JFK PLAZA GARAGE FACILITY
Philadelphia, PA

Facility Assessment

Volume 1 - Report

September, 2006

Carl Walker, Inc. Project No. R1-2006-031

For:
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## Volume II – Phase I Environmental Assessment
I. INTRODUCTION

In accordance with Carl Walker, Inc.’s (Carl Walker) proposal dated April 25, 2006 and the notice to proceed issued by the Philadelphia Industrial Development Council (PIDC) dated June 12, 2006, an investigative study of the JFK Plaza Garage Facility located in Philadelphia, Pennsylvania was undertaken. The project team for the facility assessment consists of:

- **Carl Walker, Inc.** - Prime/Structural/Functional Consultant
- **DPK&A Architects** - Architectural consultant
- **ANG Associates** - Mechanical/Electrical/Plumbing Consultant
- **Brinkerhoff Environmental Services, Inc.** - Environmental Consultant

Parking Facility Description

The JFK Plaza Garage Facility is sited in Center City, Philadelphia, Pennsylvania adjacent to the City Hall Building. The garage is located between 15th and 16th streets on the east and west sides, and Arch Street and John F. Kennedy Boulevard on the north and south sides respectively.

The garage was constructed in 1964, occupies a total of 336,700 square feet over four levels underground. This provides for approximately 810 monthly and transient parking spaces below JFK Plaza (also referred to as Love Park). The parking facility location provides convenient access to the Convention Center, Suburban Station, surrounding municipal buildings, and Penn Center buildings.

JFK Plaza (Love Park) is located above the parking levels and provides a fountain and park area with landscaping.

The garage is owned by the City of Philadelphia, and leased to the Philadelphia Parking Authority (PPA). Currently, the garage facility operations are handled by Parkway Garage, Inc. (Parkway) of Philadelphia, Pennsylvania. Parkway is responsible for the routine and preventive maintenance of the facility. The City of Philadelphia maintains all of the JFK Plaza elements, including, but not limited to the fountain, and landscaping.

The Parkway Corporation is currently responsible for the routine and preventive maintenance of the facility. The City of Philadelphia maintains all of the JFK Plaza elements, including, but not limited to the fountain, and landscaping.

Project Scope

The following outlines the scope the facility assessment performed by **Carl Walker** and its sub-consultant team:

*Architectural/Code Compliance*

1. Outline Upgrades that require compliance with Federal, State and Local codes:
• Egress
• Length of Travel
• Fire Separations
• Construction Type
• Use
• Building Systems

2. Provide Recommendations for upgrades required by the Americans with Disabilities Act (ADA).
   • Number, size and location of handicapped accessible parking spaces
   • Doors
   • Vertical and horizontal travel and access

3. Review the feasibility and impact of erecting an enclosed entrance and extending an elevator to the street level (new or existing). A schematic architectural rendering will be included.

**Structural**

1. Evaluate the overall structural integrity and performance of structural repairs completed in the past.

2. Review the existing waterproofing and drainage system above the garage (repairs required between garage & park, status of existing waterproofing life with projected replacement)

**Building Systems**

1. Review the condition and existing Upgrades or disconnections/capping.
   • Electrical
   • HVAC
   • Plumbing (Not Including the Love Park Fountain).
   • Fire protection

2. Assess the feasibility to separate the life safety systems for the City of Philadelphia's Municipal Services Building from the systems which serve the Garage.

**Environmental Evaluation**

1. Assess and document environmental hazards that could impact a rehabilitation/repair project.
**Operational Assessment**

1. Assessment of the current major operational characteristics of the Garage, particularly the vehicle circulation pattern, parking space layout, ticketing and payment systems, etc. Recommended modifications to each of these features of the Garage operation will also be discussed to improve the efficiency.

In addition to the facility assessment report, drawings of existing conditions and proposed improvements are included. A cost estimate to incorporate the recommendations provided in this report is also included.

**Structure Description**

The 810 space below grade parking garage consists of three supported levels and one on-grade level. The Main vehicular entry/exit to the garage is provided by a structured ramp along Arch Street on the north side of JFK Plaza. An entry/exit from Cherry Street also exists via a slab on grade ramp, which connects directly to the third level. The Cherry Street exit/entrance also provides access to a loading dock for the adjacent Municipal Services Building.

