		**$ 1,428,000**	**$ 1,681,000**	**$ 1,427,500**	**$ -**	**$ -**	**$ 18,500**	**$ -**	**$ -**	**$ 204,500**	**$ -**	**$ 12,000**	**$ 18,500**
Opinion of Annual Budget (Adjusted Future Value)			**$ 1,784,000**	**$ 1,470,400**	**$ -**	**$ -**	**$ 20,900**	**$ -**	**$ -**	**$ 251,600**	**$ -**	**$ 15,700**	**$ 24,900**
	Current / Annualized Cost =	**$ 1,428,000**	**$ 168,100**										
	Current / Annualized Cost/square foot =	**$ 7.89**	**$ 0.93**										
	Current / Annualized Cost/Space =	**$ 2,856**	**$ 336**										

NOTES:

Note 1: Contingency based on 12% of Sub Total rounded up to the nearest $500.
Note 2: General Conditions based on 8% of Sub Total rounded up to the nearest $500.
Note 3: Consulting & Engineering Fees based on 12% of Sub Total rounded up to the nearest $500.
Note 4: Inflated Future Value (based on 3% annual discount rate) accounts for general inflation of the U.S. Dollar and does not include an increase for material or labor.
Note 5: 2005 Engineering costs reduced to reflect repair design and related costs have already been paid. Costs shown represent estimated construction phase costs.

Police Headquarters Garage
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	Current Repairs	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Construction Date: 2001													
1	**Concrete Repairs**	**$ 4,000**	**$ 18,000**	**$ 4,000**	**$ -**	**$ -**	**$ -**	**$ 7,000**	**$ -**	**$ -**	**$ -**	**$ 7,000**	**$ -**
1.1	Floor	4,000	$ 10,000	4,000				3,000				3,000	
1.2	Column, Beam, Ceiling		$ 6,000					3,000				3,000	
1.3	Curb		$ 1,000					500				500	
1.4	Wall		$ 1,000					500				500	
2	**Waterproofing**	**$ 16,500**	**$ 123,500**	**$ 16,500**	**$ -**	**$ -**	**$ -**	**$ 80,500**	**$ -**	**$ -**	**$ -**	**$ 26,500**	**$ -**
2.1	Expansion Joint Repair (Seal and/or Cover Plate)		$ 2,000					1,000				1,000	
2.2	Expansion Joint Replacement		$ 6,000					6,000					
2.5	Traffic Topping Recoat		$ 7,500					7,500					
2.6	Rout/Seal Cracks	1,500	$ 4,500	1,500				1,500				1,500	
2.7	Re-seal Tee-to-Tee joints	11,000	$ 44,500	11,000				23,000				10,500	
2.8	Sealer		$ 40,000					30,500				9,500	
2.9	Cove Sealant	4,000	$ 19,000	4,000				11,000				4,000	
3	**Stair/Elevator Tower Repair**	**$ -**	**$ 5,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 2,500**	**$ -**	**$ -**	**$ -**	**$ 2,500**	**$ -**
3.1	Concrete Stair Tread Repairs		$ 1,000					500				500	
3.2	Paint Hand Railings		$ 4,000					2,000				2,000	
4	**Mechanical/Electrical/Plumbing**	**$ -**	**$ 27,500**	**$ 5,500**	**$ -**	**$ -**	**$ -**	**$ 12,000**	**$ -**	**$ -**	**$ -**	**$ 10,000**	**$ -**
4.1	PARCS Maintenance/Replacement		$ 4,000					2,000				2,000	
4.2	Light Fixture Repair / Replacement		$ 4,000					3,500				500	
4.3	Relamp Light Fixtures		$ 16,500	5,500				5,500				5,500	
4.4	Drain Repair/Replacement		$ 3,000					1,000				2,000	
5	**Architectural/Miscellaneous**	**$ -**	**$ 12,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 6,000**	**$ -**	**$ -**	**$ -**	**$ 6,000**	**$ -**
5.2	Paint Perimeter Handrails		$ 6,000					3,000				3,000	
5.3	Repaint Traffic Markings		$ 4,000					2,000				2,000	
5.4	Materials Testing		$ 2,000					1,000				1,000	
6	**Enhancements**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Sub Total		$ 20,500	$ 186,000	$ 26,000	$ -	$ -	$ -	$ 108,000	$ -	$ -	$ -	$ 52,000	$ -
Contingency		$ 2,500	$ 23,000	$ 3,500	$ -	$ -	$ -	$ 13,000	$ -	$ -	$ -	$ 6,500	$ -
General Conditions		$ 2,000	$ 16,000	$ 2,500	$ -	$ -	$ -	$ 9,000	$ -	$ -	$ -	$ 4,500	$ -
Consulting & Engineering Fees		$ 2,500	$ 23,000	$ 3,500	$ -	$ -	$ -	$ 13,000	$ -	$ -	$ -	$ 6,500	$ -
Opinion of Annual Budget (2005 Dollars)		**$ 28,000**	**$ 248,000**	**$ 35,500**	**$ -**	**$ -**	**$ -**	**$ 143,000**	**$ -**	**$ -**	**$ -**	**$ 69,500**	**$ -**
Opinion of Annual Budget (Adjusted Future Value)			**$ 294,000**	**$ 36,600**	**$ -**	**$ -**	**$ -**	**$ 165,800**	**$ -**	**$ -**	**$ -**	**$ 90,700**	**$ -**
	Current / Annualized Cost =	**$ 28,000**	**$ 24,800**										
	Current / Annualized Cost/square foot =	**$ 0.26**	**$ 0.23**										
	Current / Annualized Cost/Space =	**$ 100**	**$ 89**										

NOTES:

Note 1: Contingency based on 12% of Sub Total rounded up to the nearest $500.
Note 2: General Conditions based on 8% of Sub Total rounded up to the nearest $500.
Note 3: Consulting & Engineering Fees based on 12% of Sub Total rounded up to the nearest $500.
Note 4: Inflated Future Value (based on 3% annual discount rate) accounts for general inflation of the U.S. Dollar and does not include an increase for material or labor.

Convention Center Garage
10 Year Budget Forecast

WALKER PARKING CONSULTANTS

NO.	WORK DESCRIPTION	Current Repairs	10-YEAR TOTAL COST	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Construction Date:													
1	**Concrete Repairs**	**$ 2,000**	**$ 9,500**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 5,500**	**$ -**	**$ -**	**$ 4,000**	**$ -**	**$ -**
1.1	Floor	2,000	$ 5,000					3,000			2,000		
1.2	Column, Beam, Ceiling		$ 2,500					1,500			1,000		
1.3	Curb		$ 1,500					1,000			500		
1.4	Wall		$ 500								500		
2	**Waterproofing**	**$ 8,500**	**$ 94,000**	**$ -**	**$ 7,500**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 86,500**	**$ -**	**$ -**
2.1	Expansion Joint Repair (Seal and/or Cover Plate)	2,000	$ 1,000		1,000								
2.2	Expansion Joint Replacement		$ 43,500								43,500		
2.6	Rout/Seal Cracks	1,500	$ 3,000		1,500						1,500		
2.7	Chemical Grout Injection @ Basement Wall Expansion Joint	5,000	$ 5,000		5,000								
2.8	Sealer		$ 38,500								38,500		
2.9	Cove Sealant		$ 3,000								3,000		
3	**Stair/Elevator Tower Repair**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
4	**Mechanical/Electrical/Plumbing**	**$ -**	**$ 63,500**	**$ -**	**$ 20,500**	**$ -**	**$ -**	**$ 22,500**	**$ -**	**$ -**	**$ 20,500**	**$ -**	**$ -**
4.1	HVAC Maintenance/Replacement		$ 12,000		4,000			4,000			4,000		
4.3	PARCS Maintenance/Replacement		$ 12,000		4,000			4,000			4,000		
4.4	Light Fixture Repair / Replacement		$ 6,000		2,000			2,000			2,000		
4.5	Relamp Light Fixtures		$ 31,500		10,500			10,500			10,500		
4.6	Drain Repair/Replacement		$ 2,000					2,000					
5	**Architectural/Miscellaneous**	**$ -**	**$ 8,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 8,000**	**$ -**	**$ -**
5.2	CMU/Brick Replacement/Tuckpointing		$ 5,000								5,000		
5.4	Repaint Traffic Markings		$ 2,000								2,000		
5.5	Materials Testing		$ 1,000								1,000		
6	**Enhancements**	**$ -**	**$ 136,500**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 136,500**	**$ -**	**$ -**
6.1	Paint/Stain Ceilings (Upper Level)		$ 136,500								136,500		
Sub Total		$ 10,500	$ 311,500	$ -	$ 28,000	$ -	$ -	$ 28,000	$ -	$ -	$ 255,500	$ -	$ -
Contingency		$ 1,500	$ 38,000	$ -	$ 3,500	$ -	$ -	$ 3,500	$ -	$ -	$ 31,000	$ -	$ -
General Conditions		$ 1,000	$ 25,500	$ -	$ 2,500	$ -	$ -	$ 2,500	$ -	$ -	$ 20,500	$ -	$ -
Consulting & Engineering Fees		$ 1,500	$ 38,000	$ -	$ 3,500	$ -	$ -	$ 3,500	$ -	$ -	$ 31,000	$ -	$ -
Opinion of Annual Budget (2005 Dollars)		**$ 15,000**	**$ 413,000**	**$ -**	**$ 37,500**	**$ -**	**$ -**	**$ 37,500**	**$ -**	**$ -**	**$ 338,000**	**$ -**	**$ -**
Opinion of Annual Budget (Adjusted Future Value)			**$ 512,000**	**$ -**	**$ 39,800**	**$ -**	**$ -**	**$ 43,500**	**$ -**	**$ -**	**$ 428,200**	**$ -**	**$ -**
	Current / Annualized Cost =	**$ 15,000**	**$ 41,300**										
	Current / Annualized Cost/square foot =	**$ 0.07**	**$ 0.20**										
	Current / Annualized Cost/Space =	**$ 26**	**$ 71**										

NOTES:

Note 1: Contingency based on 12% of Sub Total rounded up to the nearest $500.
Note 2: General Conditions based on 8% of Sub Total rounded up to the nearest $500.
Note 3: Consulting & Engineering Fees based on 12% of Sub Total rounded up to the nearest $500.
Note 4: Inflated Future Value (based on 3% annual discount rate) accounts for general inflation of the U.S. Dollar and does not include an increase for material or labor.

