

Walker Parking Consultants 1660 South Highway 100, Suite 350 Minneapolis, MN 55416

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October 15, 2003

Mr. Buick Alavy City of Minneapolis Property Services 350 South 5th Street, Room 223 Minneapolis, MN 55415

Re: Annual Observation Report Centre Village Parking Facility 700 Fifth Avenue South Minneapolis, Minnesota Walker Commission No. 21-3136.04

Dear Mr. Alavy:

In conformance with the City of Minneapolis inspection requirements for parking ramps, the following is a summary of the structural condition of the Centre Village Parking Facility.

Walker completed a first year field observation, chain drag and chloride ion testing of this parking facility to review the condition of the structural elements.

FACILITY DESCRIPTION

Built in 1983-84, the Centre Village Parking Facility is a cast-in-place, post-tensioned concrete parking structure approximately 328 feet long and 122 feet wide. This facility supports a condominium complex above. There are three supported parking levels and one slab-on-grade level below street level, and seven supported levels above street level. The supported floor area is 310,000 square feet and the slab-on-grade area is 40,000 square feet. The supported floor consists of an eight-inch thick, two-way post-tensioned concrete slab system supported on conventionally reinforced concrete columns. The slab spans typically 27'-8" in the north-south direction. In the east-west direction the slab spans are 16 feet and 28 feet. Epoxy coated reinforcing steel was used in the top portion of the floor slab. A corrosion-inhibiting admixture (DCI, by W.R. Grace Co.) was added to the concrete used in floor slabs. A typical dose rate was 3.5 gallons per cubic yard of concrete. In addition, a concrete sealer was applied to the slab surface upon completion of construction and periodically afterward.

Access to the above grade parking is provided by an entry express ramp from Fifth Avenue and with an exit express ramp to Eighth Street. Access to the below grade parking is provided by an entry express ramp from Seventh Street and with an exit express ramp to Fifth Avenue.



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The traffic flow on the supported levels is one-way with 90-degree parking. The levels below grade are an end-to-end helix and the upper levels are of a double-threaded helix design. Stair towers are located at the northeast and southeast corners of the facility. Elevator towers are provided at the northwest corner and the center of the west side. An additional stair tower is provided at the center of the west side for the below grade parking. The facility provides parking for approximately 1190 vehicles.

VISUAL OBSERVATION SUMMARY AND CONCLUSIONS

During the course of our visual observation of this parking facility, we did not observe any conditions, which would restrict the facility from qualifying for an operating certificate. Limited overhead concrete removals to reduce the hazard of falling concrete are recommended. However, hidden or latent conditions may exist in this facility, which have not yet revealed themselves through visual evidence and may require removal in subsequent years. The following is a summary of conditions noted:

- 1. Isolated floor slab delaminations were noted throughout all levels primarily located adjacent to construction joints and columns.
- 2. Exposed post-tensioning tendons were noted at a few floor slab spalls. Tendon sheathing was noted to be in good condition.
- 3. One slab post-tensioning tendon was noted broken at Level 3.
- 4. Exposed conventional reinforcement at isolated locations.
- 5. Extensive full depth floor cracking throughout Levels D through 2. Light to heavy water staining on ceilings below.
- 6. Full depth floor cracking was primarily concentrated to the middle crossover and end bays at Levels 3-9. Light to heavy water staining on ceiling below.
- 7. Isolated floor slab construction joints were leaking.
- 8. Leaking has contributed to debonding of sealant material on the ceiling spread over through slab cracks throughout Levels B-D.
- 9. Traffic topping was noted worn in the drive aisles and turn areas. Traffic topping worn over the lobbies.
- 10. Adhesive failure of cove joint sealant was noted primarily at the Street Level. Cove joint sealant is needed at concrete islands/curbs and at the uphill side of columns throughout.
- 11. Cove joint sealant is needed at the south, east and west walls at Levels 2-7.
- 12. Failed joint sealants between the sidewalk and supported slab along the south elevation results in leaking below.
- 13. Adhesive joint sealant failure was noted at sidewalk and supported slab throughout the Street Level.
- 14. Isolated concrete ceiling delaminations were noted primarily at leaking slab cracks or construction joints.
- 15. Isolated concrete column delaminations were noted primarily at the corners at the slab intersection.
- 16. Isolated concrete islands/curbs were delaminated primarily at the Street Level.
- 17. Extensive cracks in the concrete walls and stair landings at the southeast and southwest stair towers. Minimal leaking was noted.