![Diagram of JFK Plaza Garage Facility Assessment](image)

Vehicular access between the four parking levels is provided by a single threaded helix ramp system. Traffic flow is mainly one way with 90 degree parking spaces. Vertical clearance for the garage is posted as 6'-0", therefore access by handicap accessible vans and tall vehicles is not possible.

Pedestrian access between levels is provided by four stair towers located throughout the garage, three of these towers extend to the plaza level. Two elevators are provided within the parking facility, neither elevator extends up to the JFK Plaza (street level). Both of the elevators do not currently function.
The parking facility and plaza are constructed of conventionally reinforced concrete slabs, walls and columns. The structured parking surfaces are composed of a 9” thick two way slab system with drop panels. The slabs typically span between concrete columns, exterior foundation walls and interior ramp walls.

**Building Systems**

The mechanical building systems include ventilation fan systems and associated shafts, Plaza Level intakes/exhausts, air inlet and outlet grilles that assist in the delivery of ventilation air. A carbon monoxide system is present in all below grade levels of the parking facility.

The electrical components of the parking facility include the lighting systems, the garage power systems, and an emergency generator.

Plumbing systems include storm systems for the garage and for the plaza above, sanitary systems serving the first level restroom facility, domestic water and fire protection systems serving the garage and fountain above.

**Functional System**

As stated previously, vehicular access between the four parking levels is provide by a single thread helix ramp system. Traffic flow is mainly one way but parking spaces are oriented at 90 degrees to the drive lanes. The layout of parking stalls is restricted by the 28 ft. x 30ft. column grid system resulting in 8’-6” wide stalls.

Access control to the garage is provided by ticket dispenser for daily patrons, and a proximity card reader for monthly patrons. Booths are present at each garage exit (Level 1 Arch Street exit and Level 3 Cherry Street exit) for collection of parking fees from daily parkers (pay-on-exit system). A layout of current parking control equipment is provided in Appendix B.

Parking stalls are typically 8’-6” in width. The layout of parking stalls is restricted by the 28 ft. x 30ft. column grid system resulting in 8’-6” wide stalls. Handicap parking spaces are currently provided on Level 1. Since the garage elevators do not work, an employee of the garage operator must assist wheel chairs by pushing them up the Arch Street exit ramp.
Evaluation of JFK Garage Facility

From June to August 2006, personnel from Carl Walker and its sub-consultant team conducted a detailed review of the JFK Plaza Garage. Visual examinations helped define the nature and extent of deterioration of the structure, as well as the general condition of the mechanical, electrical, and plumbing systems. A code analysis of existing architectural systems intended to highlight the main areas of concern in rehabilitating an existing garage structure was also completed. The evaluation and recommendations for addressing each of the garage facility systems mentioned above follows.
II. ARCHITECTURAL/CODE COMPLIANCE

A review of the code provides the basic parameters to identify the facility; as well as provide minimum requirements to safeguard public safety, health and general welfare through means of egress, structural strength, stability, sanitation, lighting, ventilation, and safety to life and property from fire and other hazards.

Code compliance items relating to structural, mechanical, electrical and plumbing have been included in their respective sections of this report. An analysis of the architectural code issues is included herein.

**JFK Plaza Garage Building Code Analysis**

Applicable Code for the City of Philadelphia:

- International Existing Building Code (IEBC), 2003
- International Building Code (IBC), 2003

Applicable American National Standard referenced in the IBC:


This code analysis is not meant to be exhaustive, but instead intended to highlight the main areas of concern in rehabilitating the existing garage structure to more closely comply with the applicable codes noted.

Use and Occupancy Classification: **S-2**

Construction Type: **Type 1A** (non-combustible materials)

Allowable Height: **Unlimited** (in stories above or below ground)

Existing Height: **4 stories**

Allowable Area: **Unlimited**

Existing Area: **84,000 sq. ft.** Per floor.

Occupant Load: **420** @ 200 gross sq. ft. per occupant.

Egress Width: **84 in.** @ .2 inches per occupant.

Existing Width: **132 in.**

Number of Exits: **3** Required.