REPAIR STRATEGIES

GENERAL

There is a significant amount of literature on concrete repair methods and materials that has been published during the past several years. Many committees of the ACI have now published reports that directly or indirectly relate to the repair and restoration of concrete structures. The results of research and the application of repair methods and materials have been reported in publications presented by the Federal Highway Administration research programs, the Portland Cement Association, the Corps of Engineers, and in articles presented in various trade journals. Therefore, in this section we will only attempt to summarize the basic requirements for durable repair techniques we commonly use to restore a parking structure. Other less frequently used techniques have not been included. The restoration of parking facilities requires the use of several repair methods to address existing deterioration of structural members and provide effective protection to extend the service life of the restored structure. Table E-1 summarizes the repair objectives and the methods we commonly utilize to repair various structural elements. The horizontal floor-slabs generally experience the most deterioration and usually require implementing a combination of repair methods to develop an approach that will effectively restore the structure. For instance, the approach might consist of a combination of repair methods that includes patching to restore floor-slab integrity and membrane protection to effectively waterproof and minimize future corrosion induced concrete deterioration.

TABLE E-1: REPAIR OBJECTIVES AND METHODS

Repair Objective	Repair Method	Primary Applications
Restore integrity	Patching	
	a. Partial-depth	Floor-slab, beam, column, wall, etc.
	b. Full-depth	Floor-slab
	Replacement	Floor-slab, beam, columns
Provide protection		
Abrasion	Coating	Floor-slab
Freeze-Thaw	Replacement	Floor-slab
	a. Partial-depth	
	b. Full-depth	
	Coating	Floor-slab
Corrosion	Cathodic protection	Floor-slab
	Replacement	Floor-slab
	Coating	Floor-slab, beam, columns, wall
Waterproofing	Sealing	Floor-slab, joints, cracks

BASIC REQUIREMENTS FOR CONCRETE REPAIRS

A repair is generally successful if the repair material is compatible with the original substrate and has the required strength and durability. Other considerations are appearance and economy. The four basic requirements for a satisfactory concrete repair are:

- Concrete removal and surface preparation
- Application of bonding medium
- Proper selection of repair material
- Proper material application

CONCRETE REMOVAL

For all concrete repair situations, regardless of the type of structural member, a basic requirement is to remove all the deteriorated, delaminated, and unsound concrete prior to placing any new patch material. When complete removal of the deteriorated concrete is not accomplished, there is a good probability of patch failures.

Concrete removal in parking structures is commonly performed by light (15 lbs. maximum) chipping hammers. These light hammers are convenient for concrete removal around and below the existing reinforcement. The size of the chipping hammer is limited to minimize damage to the surrounding area.

Removal of relatively thin layers of concrete over large areas, such as shallow concrete removal from the surface in preparation for placement of an overlay, may be more effectively done with a scabbler, scarifier or planer, than with chipping hammers. These machines are particularly effective in cleaning the surface by removing the top surface contamination of traffic oils and greases. In addition, high-pressure sand and water blasters are capable of removing deteriorated concrete and many surface contaminants. Scarification of concrete surfaces using an abraded metal-shot-rebound method has also been used in the preparation of surfaces for installing a membrane or overlay. Some other methods utilized for very extensive full-depth slab removals include saw cutting and large, mechanically operated breakers.

SURFACE PREPARATION

Another important step in the repair of concrete structures is the preparation of the surface to be repaired. The repair is only as good as the surface preparation, regardless of the repair method or materials selected. For reinforced concrete structures, repairs must include proper preparation of the reinforcing steel in order to develop a bond with the replacement concrete.

BONDING MEDIUM

Bonding of the new patch or overlay to the concrete substrate is essential for a durable repair. An adequate bond between the patch or overlay material is required to resist stresses due to differential volume change between the patching material and the substrate. The failure can occur either at the bond interface or adjacent to the interface within the section of the lower strength material.

Once debonding is initiated, the effects of freeze-thaw cycling and dynamic impact of vehicle wheel loads can contribute to the progressive deterioration of the repaired area. Debonded areas are generally prone to cracking. The cracking is usually through the entire thickness of the patch or overlay material, which can permit water leakage to the interface and the underlying substrate.

MATERIAL APPLICATION

Concrete repair materials must be properly placed, consolidated, and cured. Our repair specification will include specific requirements for concrete placement, consolidation, and curing for patches and overlay. The most common application and placement methods include the following:

- Cast-in-place concrete for patches, overlays and floor-slab replacements.
- Shotcrete repairs for overhead and vertical patches.
- Formed and pumped concrete or mortar for deep repairs to slab, beam and columns sections.
- Trowel applied mortars for shallow overhead and vertical patches.

PATCHING

Patching replaces deteriorated concrete on the surface of horizontal and vertical members. When properly implemented, patching will restore structural integrity, as well as improve serviceability or correct cosmetic damage.

Patching can be referred to as "partial-depth" or "full-depth" based on the extent of concrete removed. Quite often, for thin slab sections (less than 5 inches thick) it is difficult to perform shallow concrete removals and usually results in full-depth concrete removal.

As a general rule of thumb, a full-depth patch is specified when concrete removal equals or exceeds half the slab's thickness.
Patching consists of removing the unsound concrete, cleaning the reinforcing steel exposed by removals, preparing the exposed surface, and installing a specialty concrete patching material. Patch edges for partial-depth removals are often chipped or saw-cut to near vertical to a depth of at least 3/4-inch, as opposed to leaving a "feather-edge".

Although patches of high-quality (low permeability) material are installed, the adjacent surface tends to have lower durability. In chloride-contaminated slabs, the durability of this repair system is adversely affected by delamination and spalling of floor-slab areas due to continuing corrosion of reinforcement beyond the patch limits. Patching can, however, rapidly restore the structural integrity of the member and limit further damage to embedded reinforcement. The emphasis is on repairs that address only existing damage.

REPLACEMENT

When a floor slab is extensively deteriorated, removal and replacement of the slab may be a viable repair alternative, provided the underlying members are in relatively good condition. This is referred to as "partial-depth" replacement. Floor-slabs that are less than 5 inches thick are difficult to repair. Concrete removals on pan-joist, waffle-slab, and one-way slab systems usually result in complete removal of the thin slab. The existing underlying beams and waffle or pan-joist ribs are used to support the new slab, provided adequate measures are taken to ensure composite behavior of the rebuilt floor system. The new slab can be reconstructed with durable concrete and epoxy-coated reinforcement and other internally-built corrosion protection systems to extend the service life of the facility. However, the new slab is susceptible to cracking due to volume-change restraint

offered by the existing underlying members. In extreme cases, "full-depth" replacement of the floor system (slab and underlying elements) may be necessary.

CATHODIC PROTECTION

In concept, the only method that will effectively stop the corrosion of embedded reinforcement in chloride-contaminated slabs is cathodic protection. Cathodic protection works by putting energy in the form of electrical current into the concrete to be protected. The introduced energy prevents corrosion in the steel reinforcement. Corrosion of metal is, put simply, a loss of energy from that metal. Feeding in more energy prevents that corrosion. Cathodic protection is the only protective measure that prevents corrosion from starting. If corrosion has already started before cathodic protection is introduced, it is the only protective measure, which will stop corrosion. All other measures described are but delaying actions, though some are very effective; they will slow corrosion, but not stop it.

Application of cathodic protection can only mitigate corrosion; repairs to restore structural integrity and serviceability must still be performed. Therefore, a cathodic protection system is more cost-effective when it is applied to structures with limited concrete deterioration, such as floor-slabs in the initial stages of deterioration. Also, a cathodic protection system is not economical when applied to structures with less than 10 years of planned or anticipated life expectancy. Presently, only conventionally reinforced concrete structures have been cathodically protected. Cathodic protection of prestressing steel is still in a developmental stage. The concern is due to evolution of hydrogen ions as a result of application of cathodic protection to concrete structures. Hydrogen ions can potentially contribute to embrittlement of the high strength prestressing steel and abrupt tendon failures. Hydrogen embrittlement is not a concern for conventional mild steel reinforcement.

