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October 14, 2005

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

Re: Annual Observation Report Loring Park Parking Facility 1330 Nicollet Mall Minneapolis, Minnesota Walker Commission No. 21-3254.00

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 Loring Park 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 1980, the Loring Park Parking Facility is a cast-in-place, post-tensioned concrete parking structure approximately 265 feet long by 120 feet wide. There are nine supported parking levels with a total supported floor area of 265,000 square feet. The floor consists of 6-1/2 inch to 9-1/2 inch thick concrete floor slabs supported on post-tensioned concrete beams spaced at 27 feet and 38 feet on center, respectively. The beams span 59 feet and are supported on conventionally reinforced concrete columns. The top reinforcement in the floor slab, beam top bars, and beam stirrups are epoxy coated. A concrete sealer was applied to the slab surface upon completion of construction and again in 1988 and 1994.

Access to the facility at street level is provided by an express ramp from Nicollet Avenue with the exit express ramp to LaSalle Avenue. The parking structure is a double threaded helix design with one-way traffic and angle parking. A stair tower is located at the northwest corner of the facility and a stair/elevator tower is located at the northeast corner. The facility provides parking for approximately 750 vehicles.

## VISUAL OBSERVATION SUMMARY AND CONCLUSIONS

During the course of our visual observation of this facility, we did not observe any conditions, which would restrict the facility from qualifying for an operating certificate. However, hidden or latent



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conditions may exist in this facility, which have not yet revealed themselves through visual evidence and may require removal subsequent years. The following is a summary of conditions noted:

- 1. Floor cracking and scaling.
- 2. Concrete floor, ceiling and column delaminations of limited areas.
- 3. One broken post-tensioned slab tendon exposed at Level 4 ceiling southwest corner..
- 4. Isolated leaking ceiling cracks and east / west construction joints.
- 5. Grease stains at isolated ceiling cracks.
- 6. Isolated beam delaminations adjacent to expansion joints.
- 7. Many delaminations and spalls to bumper walls primarily located at and just above the floor slab. Vertical wall reinforcing steel has minimal concrete cover.
- 8. Isolated floor slab spalls at slab-on-grade.
- 9. Isolated water ponds.
- 10. Minor expansion joint nosing deterioration and leaking.
- 11. Leaking around Roof Level drains at ceiling of Level 9.
- 12. Water draining through holes in Roof Level slab.
- 13. Unsealed construction joints at Level 3.
- 14. Random spot rust staining on ceiling.
- 15. Debonded transition concrete overlay at crossovers.
- 16. Exposed ends of reinforcing bars on floor slab. Minimal concrete cover.
- 17. Leaching at exterior P/T anchor pockets at random locations.
- 18. Scaled walls at isolated locations in and around the stair and elevator towers.
- 19. Delaminated lintel in the stair tower at Levels 6 and 8.

City of Minneapolis Maintenance and Repairs Department completed stair repairs at the northwest stair tower in 2004. Floor repairs are scheduled for 2005.

Leaking construction joints, expansion joints, or cracks can contribute to corrosion of embedded posttensioning tendons and anchors and reinforcing steel. Corrosion of embedded post-tensioning 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 1984, 1987, 1990, 1992, 1996, 1999, and 2002 sites. Twenty-four (24) concrete powder samples were removed from eight (8) locations and tested for acid 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.



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Concentrations of chloride ions ranging from 375 to 550 parts per million (PPM), along with the presence of moisture and oxygen, are needed to support corrosion of "gray" (non-epoxy coated) mild 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 1480 PPM to greater than 6000 PPM, averaging 3701 PPM. At the 1 to 2 inch increment, the amount of chloride ranges from 410 PPM to 5940 PPM, averaging 2761 PPM. At the 2 to 3 inch increment, the amount of chloride ranges from <80 PPM to 2635 PPM, averaging 1001 PPM.

Review of the test results indicates high chloride ion concentrations in the top three inches of the floor slab. Values above the threshold values can support corrosion of "gray" reinforcing steel. The design drawings specify that the top 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 additional protection against corrosion is in place. Refer to American Engineering Testing Report, dated May 5, 1995; review corroded epoxy coated reinforcing steel. Further testing should be done to judge the scope and significance of the problem suggested in that report.

## 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 overhead concrete as it is detected, rout and seal all leaking or deteriorated construction joints and cracks, budget for repair of the damaged post-tensioned tendon and traffic topping, and remaining items noted above.

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

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