Existing Exits: **3**

Exit Access Travel Distance: **400 ft. max.** S-2 occupancy, fully sprinklered.
Existing travel Distance: 200 ft

Minimum Stairway Width: 44 in
48 in. clear width between handrails not required for buildings equipped throughout with automatic sprinkler system.

Existing Stairway Width: 44 in
Garage sprinklered throughout.

Area of Refuge: Not Required
For buildings equipped throughout with an automatic sprinkler system.

Existing Area of Refuge: None
Garage sprinklered throughout.

Max. Stairway Riser Height: 7 in
Existing Riser Height: 8 in
Non-compliant, but no changes are necessary in an existing building.

Min. Tread Depth: 11 in
Existing Tread: 10.25 in
Non-compliant, but no changes are necessary in an existing building.

Handrail Extensions: ADA compliant
Existing handrail Extensions: None
Non-compliant, but no changes are necessary in an existing building.

Guardrail: Required when drop is 30 in or more.
Existing Guardrails: None
Required in some of stairway landings.

Stairway Enclosures-Fire Rating: 2 hr
Existing Fire Rating: 2 hr

Door Fire Rating: 1 ½ hr
Existing Doors: 1 ½ hr

Door Hardware: Panic Hardware, Closer & Paddle Handles
Existing Door Hardware: Panic Hardware, Closer & Paddle Handles

Door Swing: In Direction of Travel
Existing Door Swing: In Direction of Travel

Door Clear Width: 32 in
Existing Clear Width: 34 in
Existing doors are 36 in wide.

Elevator Requirements: Accessible Elevator to Street Level
Standby Power Required
Existing Elevators
2 Elevators
Non-functioning, non-accessible, terminate below Street Level & no standby power.
### Parking Structure Clearance:
- **7 ft**
- **Existing Clearance:** 6 ft

Increasing the existing garage clearance is not economically feasible.

### Handicap Parking Spaces:
- **18**
- **Existing Handicap Spaces:** 18

(16) Passenger Car & (2) Van. No Van Spaces due to clearance Height.

### Handicap Parking Surface:
- **Max 2% Slope**
- **Existing Surface:** Greater than 2%

### Handicap Parking Obstructions: **Min 80 in Clear Height**

Guards required to block off areas below 80 in. high.

### Existing Handicap Parking:
- **Below 80 in Min.**

Column capitol diminish clear height required @ isles.
Summary and Recommendations

Throughout this report, recommendations will be broken down into two categories: _General Repairs (A.R.#)_ and _Recommended Improvements (A.I.#)._ 

For the architectural items, _General Repairs_ are items that are necessary for the JFK Plaza Garage facility to meet minimum building code requirements. These items typically address entry/exit of pedestrians from the garage (emergency egress), and should be incorporated regardless.

_Recommended Improvements_ are items that will bring the Garage facility up to current building code requirements, and help provide a comfortable and efficient parking for garage patrons and employees. These items also include aesthetics, entry/exit form the garage and ADA compliance issues.

**General Repairs**  
**Code Compliance (Architectural):**

**ADA and General Compliance**

A.R.1. **Provide clear large signs located at vehicular entrances indicating that the garage has no means of egress for wheelchair users.** Currently, small innocuous signs point out this fact.

A.R.2. **Add an ADA compliant handicap ramp to the curb leading up to the garage manager's office and reconfigure the ramp on the curb leading up to the bathrooms to be ADA compliant.**
A.R.3. Reconfigure the existing Toilet Rooms to be ADA compliant.

A.R.4. Provide missing code compliant guardrails at stairs where needed.

A.R.5. Provide ADA compliant ramps leading up to all stairway entrance doors. An elevation change exists up to the stair entrance doors, which varies from 3 to 6 inches. The existing ramps up to the doors are not ADA compliant ramps.

A.R.6. Relocate the existing accessible parking spaces to level areas without ADA clearance issues. The existing column capitals reduce the clearance around columns to below the required 80”.