SEALING

Sealing consists of performing repairs that will reduce water leakage through floor-slab cracks and joints. Since sealing by itself cannot be considered a repair method, it must always be performed in conjunction with the other repair methods described earlier. Potential sources of water leakage are:

1) expansion joints,

2) construction joints,
3) control or isolation joints, and
4) construction- or service-related cracks.

Under certain circumstances, cracks can be repaired by epoxy injection. The material and its application are described in ACI 224.1R. Epoxy injection of service-related (active) cracks usually results in cracking adjacent to previously injected cracks. Active cracks should be treated with a flexible joint sealant material.

Surface or pattern cracks that are inactive can be treated by application of high molecular weight methacrylate (HMWM). The concrete surface is soaked to fill and heal the cracks. These "crack healers" have a viscosity slightly greater than water. Surface cracks can also be treated with a traffic bearing elastomeric membrane. In addition, these membranes also have the ability to bridge and protect the surface from active cracks. Application of silane sealer is also sometimes effective in keeping moisture out of fine hairline surface cracks that are not active.

SUMMARY

The intent of these sections was to discuss our commonly used repair approaches and methods for restoring parking structures. Construction and design deficiencies, along with errors in design or construction, may require strengthening or stiffening of the structural element. Also, severely deteriorated structural elements in a parking facility may require strengthening. In these instances, the primary cause of the distress must be first determined, and the appropriate corrective actions taken. These situations are generally uncommon. If construction and design deficiencies are present, then repair and/or strengthening methods must address the specific conditions encountered.

PATCHING MATERIALS

REPAIR MATERIALS

The selection of patching and concrete material is based on the consideration of the following five characteristics, as they relate to the member being repaired:

- Thermal compatibility or incompatibility
- Shrinkage
- Strength of repair material and the substrate
- Durability of the repair material and the substrate

- Ability to permit vapor transmission

The compatibility of the repair materials with the existing concrete is an important concern in the selection of appropriate repair materials. Since parking structures are exposed to temperature extremes, a difference in thermal properties of the repair material and the existing concrete will contribute to the debonding and failure of repaired areas. For parking structures, Portland cement-based patching and overlay materials generally perform better than any other material. Portland cement-based materials also reduce failures associated with a difference in the modulus of elasticity between the repaired material and existing concrete.

The differential shrinkage between the original concrete and the repair material can also contribute to debonding and cracking due to development of shear stresses along the interface. Reducing the shrinkage potential of the concrete repair material is particularly important for full-depth patches and floor-slab replacements. Cracking of full-depth patching and floor-slab replacements is a common occurrence.

For horizontal floor-slab surfaces, low-slump high-density and microsilica modified concrete patching materials that are properly proportioned and adequately air entrained tend to perform well. Also, latex-modified concrete patching materials perform well since they are not as susceptible to freeze-thaw damage. For full-depth floor-slab replacements we specify a concrete mix with low potential for shrinkage.

The patching material used for overhead and vertical surfaces is less susceptible to freeze-thaw deterioration than that used for the floor-slab or horizontal surface. For areas that are protected from direct exposure to moisture, such as the ceiling, rapid-setting prepackaged Portland cement-based repair materials have been used successfully. Other successfully, but not widely used patching materials are various epoxy and polymer concretes. Polymer concretes are classed as thermosetting and hydrating. Examples of thermosetting polymer concretes are those containing epoxy and those containing methyl methacrylate. Examples of hydrating polymer concretes are those containing styrene-butadiene ("latex") additives which enhance the bond and reduce permeability. Limit the use of thermosetting polymer concrete materials for cosmetic or aesthetic repairs. For large shallow areas, pneumatically applied concrete (shotcrete) has also been used effectively. We specify the wet process with air-entrainment when there is a potential for saturation of the surface by moisture.

SEALERS

Concrete sealer is a liquid that is sprayed, squeegeed, or brushed onto the concrete surface. A sealer makes the concrete less permeable to keep chloride ions, moisture and water out of the concrete. However, it cannot completely screen out the chloride ion or moisture like a traffic topping. Many generic types and brands of sealers are available with considerable variation in effectiveness and performance. It is important to select a sealer that will perform. Silanes are considered to be most effective because of their ability to penetrate deeper into the concrete. However, all silanes do not perform equally. The desirable properties of a good sealer are:

- Reduce water absorption
- Effective chloride ion screen and chemical stability when exposed to road salt
- Ability to "breath" which permits moisture vapor transmission
- Resist ultraviolet exposure
- Provide a skid resistant surface after application
- Ability to penetrate to the concrete surface

The better performance of silanes is due to their smaller molecular structure. These sealers can penetrate as much as 1/8 inch into the concrete surface. Depth of penetration is obviously related to the concrete porosity and permeability. Concrete with a higher water-to-cement ratio is more porous and will permit greater sealer penetration than a concrete that is less porous. Also, the sealer effectiveness is influenced by the sealer application rate and the concrete porosity. Some other factors that can affect sealer performance are condition of the surface at the time of sealer application, surface preparation, moisture content of the concrete and sealer concentration. The effectiveness of the sealer under service condition and/or frequency of reapplication can be monitored.

One recent development is the use of water-based solvents for silanes. The more volatile alcohol based solvent carriers that were traditionally required have been replaced by water-based solvents. This is due to the very stringent regulations for Volatile Organic Compounds (VOC) that have been imposed by several states. These state standards exceed the current Environmental Protection Agency's Clean Air Act Amendment standards. Therefore, some manufacturers have already developed solvent-free 100% silane sealers. This highly concentrated sealer is obviously more expensive than current sealers packaged at 20 to 40% silane content. The new sealers can potentially last longer

due to greater penetration into the concrete surface and provide better corrosion protection due to their high solids content.

MEMBRANES (TRAFFIC TOPPING)

The present ASTM test methods for testing properties of traffic-bearing membranes are not adequate to evaluate the performance and the abrasion resistance of systems. There are many manufactures that supply the membrane but all membrane systems do not perform equally. Some basic characteristics that help to evaluate the systems are:

- Impermeability - Should be impermeable to water under normal use.
- Tear Resistance - Membrane should be capable of bridging cracks under normal as well as cold-weather conditions.
- Adhesion - Intercoat as well as adhesion to the substrate.
- Moisture Vapor Transmission - The membrane should be capable of breathing.
- Material Stability - Stability under service-exposure conditions to perform over extended time period.
- Chemical Resistance - Should be resistant to gasoline, oil, and antifreeze spills.
- Ease of Installation - The waterproofing material and installation procedures must be tolerant of site conditions, as opposed to ideal laboratory conditions.

We select membrane systems based on performance history, compatibility with other sealant systems, cost and the manufacturer's reputation to properly install and service the topping. Improper application of polyurethane membranes can result in localized imperfections, such as blistering and pinholes. Therefore, the performance of the membrane systems is affected by the care taken to install the systems. These systems require more frequent maintenance in high traffic areas. The service life and the level of maintenance are affected by the abrasion resistance of the system.

The stricter VOC regulations imposed by several states have led to the recent development of some solvent-free (100% solids) membrane systems. Currently, most of the urethane membrane systems are solvent based. Also, low-odor systems are offered by many manufacturers for membrane installation in enclosed areas or areas adjacent to occupied spaces in buildings. Presently, there are no standards to measure or

compare the odor characteristics. After all, odor is a very subjective issue and cannot be defined.

The life expectancy of a properly applied and maintained state-of-the-art traffic topping is approximately 15 years, requiring top coat reapplication to the entire surface to further extend the service life. For surfaces exposed to direct sunlight and ultraviolet lights, the life expectancy is reduced to 10 years.

Traffic topping has a high initial application cost that is 6 to 8 times the cost of a protective concrete sealer. The membrane is susceptible to traffic abrasion and wear, requiring more frequent maintenance in heavy traffic areas such as entry/exit points, drive aisles and turn areas. Also, traffic topping will require use of mechanized scrubbers and sweepers to clean the surface. It is normal for the traffic topping to gradually discolor when directly exposed to sunlight. Black or dark membranes will reduce the light levels within the facility, particularly in the lower covered levels.

OVERLAYS

The most widely used specialty concrete overlay systems that have demonstrated a satisfactory long-term performance history are latex-modified concrete (LMC) and low-slump high-density concrete (LSDC). LMC is more effective at preventing additional water and salt penetrations into the base slab than LSDC. However, the long-term durability of both systems appears to be equivalent. Polymer-concrete overlays have been used only on a limited scale and have not been fully evaluated. Such systems, whether referred to as polymer or epoxy concrete, can offer solutions to surface deterioration problems and should not be excluded from consideration. Another specialty concrete overlay utilizing silica-fume-modified, high-density concrete is currently available. The installation cost of the silica-fume modified overlay is lower than that of the LMC system.

SELECTION OF REPAIR APPROACH AND METHOD

GENERAL

The selection of repair schemes to restore a parking structure is related to the following six basic issues:

- Nature of distress
- Extent of deterioration
- Type of structure

- Repair alternatives
- Life expectancy of the repaired structure
- Economics

The same repair approach cannot be used for all structures. The approach selected to restore a structure damaged by corrosion of embedded reinforcement will be different from that selected for a slab damaged by freezing and thawing. In addition, the repair approach selected must address the adverse effect of other contributing factors, such as the quality of the concrete, poor drainage, floor-slab cracking, shallow concrete cover over reinforcement, and lack of adequate air-entrainment.