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- 18. Cracks in the retaining walls throughout Levels B-E primarily located adjacent to stair towers and ventilation shafts. Cracks were not leaking.
- 19. Small areas of ponding water were noted throughout.
- 20. Horizontal crack in brick cap mortar joint of the exterior panels.
- 21. Debonded traffic topping strips over cracks and construction joints at isolated areas of the slab-on-grade level.
- 22. Rusted concrete panel to column connection.
- 23. Broken floor drain grates.
- 24. Isolated floor drains/pipe connections were noted leaking.
- 25. Isolated light fixtures were not illuminated.
- 26. Peeling paint on walls and ceilings were observed at most levels of stair towers.
- 27. Isolated loose handrails were noted in northeast and southeast stair towers.
- 28. Isolated light to heavy corrosion of the bottom 1 foot of metal doors and door frames at the northeast and southeast stair towers were noted. Also, isolated doors did not close fully.
- 29. Spalled brick on east wall elevation.
- 30. Isolated mortar joint deterioration observed.
- 31. Many vertical wall cracks in mortar joints and through bricks on east wall of north and south stair towers.
- 32. Rust staining and deteriorated joint sealant observed at brick construction joints.
- 33. Corrosion of brick shelf angles was noted throughout.
- 34. Emergency electrical generator exhausts directly into Level B.

Leaking or unsealed construction joints, expansion joints, or cracks can contribute to corrosion of embedded post-tensioning tendons and anchors, and reinforcing steel. Corrosion of embedded posttensioning tendons and anchors can adversely affect the structural integrity of the floor slab; therefore, all joints and cracks should be sealed and maintained annually.

It should be noted that Walker Parking Consultants/Engineers, Inc. has not performed a structural review to verify the structural adequacy of the original design, as this is not within the scope of work. During our review, we did not observe deterioration to be indicative of inadequate original structural design or construction.

CHLORIDE ION TESTING

Enclosed are test results from American Engineering Testing. A chloride comparison table indicates the change in chloride concentrations at selected locations in the parking facility. Chloride sampling this year was taken in close proximity to the 2000 sites.

Twenty-one (21) concrete powder samples were removed from seven (7) locations and tested for soluble chloride ion content (salt contamination). Powder samples were removed in one-inch increments at each location to establish the chloride ion content of concrete as a function of depth.

Concentrations of chloride ions ranging from 280 to 410 parts per million (PPM), along with the presence of moisture and oxygen, are needed to support corrosion of "gray" (non-epoxy coated) mild



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steel reinforcement in concrete. Of particular importance is the chloride ion concentration at the level of steel reinforcement.

The amount of chloride ions in the concrete at the 0 to 1 inch increment below the surface ranges from 1715 PPM to greater than 6000 PPM, averaging 4270 PPM. At the 1 to 2 inch increment, the amount of chloride ranges from 445 PPM to 5755 PPM, averaging 2855 PPM. At the 2 to 3 inch increment, the amount of chloride ranges from 305 PPM to 4475 PPM, averaging 1540 PPM.

Review of the test results indicates high chloride ion concentrations, above the threshold values to support corrosion of "gray" reinforcing steel, in the top 3 inches of the floor slab. The design drawings specify that the top of slab mild steel have 1-1/2 inches of concrete cover. Therefore, the floor slab is chloride contaminated at the level of top reinforcing steel. Since the mild steel in the top of the floors, beams and stirrups are epoxy coated and the concrete contains microsilica and corrosion inhibitor (DCI), additional protection against corrosion is in place.

CERTIFICATION

The City of Minneapolis Ramp Certification Ordinance requires that the engineer state whether the structure is capable of supporting the loads for which it is used. This structure is primarily used for the parking of passenger cars and, in our opinion, presently is capable of supporting that load.

Our recommendations include the continuation of annual structural maintenance, removal of all loose concrete overhead as it is detected, and remaining items noted above and shown on drawings. We strongly recommend a program be undertaken this summer to repair the leaking and slab cracks and construction joints to protect the post-tensioning tendons. Additionally, we recommend a more detailed investigation and repair of the façade cracks, brick spalling and rusting shelf angles to project the public from falling materials. Structural maintenance should include consideration of traffic topping around the columns where the reinforcing steel is located near the top surface of the slab. Also, item 34. is a safety issue and needs further review.

The above engineering services provided were completed by me or under my direct supervision. My field of practice is structural engineering with primary emphasis on concrete deterioration and renovation. Walker Parking Consultants/Engineers, Inc. carries the \$250,000 insurance coverage required by Section 108.80 of the City Ordinance.

If we can be of further assistance or answer any questions, please call on us.