Stair Nos. 1 and 3
A.R.7. Stair No. 1 and Stair No.3 have Street Level signs on the exterior of the doors directing parking garage customers to use the Arch Street car entrance ramps when the stairs are locked (Stair No. 3 is locked at all times). These signs are against code requirements stating that vehicular entrance and exit ramps are not allowed to be used by pedestrian for access or egress. Remove these signs and if street entrances are locked and install signs directing customers to use the nearest code compliant means of egress.
Stair No. 4
A.R.8. Erect 2 hr fire rated walls blocking off the existing non-functioning elevator adjacent to Stair No. 4 on all stair levels. Within this newly created exit access corridor add illuminated EXIT signs directing people to the stairs. Another approach to separate Stair No. 4 as required by code is to create an entrance directly into Stairway No. 4 similar to Stairway No. 1, 2 & 3 on all levels thus bypassing the elevator lobby entrance. The existing doorway from the elevator lobby to the stairs would need to be closed off with a 2 hr fire rated wall and appropriate EXIT signage reconfigured.

Reverse the swing of the double doors leading to the MSB concourse just above the First Level of the garage at Stairway No. 4, and remove the illuminated EXIT sign on the MSB concourse side of the doors. The MSB concourse already has two means of egress to the street. Add directional signs at these reconfigured doors within Stair No. 4 directing people either to the MSB concourse or the Street Level exit. Currently these doors are chained open during the day and chained shut during the night, violating the code and no signs direct people to the Street Level as required by code.

Stair No. 2
A.R.9. There are lighted exit signs at the entry to Stair No. 2 on Levels 2 and 3 that should be removed. The stair does not extend to the Plaza/Street Level, since lighted exit signs are intended to locate emergency egress paths, this could confuse patrons in an emergency.
Recommended Improvements
Code Compliance (Architectural):

A.I.1. Eliminate Stair No. 2: Remove existing walls and stairway and in-fill the concrete decks.

There are a total of four stair towers that provide access between levels in the parking facility; three of the stair towers provide egress from the garage to the Plaza/Street Level. Stair No. 2 is located adjacent to the Arch Street vehicular ramps. This stairs does not extend up to the ground level as required by code, but stops one level below ground ending near the garage office and ticket dispensing machines. Upon reaching the top of Stair No. 2 the nearest way up and out to Street Level is using the vehicular ramps which is not allowed by code or going back through the garage at Level One to exit at either Stair No. 1 or Stair No. 3 which is not allowed by code.

Although signage exists that indicates no pedestrians are allowed on the ramps and signs at the top of Stair No. 2 direct people to exit at Stair No. 1 or Stair No. 3, signs alone mean nothing in an emergency. The fact that Stair No. 2 looks identical to means of egress Stair No. 1, 3 & 4 creates confusion and therefore compromises safety.

A.I.2. Replace Stair Nos. 1, 3 & 4: Presently, all the stairways throughout the garage have a riser height of 8 inches and tread depth of 10.25 inches. The code requires maximum 7 inch risers and 11 inch treads. These stairways also do not contain code compliant handrails or guardrails. Because of the significant effort that would be required to reconfigure the existing stairs, we recommend relocating these stairways to location near the existing, then infilling the existing stairs. The garage could then remain open while the new stairs are being built.

A.I.3. Provide Two New ADA Compliant Elevators to Street Level: One ADA compliant elevator is required by code. We recommend that two ADA compliant elevators be provided side by side because of the maintenance issues associated with elevators. Additionally, if one elevator is out-of-service, a person in a wheelchair would still have a means of egress from this location.

A.I.4. Potential Head House Locations: Three alternatives have been explored in order of preference for a new elevator/stair head house at Street or Plaza Level.

The following pages provide sketches and comments explaining the order of preference.
Alternative No. 1

We strongly recommend Alt. 1 which shows the head house located within the plaza. This location gives the garage below a strong identity and identification marker within the plaza. This area is open, well lit and will enhance the urban experience of the garage user. Coming up to Plaza Level, the elevator doors will open onto the fountain, which is on axis with two of the cities most recognizable landmarks. This option will require relocating the Parking Operator office.

We feel that this location would best serve the garage and the public using this facility.

Plaza Level Plan

Level 1 Plan
Alternative No. 2

This option provides a head house located along 15th Street. The exterior glass wall of the lobby would merge with the existing granite walls and feel “tucked into” the surrounding urban fabric. The roof of the head house could be planted or be used as a platform for sound equipment used in outdoor events at the plaza.