The extent of the deterioration and type of structural system will also influence the selection of the repair scheme. For instance, if a 4-inch thick slab of a pan-joist system is extensively damaged due to corrosion, then patching, sealing, or cathodic protection may not be an acceptable solution. The appropriate repair scheme in this instance is probably going to be the replacement of the slab of the floor system. Slab replacement will be required, since it is difficult to perform partial-depth repair of slabs that are less than 5 inches thick. On the other hand if the 4-inch slab is damaged by surface scaling, an elastomeric-waterproofing membrane or an overlay may be acceptable solutions. However, if the extent of the freeze-thaw damage extends 1-2 inches below the surface, replacement may be a more appropriate repair method.

In summary, from a technical standpoint, we consider the nature and extent of the deterioration, the pros and cons of the repair methods that are technically acceptable, and the impact of the repair on factors contributing to the deterioration. Also, we make certain that the structure can be repaired (as opposed to replaced), and that all elements of the structure will support additional loads imposed by the repair work.

LIFE EXPECTANCY OF REPAIRS

The life expectancy of repair methods is at best an estimate. Also, estimating the service life of repaired structures is only an educated opinion, based on experience gained from conditions observed in structures with a similar framing system. Therefore, difficulty in estimating the service life of repaired structures complicates the selection of a cost effective repair method. Removal of sound, but chloride contaminated concrete has a significant impact on the life

expectancy of repairs. The impact of concrete removal on the various repair methods can be best illustrated by considering the life expectancy of structures repaired by patching.

A distinction can sometimes be made between temporary and permanent repair patches. However, because of the progressive nature of corrosive processes, the service life of even a "permanent" patch is limited. In a temporary patch the concrete is removed only to the level of reinforcement. This situation contributes to progressive deterioration within and adjacent to the patch. Also, the life expectancy of the patch may be limited to only 1 or 2 years. This method of patch repair may be appropriate for structures when serviceability is to be maintained for a limited time, or when constraints are imposed due to available funds or weather conditions.

In the instance of a relatively permanent patch, the concrete is removed below the existing reinforcement to minimize potential for corrosion within the patch boundary. Also, to control corrosion adjacent to the patch boundary, the existing reinforcement may be epoxy coated. The entire floor surface is then sealed to reduce the deterioration rate of areas beyond the patch boundary. Under these conditions, the life expectancy of the patch repairs is 3 to 5 years.

In certain instances, where longer life expectancy is desirable, concrete removal along the entire length of reinforcement can be specified. The life expectancy of the "strip-patch" repair may be estimated at 10 - 20 years, limited primarily by other contributing factors, such as cracking, lack of air-entrainment and poor drainage that may adversely affect the service life of the structure. However, it is not feasible to implement the strip-patch-repair approach in structures with relatively thin slabs (less than 5 inches thick). Therefore, considerations, such as the structural system involved and the existing reinforcement, size, placement and pattern, will limit the ability to implement this repair approach.

At present, the only way to be assured of a "permanent" repair requiring little maintenance is to remove all concrete that contains chlorides in excess of the corrosion threshold. The emphasis should be on selective, but cost-effective, removals of chloride-contaminated concrete, based on consideration of overall repair strategies and the desired life expectancy of the repairs.

Based on the extent of concrete removals, the structural system involved, and the concrete cover over existing reinforcement, patching and then coating the floor-slab with a waterproofing membrane is likely

to extend the service life of the structure 5 - 10 years. An overlay can extend the service life of structures 10 - 20 years. In concept, the only method that will mitigate corrosion of the embedded reinforcement without removal of sound concrete is cathodic protection. Application of cathodic protection is estimated to extend the service life of structures beyond 20 years. Full-depth slab and floor removal can be designed to be rebuilt with a life expectancy of 20 - 40 years. A probable estimate of repair service life of various repair approaches is summarized in Table E-2. As previously mentioned, estimating the service life of repairs is not easy. Currently there is no industry standard or guide to assess service life of repairs. The only avenue we rely on is experience gained from past performance of the repairs under actual service conditions. Therefore, the table should only serve as a guide. Some of the factors that can influence the service of the repairs include:

- Age of the facility
- Type of structural system and pattern of reinforcement
- Quality of material specified for the original construction and for the repairs
- Extent of deterioration
- Degree of chloride contamination
- Nature of the deterioration
- Adverse conditions
- Geographic location of the structure
- Exposure conditions
- Preventive maintenance

TABLE E-2: ESTIMATE OF REPAIR SERVICE LIFE

Repair Approach	Service Life (Years)
Patching (shallow)	1 - 2
Patching (deep)	3 – 5
Patching and Sealer	3 – 5
Patching and Traffic Topping	5 – 8
Concrete Overlay	10 – 15
Strip Patching and Sealer	10 - 15
Strip Patch and Traffic Topping	10 – 20
Partial-depth Slab Removal and Replacement	10 – 20
Full-depth Slab Removal and Replacement	20 - 30

The table suggests that it is possible to match the service life of the repairs to meet the strategic objectives of the City. For instance, patching cannot be considered as the primary repair method if the strategic objective is to keep the structure in service for long term (20

years or more). It is also apparent that repair schemes with longer service life will incur higher repair costs. The repair methods also tend to get more aggressive and disruptive with increased service life expectancy. Therefore, the selection of the repair approach will have an impact on the repair budget, construction schedule, and operations of the facility.

REPAIR ALTERNATIVES

It is not uncommon that we develop several technically acceptable repair alternatives for a structure based on the following overall repair strategies:

1) Do nothing and use up the remaining useful life of the structure.
2) Perform repairs to address only potentially unsafe conditions that presently exist. This approach amounts to performing only "band-aid type" repairs either prior to implementing a comprehensive restoration program or demolishing the structure.
3) Perform necessary repairs to extend the life of the structure 5 - 10 years.
4) Perform necessary repairs to extend the life of the structure 10 - 20 years.
5) Perform repairs to extend the life of the structure 25 years or more.

We have tried to help the University to select repair alternatives based on the overall strategies. This process assists in selecting schemes that will address future plans for use of the structure based on funds that are presently available or obtainable. However, we do not consider technically unacceptable alternatives primarily to limit restoration costs. The nature and the extent of the deterioration will also limit the selection of repair alternatives. For instance, it may not be appropriate to extend the life of a structure 5 - 10 years simply by patching, if the slab is likely to undergo progressive damage due to freezing and thawing. Also, it may not be possible to assure safe operating conditions by performing only limited repairs to a structure that is extensively damaged.

Two important objectives to restore parking structures are:

- Restore structural integrity, and
- Provide protection to extend the life of the repairs and the service life of the structure.

The above objectives provide an opportunity to generate repair alternatives, individually and in combination.

SELECTION OF REPAIR APPROACH

The mechanics of selecting the repair approach involves generating technically feasible repair schemes that are applicable to the structure. This will require the understanding and knowledge of the following:

- Existing Conditions
- Repair methods
- Repair materials
- Advantages and Disadvantages of Repair Methods
- Repair Alternatives
- Life Expectancy of Repairs

The information covered by the items shown above can be conveniently qualified to assist in the selection of a technically appropriate repair approach by using a decision matrix as shown in Table 9. The concept of the decision matrix was developed by the Ontario Ministry of Transportation, Research and Development Branch. This decision matrix concept has been used for selection of bridge-deck rehabilitation methods. The decision matrix presented in Table E-3 has been adapted from the material published in the Ministry of Transportation's manual. The table assists in the selection of a repair approach with the least amount of technically unfavorable elements. Note that patching or sealing, as a repair approach by itself, will be ineffective in restoring the slab. Patching and sealing is usually done in conjunction with application of a surface sealer, traffic topping, or an overlay. The exception could be the use of patching and sealing by itself for the purpose of preventive maintenance.

The decision matrix leads, by elimination, to the selection of repair approaches with the least disadvantages. In some cases, most of the schemes considered may be inappropriate. For instance, a structure that is extensively cracked, consisting primarily of active cracks and delaminated over 30% of the floor area, will necessitate working through the selection process and examining the implication of violating each criterion in turn for the selected alternatives. If the structure is considered to be important, then the scheme may consist of slab replacement with a traffic topping to minimize leakage through active floor-slab cracks. The criteria contained in Table E-3 is not rigid, but serves only as a useful starting point from a technical standpoint.

Repair strategies, life expectancy, and economic issues usually influence the selection of the final repair scheme.

ECONOMICS

The selection of a cost-effective repair method consists of:

1) Preparing cost estimates of technically acceptable repair alternatives, and
2) Estimating the service life of the repaired structure.

Repair costs can vary significantly even for the same method of repair. Factors contributing to cost variations are geographic location of the structure, scope of the overall contract, size and volume of the repair work, and availability of materials and qualified contractors. Constraints associated with maintaining traffic during construction and the overall volume of construction work at the time of bidding can also vary the overall repair costs. Realistic estimates are obtained by using costs from an historical record and assigning appropriate contingency factors to the total cost of the work.

In some instances life cycle cost analysis of repair methods is also performed to select an economical repair method. Once again, the economics are difficult to estimate due to the possible inaccuracy in assessed costs and assumed service life of the repaired structure.