Sincerely,

WALKER PARKING CONSULTANTS

Stephen D. Disch, P.E. Principal

Richard J. Elsner, P.E. Project Manager

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CENTRE VILLAGE PARKING RAMP -- CHLORIDE COMPARISON

		1984 PPM VALUES			1987 PPM VALUES		1990 PPM VALUES		1992 PPM VALUES		1997 PPM VALUES			2000 PPM VALUES			2003 PPM VALUES					
# IC	TIER	0"-1"	1"-2"	2"-3"	0"-1"	1"-2"	2"-3"	0"-1"	1"-2"	2"-3"	0"-1"	1"-2"	2"-3"	0"-1"	1"-2"	2"-3"	0"-1"	1"-2"	2"-3"	0"-1"	1"-2"	2"-3"
1 D	D	300	210	210																		
2 D	D	770	170	80	864	304	228	1060	596	289	337	212	182	2501	1144	953	1475	650	390	1715	445	390
3 D	С				5340	2490	374	4265	1490	618	4080	1340	290	6000	6000	3590	6000	6000	5670	4380	1890	445
4 D	С																					
5 D	В	380	190	160																		
6 D	В	1010	170	130	1900	426	196	970	197	40	732	112	98	2365	797	581	6000	6000	3980	3510	950	305
7 D	SK	3180	400	210	6510	3180	1180	5543	2950	1240	3612	1844	576	6000	6000	6000	6000	6000	5970	>6000	5140	4475
8 D	SK	1940	200	200	4750	2390	387	4377	1750	502	4640	2512	552	6000	6000	3232						
9 D	з				1470	205	204	1117	1070	243	944	177	150	6000	1570	1243						
10 D	з																					
11 D	4	560	250	240	2290	834	165	3871	1045	238	4400	2424	436	6000	6000	3702	5550	1380	765	>6000	5755	2745
12 D	4	360	170	150																		
13 D	5				3320	2030	431	4472	1552	345	4080	1664	452	6000	6000	4394	6000	6000	2580	4715	3420	1685
14 D	5																					
15 D	6	860	180	150	2880	787	161	2493	892	431	2376	768	181	5243	6000	1486	6000	3120	1375	3555	2385	720
16 D	7	230	160	130																		
17 U	SI	670	190	190						un en				i in a constant constant of the second								
# ENTRI	ES	11	11	11	9	9	9	9	9	9	9	9	9	9	9	9	7	7	7	7	7	7
MINIMU	M	230	160	80	864	205	161	970	197	40	337	112	98	2365	797	581	1475	650	390	1715	445	305
AVERAC	ΒE	933	208	168	3258	1405	370	3130	1282	438	2800	1228	324	5123	4390	2798	5289	4164	2961	4268	2855	1538
STD DE	V	844	65	44	1795	1054	303	1647	747	324	1628	898	172	1457	2284	1729	1565	2226	2122	1405	1872	1454
MAXIMU	М	3180	400	240	6510	3180	1180	5543	2950	1240	4640	2512	576	6000	6000	6000	6000	6000	5970	6000	5755	4475
% increase from previous year			r =		249%	575%	120%	-4%	-9%	19%	-11%	-4%	-26%	83%	257%	763%	3%	-5%	6%	-17%	-35%	-45%
% increase from 1984 =				249%	575%	120%	236%	516%	161%	200%	490%	93%	449%	2009%	1564%	467%	1900%	1661%	358%	1271%	814%	
Overall A	verage	1	984 AVG=	436	19	987 AVG=	1678	19	990 AVG=	1617	19	992 AVG=	1451	19	997 AVG=	4104	20	000 AVG=	4138	20	03 AVG=	2887



CHLORIDE ION CONTENT DETERMINATION LABORATORY ANALYSIS RESULTS FORM

		<u>CHLORIE</u> Dep	DE ION CONTE		
Sample No.	Sample Identification	0" - 1"	1" - 2"	2″ - 3"	Comments
CL-2	Drive Lane	1715	445	390	Level D, West Bay
CL-3	Drive Lane	4380	(890	445	Level C, West Bay
CL-6	Drive Lane	3510	950	305	Level B, East Bay
CL-7	Drive Lane	>6000	5140	4475	Level Skyway, West Bay
CL-11	Drive Lane	76000	5755	2745	Level 4, West Bay
CL-13	Drive Lane	4715	3420	1685	Level 5, East Bay
CL-15	Drive Lane	3555	2385	720	Level 6, East Bay
			2		
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American Information

Date Received: Test Required: Samples Tested By

	7-30-03	
	Acid Soluble Chloride Content	
/:	Late Heiden	



Walker Information

Project Name: Project Number: Samples Taken By: Date Sampled: Number Submitted: Date Submitted:

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