We feel this location/alternate is the second best location for extending the elevators to the plaza/street level. By placing the elevators along 15th street, it would not be centrally located within the parking facility. There also could be safety concerns in this location since the elevator lobby would be hidden by the surrounding planter areas.
Alternative No. 3

This location along 16th Street was included because it was identified by PIDC as a possible site for the head house.

We do not recommend this location because the head house would be located within the view corridor from City Hall to the Art Museum, which could be unacceptable aesthetically. Furthermore, the garage level ramps slope considerably in the garage below in this location potentially creating access problems for stairs and elevators.
A.I.5. Aesthetic Enhancements

Recommend enhancements to the garage that will improve user comfort and safety as well as visual impact.

- Repaint Color-Coded Columns & Stairtowers - We recommend refreshing the painted color-coded wayfinding scheme on columns and stairtower walls.
- Paint Walls/ Ceilings for reflectance - Lighting levels can be significantly enhanced through the use of reflective paint/stain on ceilings and walls. Increased lighting provides a more user-friendly environment in underground facilities and can enhance the safety of garage patrons as well.
- Replace Doors, Frames, and Hdwrs - Misc. Rooms Storage rooms and other miscellaneous rooms in the garage should be secured to prevent unauthorized access. We recommend replacement of doors, frames and hardware throughout (except the stair tower doors and others recently replaced) to secure these rooms and/or make them accessible for their intended use.

Estimated Costs

A cost estimate for implementation of the General Repair and Recommended Improvement Architectural items is listed in Appendix A.
### III. STRUCTURAL ASSESSMENT

**Structure Summary**

<table>
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<tr>
<th>STRUCTURE NAME:</th>
<th>JFK Plaza &amp; Parking Garage</th>
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<tbody>
<tr>
<td>LOCATION:</td>
<td>1500 Arch Street Philadelphia, PA</td>
</tr>
<tr>
<td>YEAR BUILT:</td>
<td>1963/64</td>
</tr>
<tr>
<td>YEAR(S) REPAIRED:</td>
<td>1991-93: Major Structural Renovation</td>
</tr>
<tr>
<td>CONSTRUCTION TYPE:</td>
<td>Cast-in-place, conventionally reinforced, two-way flat slab with drop panels</td>
</tr>
<tr>
<td>CONCRETE TYPE:</td>
<td>Conventional</td>
</tr>
<tr>
<td># OF LEVELS:</td>
<td>4 Levels Below Ground</td>
</tr>
<tr>
<td># OF STAIRS:</td>
<td>4</td>
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<tr>
<td># OF ELEVATORS:</td>
<td>2 Hydraulic, (both non-operational)</td>
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<tr>
<td>FLOOR AREA (SOG):</td>
<td>84,000 SF</td>
</tr>
<tr>
<td>FLOOR AREA (Supported Slab):</td>
<td>238,000 SF (not including plaza level)</td>
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<tr>
<td>FLOOR AREA (Total Parking):</td>
<td>322,000 SF</td>
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<tr>
<td>FUNCTIONAL TYPE:</td>
<td>Single-threaded helix</td>
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<tr>
<td># OF PKG. SPACES:</td>
<td>810 Spaces</td>
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Previous Repairs
The supported parking levels in this garage were extensively repaired in 1991 through 1993. At the conclusion of that work, approximately 70% of the supported floors had either been completely replaced or “strip patched” with a new concrete overlay and epoxy coated reinforcing steel (top layers only). Of the remaining supported floor area, all top-side and ceiling delaminations were repaired on a spot basis. A 40% silane sealer was applied to all supported floors following repairs.

In the areas receiving full slab replacement with new reinforcing steel, the depth of concrete cover over the reinforcing steel was increased to a minimum 2”. Floor drainage was also improved to direct water away from walls, columns and other vulnerable areas.

Another project was undertaken in 1993 to replace the reinforced concrete stair landings in all stair towers.

Stair tower doors frames and hardware were replaced within the last two years. There is also evidence of some miscellaneous overhead spall repair and floor crack injection that has been undertaken over the last few years, including some ongoing work observed during the course of this survey.