Criterion	Patching (Partial or Full-Depth)	Protective Coatings			Replacement (Partial or Full-Depth)	Cathodic Protection [1,2]
		Sealer	Traffic Topping	Overlay		
1. Corrosion-induced deterioration --- > 10% of the floor area	No	No				
2. Corrosion-induced deterioration --- > 30% of the floor area	No	No	No	No		No
3. Moderate scaling --- 10% of the floor area	No	No				Yes/No
4. Non air-entrained concrete	No	No	No			Yes/no
5. High concrete permeability	No	No				
6. Need to improve drainage	No	No	No			Yes/no
7. Shallow concrete cover	No	No	No			
8. Limited structural capacity				No		Yes/no
9. Limited floor clearance				No		Yes/no
10. Remaining life less than 10 yrs.				No	No	No
11. Active cracks	No	No		No	No	

[1] Items 3, 4, and 7 are appropriate if the C.P. system selected consists of anode embedded in a concrete overlay.
[2] Items 8 and 9 will be appropriate if the C.P. system consists of anode embedded in slots cut in the structure.
Adapted from: "Bridge Deck Rehabilitation Manual," Part Two: Contract Preparation, Ontario Ministry of Transportation.

TABLE E-3: SELECTION OF A FLOOR-SLAB REPAIR APPROACH

Report

Laboratory Studies
of
Concrete Core Samples

from the

Tampa Parking Garages
CIPP Investigation Project

Tampa, Florida

for

Walker Parking Consultants

UCT Project 05229
November, 2005

November 9, 2005

UCT Project No. 05229
Walker Project No. 15-1340.40

Mr. Russ Thurston, P.E.
Walker Parking Consultants
2121 Hudson Avenue
Kalamazoo, MI 49008

Re: Laboratory Studies of Concrete Samples
Tampa Parking Garages CIPP Investigation

Dear Mr. Thurston:

Universal Construction Testing, Ltd. (UCT) has completed laboratory studies of the twenty-six (26) concrete core samples delivered to our laboratories on October 14, 2005, with reference to the aforementioned project. The scope of our work was outlined in your transmittal letter of October 12, and included *compression tests (18), chloride content analyses* (78) and *petrographic examinations* (8).

SUMMARY

- *The submitted twenty-six (26) cores represent seven (7) parking garage structures located in Tampa, Florida. The concrete characteristics detrimental to its serviceability and depicted by the conducted laboratory studies are summarized in attached Table 1.*

- *The in-situ compressive strength of concrete represented by selected core samples varies between the garages as well as within the garages themselves. The overall compressive strength is close to or above 4,000 psi.*

- *The chloride ingress is negligibly low in all analyzed samples and significantly below the corrosion threshold.*

- *All eight petrographically examined cores, although removed from seven different structures, are made using normal weight coarse aggregate, consisting of limestone with a fossiliferous texture, and quartz silica sand. The concrete is judged to be well consolidated and well made. A cementitious materials content estimated to be equivalent to 6 ½ bags of portland cement per cubic yard of which fly ash is estimated to constitute 15 percent, and water-cementitious materials ratios estimated to be ranging between 0.40 and 0.45.*

- *The air contents are calculated to be ranging from 2.9% to 5.7%.*

- *There is no evidence that the aggregates had been chemically or physically unsound during their service in the concrete.*

STUDIES

Compressive Strength of the designated core samples was determined according to the applicable provisions of Standard Method ASTM C42.

The obtained test results compiled in attached Table 2, show a relatively wide range of the in-situ compressive strength. The strength varies between the garages as well as within the garages. The overall compressive strength is close to or above 4,000 psi.

Chloride Content *(water-soluble)* of the submitted core samples was determined according to the applicable provisions of Standard Method ASTM C1218.

The core samples were cut at the designated depth increments and pulvarized. The chloride content data is compiled in the attached Table 3.

Based on the present state of knowledge, maximum chloride contents of ***0.06 %*** and ***0.15%*** *by weight of cement* are suggested by ACI to minimize the risk of chloride-induced corrosion in prestressed and conventionally reinforced concretes, respectively.

Therefore, the chloride contents were found to be below the corrosion threshold in all analyzed core samples at all three designated depths.

Petrographic Examination was conducted on Cores **B-1, B-6, TW-1, SR-2, P-1, CY-2, PA-3** and **HQ-2** according to the applicable provisions of Standard Practices ASTM C856 and C457. The specimens were cut lengthwise to provide 1-inch thick plates. The plates were lapped using progressively finer silicon carbide abrasives. The lapped surfaces were examined using a stereomicroscope at 105X magnification. The paste was examined at 400X magnification using a polarized microscope in order to determine aggregate and paste mineralogy and microstructure.

Below are the individual results of petrographic examination.

Core **B-1** [Fort Brooks Garage]

General

The core is 2-3/4" in diameter and 3-1/4" in nominal length. The bottom has a fractured surface indicating partial depth coring. The top surface has a float and broom finish with no surface damage and no exposed aggregate. Consolidation of concrete is good with no signs of segregation present.

Carbonation

The depth of carbonation in the examined specimen is **2** mm.

Cracks

Cracks were not detected within the examined core.

Reinforcement

One 3/8" diameter steel rebar is located 1-3/4" from the top surface. The steel is not corroded.

Air Content

The concrete has a low level of air-entrainment with **4.0%** air and a high spacing factor of 0.0159 inch. The distribution of air is acceptable with the following air-void parameters in the main body.

Spacing factor	-	0.0159
Specific surface	-	331 in^2/in^3
Number of voids/inch	-	3.311
Avg. chord intersect	-	0.01208 inch
Paste/air ratio	-	6.615

Please note that the following parameters of the air-void system are desirable to provide maximum concrete durability:

Air Content	-	*6.5 ± 2%*
Spacing factor	-	*Less than 0.008 inch*
Specific surface	-	*600 in^2/in^3* or greater

Paste Properties

Overall Condition	good
Color	medium grey
Hardness	good
Luster	dull
Porosity	average
Paste Volume	26.46%
Optical Habit of Calcium Hydroxide	fine crystals
Mineralogy of the Cement	C-S-H and fly ash
Hydration	advanced
Relict Cement Grains	not present
Mineral Admixture	fly ash is present
Degree of Differential Settlement	low
Magnitude of Bleeding	low

Cement Content

The cementitious content is estimated to be close to **610** lbs/yd^3.

Water-Cementitious Ratio

The water-cementitious ratio is estimated at **0.43** $\pm$ 0.02.

Paste-aggregate bond

The bond between the paste and aggregates is good.

Aggregates

Several coarse aggregate particles have thick 1-mm coatings of minus 200 sieve coatings. These coatings have not caused any distress.

The *coarse* aggregate is a finely graded white, medium grained limestone with a fossiliferous texture.

The *fine* aggregate is a quartz silica sand.

There is no evidence that the aggregates had been chemically or physically unsound during their service in the concrete.

Comments

The core is in a very good condition.

Core **B-6** [Fort Brooks Garage]

General

The core is 2-3/4" in diameter and 3-1/2" in nominal length. The bottom has a fractured surface. The top surface has a float and broom finish with no surface damage or exposed aggregate.

Consolidation of concrete is good with no signs of segregation present.

Carbonation

The depth of carbonation is **7** mm.

Reinforcement

One 3/8" steel rebar and 1/4" mesh are located at 1-1/2" from the top surface. The steel is free of corrosion deposits.

Cracks

Cracks were not detected within the examined specimen.

Air Content

The concrete in this core is air-entrained having an air content of **5.2%**. The distribution of the air-voids and quality of the air-void system are acceptable with the following air-void parameters.

Spacing factor	-	0.0092
Specific surface	-	508 in^2/in^3
Number of voids/inch	-	6.611
Avg. chord intersect	-	0.00787 inch
Paste/air ratio	-	5.110

Cement Content

The cementitious content is estimated to be close to **610** lbs/yd^3.

Water-Cementitious Ratio

The water-cementitious ratio is estimated at **0.44** $\pm$ 0.02.

Paste Properties

Overall Condition	good
Color	medium grey
Hardness	good
Luster	dull
Porosity	average
Paste Volume	26.57%
Optical Habit of Calcium Hydroxide	fine crystals
Mineralogy of the Cement	C-S-H and fly ash
Hydration	advanced
Relict Cement Grains	not present
Mineral Admixture	fly ash is present
Degree of Differential Settlement	low
Magnitude of Bleeding	low

Paste-aggregate bond

The bond between the paste and aggregates is good.

Aggregates

The aggregates are similar and from the same source as in core B-1.

There is no evidence that the aggregates had been chemically or physically unsound during their service in the concrete.

Comments

The core is in a good condition.

Core **TW-1** [Twigs Street Garage]

General

The core is 2-3/4" in diameter and a nominal 3" length. The bottom surface is fractured. The top surface has a float finish with surface damage and a very slight amount of exposed fine aggregate.

The concrete is judged to be well consolidated and well made.

Reinforcement

One 3/8" diameter steel rebar is located only 3/4" from the top surface. The steel doesn't show signs of corrosion, however the concrete cover is low.

Cracks

One vertical shrinkage crack travels from the top surface to full depth. No other cracks were detected.

Air Content

The core has a low level of air-entrainment with **3.6**% of hardened air. The distribution of air is good with the following air-void system parameters:

Spacing factor	-	0.0161
Specific surface	-	345 in^2/in^3
Number of voids/inch	-	3.101
Avg. chord intersect	-	0.01161 inch
Paste/air ratio	-	7.417

Carbonation

The depth of carbonation in the examined specimen is **4** mm.

Cement Content

The cementitious content is estimated to be close to **610** lbs/yd^3.

Water-Cementitious Ratio

The water-cementitious ratio is estimated at **0.44** $\pm$ 0.02.

Paste-aggregate bond

The bond between the paste and aggregates is good.

Paste Properties

Overall Condition	good
Color	dark grey
Hardness	good
Luster	dull
Porosity	average
Paste Volume	26.70%
Optical Habit of Calcium Hydroxide	fine crystals
Mineralogy of the Cement	C-S-H and fly ash
Hydration	advanced
Relict Cement Grains	not present
Mineral Admixture	fly ash is present at a high amount
Degree of Differential Settlement	low
Magnitude of Bleeding	low

Aggregates

The *coarse* aggregate is a finely graded white, medium grained 1" limestone with a fossiliferous texture.

The *fine* aggregate is a quartz silica sand.

There is no evidence that the aggregates had been chemically or physically unsound during their service in the concrete.

Comments

Except for one shrinkage crack, the core is in a good condition.

Core SR-2 [South Regional Garage]

General

The core is 3-3/4" in diameter and has a 6" nominal length. The bottom surface is fractured. The top surface has a float and broom finish with no surface damage and no exposed aggregate. Consolidation of concrete is good with no signs of segregation present.

Carbonation

The depth of carbonation in the examined specimen is less than **0.5** mm.

Reinforcement

Neither steel reinforcement nor synthetic fibers are present within the examined core.

Cracks

One crack travels horizontally, separating the core into two separate segments at 3" from the top surface. This crack likely occurred during retrieval of the core since the length-diameter ratio is 2.2. No other cracks are present.

Air Content

The concrete in this core is air-entrained having air content of **5.2**%. The quality of the air-void system and distribution of air-voids are good with the following air-void system parameters:

Spacing factor	-	0.0084
Specific surface	-	554 in^2/in^3
Number of voids/inch	-	7.200
Avg. chord intersect	-	0.00722 inch
Paste/air ratio	-	5.069

Cement Content

The cementitious content is estimated to be close to **610** lbs/yd^3.

Water-Cementitious Ratio

The water-cementitious ratio is estimated at **0.41** $\pm$ 0.02.

Paste Properties

Overall Condition	good
Color	dark grey
Hardness	good
Luster	sub-vitreous
Porosity	low
Paste Volume	26.36%
Optical Habit of Calcium Hydroxide	fine crystals
Mineralogy of the Cement	C-S-H and fly ash
Hydration	advanced
Relict Cement Grains	not present
Mineral Admixture	fly ash is present
Degree of Differential Settlement	low
Magnitude of Bleeding	low

The dark paste color is due to the low W/CM ratio and carbon content likely stemming from fly ash in the mix.

Paste-aggregate bond

The bond between the paste and aggregates is good.

Aggregates

The aggregates are similar and from the same source as in the previous cores.

There is no evidence that the aggregates had been chemically or physically unsound during their service in the concrete.

Comments

The core is in a good condition.

Core P-1 [William Poe Garage]

General

The core is 2-3/4" in diameter and 3-1/4" in nominal length. The bottom has a fractured surface. The top surface has a float and broom finish with no surface damage and no aggregate exposed.

The concrete is judged to be well consolidated and well made.

Carbonation

The depth of carbonation in the examined specimen is **1** mm.

Reinforcement

No reinforcement is present within the examined core.

Cracks

One extremely narrow shrinkage crack travels vertically from the top surface to a depth of ½". No other cracks are present.

Air Content

The concrete in this core is air-entrained with **5.7**% of hardened air. The quality of the air void system and distribution of air-voids are good with the following air-void system parameters:

Spacing factor	-	0.0067
Specific surface	-	670 in^2/in^3
Number of voids/inch	-	9.911
Avg. chord intersect	-	0.00575 inch
Paste/air ratio	-	4.677

Cement Content

The cementitious content is estimated to be close to **610** lbs/yd^3.

Water-Cementitious Ratio

The water-cementitious ratio is estimated at **0.44** $\pm$ 0.02.

Paste Properties

Overall Condition	good
Color	light grey
Hardness	good
Luster	dull
Porosity	average
Paste Volume	26.66%
Optical Habit of Calcium Hydroxide	fine crystals
Mineralogy of the Cement	C-S-H and fly ash
Hydration	advanced
Relict Cement Grains	not present
Mineral Admixture	fly ash is present at a normal amount. The fly ash has a lower carbon content than the previous cores.
Degree of Differential Settlement	low
Magnitude of Bleeding	low

Paste-aggregate bond

The bond between the paste and aggregates is good.

Aggregates

The *coarse* aggregate is a finely graded white, medium grained 1" limestone with a fossiliferous texture.

The *fine* aggregate is a quartz silica sand.

There is no evidence that the aggregates had been chemically or physically unsound during their service in the concrete.

Comments

Except for the very narrow shrinkage crack, this core has no damage.

Core CY-2 [Centro Ybor Garage]

General

The core has a 2-3/4" diameter and has a 3-1/2" nominal length. The bottom surface is fractured. The top surface has a float finish with no surface damage and no exposed aggregate.

Consolidation of concrete is good with no signs of segregation present.

Carbonation

The depth of carbonation in the examined specimen is less than **0.5** mm.

Reinforcement

No reinforcement is present within the examined core.

Cracks

Cracks were not detected within the examined specimen.

Air Content

The core has a low level of air-entrainment at **2.9**%. The distribution of air-voids is normal with the following air-void system parameters:

Spacing factor	-	0.0166
Specific surface	-	367 in^2/in^3
Number of voids/inch	-	2.664
Avg. chord intersect	-	0.01089 inch
Paste/air ratio	-	9.207

Paste Properties

Overall Condition	good
Color	dark grey
Hardness	good
Luster	dull
Porosity	average
Paste Volume	26.70%
Optical Habit of Calcium Hydroxide	fine crystals
Mineralogy of the Cement	C-S-H and fly ash
Hydration	advanced
Relict Cement Grains	not present
Mineral Admixture	fly ash is present
Degree of Differential Settlement	low
Magnitude of Bleeding	low

Paste

The paste has a dark grey color due to carbon in the fly ash and a low water-cementitious content.

Cement Content

The cementitious content is estimated to be close to **610** lbs/yd^3.

Water-Cementitious Ratio

The water-cementitious ratio is estimated at **0.40** $\pm$ 0.02.

Paste-aggregate bond

The bond between the paste and aggregates is good.

Aggregates

The *coarse* aggregate is a finely graded white, medium grained ½" top size limestone with a fossiliferous texture.

The *fine* aggregate is a quartz silica sand.

There is no evidence that the aggregates had been chemically or physically unsound during their service in the concrete.

Comments

The core is in a very good condition.

Core PA-3 [Palm Avenue Garage]

General

The core has a 2-3/4" diameter and a 2-1/4" nominal length. The bottom surface is fractured. The top surface has a float finish with no surface damage and no exposed aggregate.

The concrete is judged to be well consolidated and well made.

Reinforcement

One ½" diameter steel rebar is located 1-1/2" below the top surface. The steel is corrosion free.

Cracks

Cracks were not detected within the examined specimen.

Carbonation

The depth of carbonation in the examined specimen is **2** mm.

Air Content

The core has a moderate level of air-entrainment with **5.0**% of hardened air. The distribution of air-voids and the quality of the air-void system are acceptable with the following air-void system parameters:

Spacing factor	-	0.0106
Specific surface	-	448 in^2/in^3
Number of voids/inch	-	5.600
Avg. chord intersect	-	0.00893 inch
Paste/air ratio	-	5.280

Cement Content

The cementitious content is high and estimated to be close to **610** lbs/yd^3.

Water-Cementitious Ratio

The water-cementitious ratio is estimated at **0.42** $\pm$ 0.02.

Paste Properties

Overall Condition	good
Color	dark grey due to fly ash
Hardness	good
Luster	dull
Porosity	low
Paste Volume	26.40%
Optical Habit of Calcium Hydroxide	fine crystals
Mineralogy of the Cement	C-S-H and fly ash
Hydration	advanced
Relict Cement Grains	not present
Mineral Admixture	fly ash is present
Degree of Differential Settlement	low
Magnitude of Bleeding	low

Paste-aggregate bond

The bond between the paste and aggregates is good.

Aggregates

The aggregates appear to be the same as the previous cores, except the coarse aggregate has a grading that is fine, ½" top size, similar to the grading in core CY-2..

There is no evidence that the aggregates had been chemically or physically unsound during their service in the concrete.

Comments

The core is in a good condition.

Core HQ-2 [Police HQ Garage]

General

The core has a 2-3/4" diameter and a 4-3/4" nominal length. The bottom surface is fractured. The top surface has a float finish with a slight amount of exposed fine aggregate. The concrete is judged to be well consolidated and well made. No reinforcement is present within the examined core.