At the time of our evaluation (June 2006), concrete repairs were being completed on all levels of the facility. Some of the necessary repairs noted in our evaluation may have been addressed as part of this project. **Carl Walker** was not provided with the current JFK Plaza Garage Facility repair project scope.
Condition Review

The structural evaluation at JFK Plaza was completed the week of June 12, 2006. The evaluation included a visual review of structural elements such as floor slabs, ceilings, beams, columns, walls and other elements including stairs and curbs. In addition to the visual review, a chain drag survey of the supported slabs and grade slabs was performed to identify areas of surface delamination. The results of the field evaluation have been documented with photos and drawings provided in Appendix C.

Chloride testing was also performed to determine the quantity and depth of penetration of chlorides in the floor slabs. Results of the concrete testing can be found in Appendix C. A list of all deteriorated items, including quantity and estimated repair cost, can be found in Section IV. The following are pictures and observations of items within the parking structure noted during our evaluation.

Concrete Floor Slabs – Supported Levels:
Our chain drag survey revealed the presence of surface delaminations primarily in areas adjacent to the repair areas from the 1993 project. The quantity of delaminations is relatively small, representing approximately 1.5% of the total supported floor area.

Large sections of the garage floor slabs which were replaced with new concrete and epoxy-coated reinforcing steel are performing well, with very little new corrosion-related delamination noted.

We noted the presence of shrinkage cracks within the repaired concrete areas (see photo; cracks highlighted with orange paint for visibility). Many cracks were identified during the repair project and were routed and sealed at that time. Many, however are untreated and are vulnerable to water and chloride penetration. This will ultimately lead to accelerated corrosion of embedded reinforcing steel.

We also noted the presence of fine “pattern” cracking in some of the concrete overlay areas. This type of cracking is usually a result of inadequate curing procedures during patch installation. While the cracks are typically very fine
and shallow, they can increase the opportunity for moisture penetration and freeze-thaw deterioration. Overall drainage in the garage is good. We noted a few exceptions where ponding was evident; such as the northwest corner of Level 1-D, and on Level 4-C (South) along the west wall adjacent to the sump pump room.

Our survey of the underneath sides of the supported slabs revealed very few problems. The total quantity of overhead spalling/delaminations was less than 0.5% of total surface area. The photos depict a couple of the more notable areas of delamination from reinforcing steel corrosion. There were a few locations where previous shotcrete repair overspray was debonded and loose, or in some cases had fallen from the ceiling. Hammer sounding of the bulk of the overhead repairs however confirmed that there is very little new delamination occurring at this time.

During our survey, crews were in the garage performing repairs on overhead delaminations, although we do not know the scope of their contract.
Concrete Floor Slabs-On-Grade:
The floors on Level 4 and portions of Level 3 are slabs-on-grade; nonetheless they are reinforced with a mat of reinforcing steel placed near the top of the slab to resist potential upward groundwater pressure. We noted a fair amount of delaminations at the surface of the concrete floor slabs on these levels. Previous repair projects did not include significant repairs to these levels, which explain why on a percentage basis the quantity of delaminations on these levels is significantly higher.

We also noted water infiltration through cracks in the floor at Level 4-C (South), which is the absolute lowest elevation in the garage. Water is seeping upward through the floor cracks and then draining along the top of the floor slab to the west wall.

Walls & Columns
Columns throughout the garage appeared to be in good condition with no visual signs of cracking, spalling or delamination.

We noted some spalling at the top of the east/west interior walls just below the slab tie-in. The spalling appears to be a result of movement restraint rather than reinforcing steel corrosion; there is no evidence of exposed or rusting rebar. Some of the locations had been previously patched and the patches were delaminated. There is no structural concern here; adequate slab to wall bearing exists in spite of the spalling. The greatest hazard is from falling concrete.

The walls along the “truck ramp” or entry/exit ramp from Cherry St. are exhibiting water infiltration through cracks and/or construction joints. Ongoing leakage has left carbonate stains on the walls and has contributed to a limited amount of surface delaminations.
Entry/Exit Ramps
The entry/exit ramps consist of a 6” topping slab over a structural slab. The topping slab was originally surfaced with a thin epoxy/aggregate coating, most of which has worn off. The ramp slabs are in relatively good condition with only isolated surface delaminations. Worst deterioration was adjacent to the trench drains located at mid-ramp. Some spalling was also noted in the curb near the bottom of the exit ramp.