Cracks

One crack travels horizontally across the center of the core, 2-3/8" from the top surface at the core center. This crack was likely formed when the core was retrieved. No other cracks are present.

Carbonation

The depth of carbonation in the examined specimen is **2** mm.

Air Content

The core is air-entrained with **4.8**% of hardened air. The distribution of air-voids and the quality of the air-void system are acceptable with the following air-void system parameters:

Spacing factor	-	0.0104
Specific surface	-	466 in^2/in^3
Number of voids/inch	-	5.597
Avg. chord intersect	-	0.00858 inch
Paste/air ratio	-	5.577

Paste Properties

Overall Condition	good
Color	dark grey due to fly ash
Hardness	good
Luster	dull
Porosity	average
Paste Volume	26.77%
Optical Habit of Calcium Hydroxide	fine crystals
Mineralogy of the Cement	C-S-H and fly ash
Hydration	advanced
Relict Cement Grains	not present
Mineral Admixture	fly ash is present
Degree of Differential Settlement	low
Magnitude of Bleeding	low

Cement Content

The cementitious content is estimated to be close to **610** lbs/yd^3.

Water-Cementitious Ratio

The water-cementitious ratio is estimated at **0.45** $\pm$ 0.02.

Paste-aggregate bond

The bond between the paste and aggregates is good.

Aggregates

The aggregates are similar in composition to all of the previous cores with a top size similar to that in CY-2 and PA-3.

There is no evidence that the aggregates had been chemically or physically unsound during their service in the concrete.

Comments

The core is in a good condition.

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We appreciate this opportunity to be of continued service to you.

Sincerely yours,
Universal Construction Testing, Ltd.

Elena Emerson
Director- Laboratory Services

Mike Pistilli, FACI
Senior Consultant-Petrographic Services

Boris Dragunsky, PhD, FACI
Principal

Attachments

BD:MP:EE/ism 05229-Report 1

Table 1. **Summary of Major Concrete Characteristics**

Concrete Parameters	Fort Brooks Core **B-1**	Fort Brooks Core **B-6**	Twigs Street Core **TW-1**	South Regional Core **SR-2**	William Poe Core **P-1**	Centro Ybor Core **CY-2**	Palm Avenue Core **PA-3**	Police HQ Core **HQ-2**
Compressive Strength, psi	3480-4850 (partner samples)		3180-3800 (partner samples)	3060-4850 (partner samples)	3120-5,000 (partner samples)	4010-6240 (partner samples)	4080-6060 (partner samples)	3730-3980 (partner samples)
Chloride Content, % *cwt*	0.01 - 0.13 (partner samples)							
Air Content, %	4.0	5.2	3.6	5.2	5.7	2.0	5.0	4.8
W/C Ratio	0.43	0.44	0.44	0.41	0.44	0.40	0.42	0.45
Cementitious Content	610	610	610	610	610	610	610	610
Depth of Top Carbonation	2 mm	7 mm	4 mm	<0.5 mm	1 mm	<0.5 mm	2 mm	2 mm
Paste-Aggregate Bond	good	good	good	good	good	good	good	good
Microcracks & other deficiencies	not present	not present	present	present	present	not present	not present	present

UNIVERSAL CONSTRUCTION TESTING, Ltd.

Project: Tampa Parking Garages CIPP Investigation — UCT Project No. 05229

Client: Walker Parking Consultants — Date: 11-09-05

Table 2. **Compressive Strength of Concrete Core Samples**
(ASTM C-42)

CORE NO.	LOCATION IN STRUCTURE	TESTED HEIGHT L. (in.)	DIAM. D. (in.)	L/D RATIO k	TOTAL LOAD (lbs.)	UNCORRECTED COMPRESSIVE STRENGTH (psi)	CORRECTED COMPRESSIVE STRENGTH (psi)
B-2	Fort Brooks Garage	2.86	2.77	1.03 0.87	24,110	4000	3480
B-3	Fort Brooks Garage	3.85	2.77	1.39 0.94	30,020	4980	4480
B-4	Fort Brooks Garage	3.20	2.77	1.16 0.91	32,150	5330	4850
B-5	Fort Brooks Garage	3.96	2.77	1.43 0.95	26,800	4440	4220
TW-2	Twigs Street Garage	3.08	2.77	1.11 0.89	25,750	4270	3800
TW-3	Twigs Street Garage	2.84	2.77	1.02 0.87	22,060	3660	3180
SR-1	South Regional Garage	2.50	2.77	0.90 0.84	21,970	3640	3060
SR-3	South Regional Garage	3.29	2.77	1.19 0.91	32,110	5330	4850
SR-4	South Regional Garage	3.30	2.77	1.19 0.91	24,400	4050	3680
P-2	William Poe Garage	3.02	2.77	1.09 0.89	33,910	5620	5000
P-2	William Poe Garage	2.70	2.77	0.97 0.86	21,880	3630	3120

Remarks: The cores were tested in air-dry conditions.

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Table 2. **Compressive Strength of Concrete Core Samples**
(ASTM C-42)

CORE NO.	LOCATION IN STRUCTURE	TESTED HEIGHT L. (in.)	DIAM. D. (in.)	L/D RATIO k	TOTAL LOAD (lbs.)	UNCORRECTED COMPRESSIVE STRENGTH (psi)	CORRECTED COMPRESSIVE STRENGTH (psi)
CY-1	Centro Ybor Garage	4.00	2.77	1.44 0.95	39,620	6570	6240
CY-3	Centro Ybor Garage	3.12	2.77	1.12 0.90	26,870	4460	4010
PA-1	Palm Avenue Garage	3.41	2.77	1.23 0.92	26,720	4430	4080
PA-2	Palm Avenue Garage	2.94	2.77	1.06 0.88	41,500	6880	6060
PA -4	Palm Avenue Garage	2.43	2.77	0.87 0.84	33,420	5540	4650
HQ-1	Police HQ Garage	2.31	2.77	0.83 0.83	27,060	4490	3730
HQ-3	Police HQ Garage	2.77	2.77	1.00 0.87	27,570	4570	3980

Remarks: The cores were tested in air-dry conditions.

UNIVERSAL CONSTRUCTION TESTING, Ltd.

Project Name: Tampa Parking Garages CIPP Investigation UCT Project No. 05229

Client: Walker Parking Consultants Date: 11-09-05

Table 3. **Chloride Content of Concrete**
(Water Soluble)

Sample Number	Location	Level tested, inch from top	Chloride ion (CL^-) Content		
			by weight of concrete %	by weight of cement* %	by weight of concrete (ppm)*
B-1	Fort Brooks Garage	0-1	0.006	**0.04**	60
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20
B-2	Fort Brooks Garage	0-1	0.030	**0.19**	300
		1-2	0.005	**0.03**	50
		2-3	0.003	**0.02**	30
B-3	Fort Brooks Garage	0-1	0.005	**0.03**	50
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20
B-4	Fort Brooks Garage	0-1	0.005	**0.03**	50
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20
B-5	Fort Brooks Garage	0-1	0.020	**0.13**	200
		1-2	0.003	**0.02**	30
		2-3	0.003	**0.02**	30
B-6	Fort Brooks Garage	0-1	0.003	**0.02**	30
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20

Remarks: *) Assumed cement content 610 lbs/cu.yd. and U.W. = 3800 pcy.

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Client: Walker Parking Consultants Date: 11-09-05

Table 3. **Chloride Content of Concrete**
(Water Soluble)

Sample Number	Location	Level tested, inch from top	Chloride ion (CL^-) Content		
			by weight of concrete %	by weight of cement* %	by weight of concrete (ppm)*
TW-1	Twigs Street Garage	0-1	0.031	**0.19**	310
		1-2	0.005	**0.03**	50
		2-3	0.002	**0.01**	20
TW-2	Twigs Street Garage	0-1	0.006	**0.04**	60
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20
TW-3	Twigs Street Garage	0-1	0.010	**0.07**	100
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20
SR-1	South Regional Garage	0-1	0.009	**0.06**	90
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20
SR-2	South Regional Garage	0-1	0.005	**0.03**	50
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20
SR-3	South Regional Garage	0-1	0.006	**0.04**	60
		1-2	0.002	**0.01**	20

		2-3	0.002	**0.01**	20

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Table 3. **Chloride Content of Concrete**
(Water Soluble)

Sample Number	Location	Level tested, inch from top	Chloride ion (CL^-) Content		
			by weight of concrete %	by weight of cement* %	by weight of concrete (ppm)*
SR-4	South Regional Garage	0-1	0.006	**0.04**	60
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20
P-1	William Poe Garage	0-1	0.003	**0.02**	30
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20
P-2	William Poe Garage	0-1	0.011	**0.07**	110
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20
P-3	William Poe Garage	0-1	0.003	**0.02**	30
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20

Remarks: *) Assumed cement content 610 lbs/cu.yd. and U.W. = 3800 pcy.

UNIVERSAL CONSTRUCTION TESTING, Ltd.

Project Name: Tampa Parking Garages CIPP Investigation UCT Project No. 05229

Client: Walker Parking Consultants Date: 11-09-05

Table 3. **Chloride Content of Concrete**
(Water Soluble)

Sample Number	Location	Level tested, inch from top	Chloride ion (CL^-) Content		
			by weight of concrete %	by weight of cement* %	by weight of concrete (ppm)*
CY-1	Centro Ybor Garage	0-1	0.008	**0.05**	80
		1-2	0.005	**0.03**	50
		2-3	0.002	**0.01**	20
CY-2	Centro Ybor Garage	0-1	0.005	**0.03**	50
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20
CY-3	Centro Ybor Garage	0-1	0.015	**0.09**	150
		1-2	0.003	**0.02**	30
		2-3	0.002	**0.01**	20
PA-1	Palm Avenue Garage	0-1	0.005	**0.03**	50
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20

Remarks: *) Assumed cement content 610 lbs/cu.yd. and U.W. = 3800 pcy.

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Sample Number	Location	Level tested, inch from top	Chloride ion (CL^-) Content		
			by weight of concrete %	by weight of cement* %	by weight of concrete (ppm)*
PA-2	Palm Avenue Garage	0-1	0.005	**0.03**	50
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20
PA-3	Palm Avenue Garage	0-1	0.003	**0.02**	30
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20
PA-4	Palm Avenue Garage	0-1	0.005	**0.03**	50
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20
HQ-1	Police HQ Garage	0-1	0.005	**0.03**	50
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20
HQ-2	Police HQ Garage	0-1	0.013	**0.08**	130
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20
HQ-3	HQ Police Garage	0-1	0.009	**0.06**	90
		1-2	0.002	**0.01**	20
		2-3	0.002	**0.01**	20

Remarks: *) Assumed cement content 610 lbs/cu.yd. and U.W. = 3800 pcy.

WALKER
PARKING CONSULTANTS

Walker Parking Consultants
4902 Eisenhower Blvd, Suite 281
Tampa, FL 33634

Voice: 813.888.5800
Fax: 813.888.5822
www.walkerparking.com

June 29, 2005

(Sent via e-mail: Mahdi.mansour@tampagov.net/US Mail)

Mr. M. Mahdi Mansour, PE
Deputy Director, Public Works
City of Tampa
City Hall Plaza 4E
306 E. Jackson Street
Tampa, FL 33602

Re: Proposal for Professional Restoration Engineering Services
Parking Structure Capital Improvement and Protection Program (CIPP)
City of Tampa Parking Structures
Tampa, Florida
Proposal No. P05-070

Dear Mahdi:

When we last met, we discussed how Walker has assisted other clients similar to yours (with multiple parking structures) in developing a prioritized work plan for repairing and maintaining multiple parking structures over a 5 or 10 year period. This proposal contains a plan and approach for providing you with the information and recommendations you need to make appropriate, cost-effective decisions about repairing and maintaining City of Tampa's eight (8) parking structures. A proposal for a condition appraisal and construction document preparation for the Whiting Street Parking Garage has being submitted separately. The Whiting Street garage will be included in the CIPP report.

The team we have assigned to your project includes key professionals that are experienced in multi-structure programs that have been in operation for over 10 years. They also have some prior knowledge of some of the City's parking structures that will be beneficial to development of the overall program.

The deliverable that we propose to provide you is clear, concise and accurate information and recommendations within the context of a long-range maintenance repair plan. This approach provides you with a valuable management tool for planning and budgeting. Careful application of this tool will help you extend the useful service lives of the City's parking structures and maximize the impact of your available maintenance/repair budgets.

We have sincerely appreciated the opportunities to work with the City of Tampa in the past and welcome the opportunity to continue our work with you. Your review of our proposal is welcomed and we are ready to begin this project.

Sincerely,

WALKER PARKING CONSULTANTS

Uday A. Kirtikar, P.E.
Vice President/Managing Principal

UAK/mm

Enclosure

cc: Jim Corbett/via US Mail & email: Jim.Corbett@ci.tampa.fl.us
Jose Fernandez/via email: Jose.Fernandez@ci.tampa.fl.us
Russ Thurston, Walker Parking Consultants/via email

SECTION II
WORK PLAN

The City of Tampa understands that proactive management of the repair and maintenance requirements for its parking structures provides a significant long-term return on investment. This return comes in the form of longer useful service life for each parking structure, less costly repairs over time, the elimination of costly and unwanted "surprises", and less downtime which affects the structure's ability to generate revenue. Like many other cities, Tampa regularly faces budget constraints that require officials to carefully evaluate and plan needed maintenance and repairs to key infrastructure components. Typically a repair and maintenance program for the parking structures is the first to be deleted from the budget. As a beginning point for this program, the City would require Walker Parking Consultants to evaluate the eight (8) parking structures out of the nine in the City's parking system.

The purpose for this evaluation is to determine the physical condition of each structure, to estimate any repair quantities and probable construction/repair costs and to recommend preventative maintenance procedures. Additionally, the City wants to be able to make smart, cost-effective planning and budgeting decisions now, and in the future, relative to repairing and maintaining each parking structure. For the City to be successful, it needs to have the appropriate data and information in a format that provides clear recommendations for current and future repair/maintenance activities. This proactive approach will enable the City to make sure that informed, cost-effective decisions about repairing and maintaining its parking structures are made now and in the future.

PROJECT APPROACH

For your project, as per our discussions, the program includes evaluations of the condition of the following parking structures:

Structure Name	No. Spaces
1. Fort Brooks Garage & Expansion	2523
2. Twiggs Street Garage	840
3. South Regional Garage	1458
4. Wm. Poe Garage	932
5. Centro Ybor Garage	1200
6. Palm Avenue Garage	1240
7. Whiting Street Garage & Expansion	500
8. Police HQ Garage	280
Total	8,973

To best address your project needs, we have crafted an approach that includes three basic tasks. They are as follows:

- Task #1 - Parking Structure Evaluations
- Task #2 - Multi-Year (3-10) Maintenance/Repair Plan
- Task #3 - Report and Recommendations

TASK #1 – PARKING STRUCTURE EVALUATIONS

During this task, we will perform a field survey on each of the eight City of Tampa Parking Structures to determine current conditions in each structure. We will also perform a general review of the electrical/mechanical systems, elevators, and limited condition observations of the Parking Access and Revenue Control Systems (PARCS) in each structure as appropriate. The level of effort for each structure will be mainly based on the age and the visual condition of the structure. Our materials testing recommendations for each structure are included in the proposed Scope of Services and will also be based on the structure's age and any current data that exists.

We have submitted a separate proposal for construction document preparation of the Whiting Street garage. The Whiting Street garage will be made a part of the final CIPP report.

TASK #2 - MULTI-YEAR MAINTENANCE/REPAIR FORECAST

After completing the evaluations of all the parking structures, we will design a Multi-Year Maintenance/Repair Forecast. This new Multi-Year Forecast will then serve as your planning and budgeting tool for current and future repair/maintenance activities in all eight parking structures.

TASK #3 – REPORT AND RECOMMENDATIONS

During this task, we will prepare a report that will include our findings, conclusions, and recommendations for repairing/maintaining the eight parking structures. The key component of the report will be the Multi-Year Forecast. The number of years will be decided upon in consultation with the City. We will provide you with a draft report and meet with you to discuss our recommendations. After this review, we will issue to you the final report. Note that the report will outline a multi-year restoration program. Actual repair document preparation will be a separate task from the CIPP report.

SCOPE OF SERVICES

Based on our understanding and project approach described above, we propose to provide the following scope of services in accomplishing this project.

TASK #1 –PARKING STRUCTURE EVALUATIONS

A. Perform a review of all 8 parking structures to identify and document deterioration conditions and quantities for repair and/or monitoring. This will include:

1. Review original construction and maintenance documentation provided by the hospitals.

2. Visual review of concrete structural elements (Floors, beams, columns, elevator shafts, etc), and architectural features (facade, elevator lobbies, graphics).

3. Visual review to evaluate the general condition of drainage systems; ventilation; lighting, conduits, and electrical distribution equipment; elevator power/controls; and vehicle access control equipment.

4. Delamination testing (chain-drag) survey of selected floor slab areas to identify delamination patterns and quantities.

5. Materials testing to establish current conditions in each structure. This testing will include petrographic analysis of concrete, compressive strength, chloride ion content analysis of the concrete, and depth of concrete cover over reinforcing steel.

B. Representative area light level readings for comparison to industry recommendations.

TASK #2 – MULTI-YEAR MAINTENANCE/REPAIR FORECAST

A. Using the information acquired in Task #1, compile a Multi-Year Maintenance/Repair Plan for each structure, which identifies repair and maintenance requirements, their relative priorities, and their estimated costs. We will work with City personnel to establish annual budgetary limitations to be built into the Plan. This Plan will help you in prioritizing and budgeting current and future work, and will be a primary decision-making tool for your use in planning work in these structures over the next ten years.

TASK #3 – REPORT AND RECOMMENDATIONS

A. Based on the results of these reviews, develop a single, combined document which:

1. Describes the overall general condition of each structure.

2. Identifies repairs required in each structure with associated cost estimates.

3. Provides relative priorities for each repair condition.

B Incorporates the multi-year program, established in Task #2, to accomplish the work based on repair priorities and budgetary constraints provided by the hospitals.

C. Meet with representative(s) of City of Tampa to review the report.

D. Issue final report, incorporating the City's comments, and provide up to six copies to the City.