There was reportedly a hot water snow melt system in the ramp topping slab that is no longer operational. Leaks were evident beneath the ramps in the ceiling of Level 1. During our survey we noted evidence of ongoing work to seal the cracks by injection of polyurethane grout.

We noted some problems with the granite cladding and railing adjacent to the ramps. Near the bottom of the entry ramp, the interior wall cladding is exhibiting freeze-thaw degradation from moisture and salt splash. The veneer panels have lost up to 1/2” in section thickness as a result. We also noted some missing granite railing balusters at the top of the exit ramp.
Stairwells
The stairs consist of metal treadplate risers and treads supported by steel stringers. Landings are constructed of reinforced concrete and were completely rebuilt in 1993. More recently the landings were coated with a polyurethane membrane deck coating, providing waterproofing protection and surface texture.

Railings are 1-1/4” painted steel pipe rail.

The overall condition of the stairs and landings is good. The west stair tower is open to the plaza level and is showing signs of water penetration to lower levels. Leakage is resulting in some rusting of supporting steel structural members attached to the walls. The railings are also exhibiting isolated areas of rust ranging from minor to significant loss of steel section.

Plaza Level (Love Park) Waterproofing System
From review of original construction drawings, the waterproofing and landscaping of the garage facility was completed in 1965, separately from the construction of the garage. The plaza surface occupies a footprint of 105,000 sq. ft and spans over the JFK Plaza Garage Facility, and a portion of the adjacent Penn Center Facility (Pennsylvania Railroad Station). Features of the plaza surface include granite paver walking surfaces, tree and planter boxes, recreational lawn areas and a central water fountain.

The plaza waterproofing system is necessary to keep water from infiltrating into the occupied garage and pedestrian spaces below. Documents indicate the plaza system consists of multiple layers:

1. Waterproofing Membrane – Asphaltic Hot Applied Membrane System over structural slab.
2. Concrete Topping Slab – 3” thick concrete slab (protection course) placed directly over the existing waterproofing membrane.
3. Porous Fill – Granular fill placed over the concrete topping slab to help achieve the varying elevations plaza elevations.
4. Concrete Sub-Slab – To provide a level surface for support of granite paver system, benches
or other landscape elements.

From conversation with personnel at the Fairmont Park Commission, renovation/repair projects completed on the plaza have been limited landscaping. While searching for drawings at the Capital Programs Office (CPO), only landscape renovation drawings were found for this area. This means that the waterproofing system is probably from original construction. The anticipated life of a typical plaza waterproofing system similar to that provided over the JFK Plaza Garage Facility is approximately 40 years.

During our review, we did not note any major leaks through the Plaza Level structural slab into the garage space, therefore replacement of the system is not an immediate concern. Additionally, replacement of plaza waterproofing systems can be very costly depending on materials used and amount of granite pavers and wall stones that can be saved. Closure of the Love Park surface (or large areas) would also be necessary to complete the waterproofing project.

Since there are no known water infiltration issues into the garage, we do not recommend resurfacing/waterproofing the Love Park/JFK Plaza structure at this time. Because the existing waterproofing system is approaching the end of its expected life, the renovation/waterproofing of this area should be planned within the next 10 years.
Summary and Recommendations

Based on our observations of the condition of this facility, we recommend implementation of a repair program to halt the progressive deterioration of key structural elements (within the next year). This repair plan, referred to as General Repairs, is considered the minimum amount of work necessary to ensure the garage will remain in service.

Recommended Improvements are preventive maintenance items intended to extend the service life of the parking structure, and extend the amount of time between costly structural repairs. Preventative maintenance measures; primarily in the form of surface-applied waterproofing materials tailored to address the particular vulnerabilities of this structure.

We also recommend certain enhancements to the garage that will improve user comfort and safety as well as visual impact.

A summary of General Repairs (S.R.#) And Recommended Improvements (S.I.#) follows. A cost estimate to incorporate the following items is also provided in the following section.

General Repairs

S.R.1. Concrete Floor Repairs-Supported Levels: Delaminated areas of the supported level slabs should be repaired by conventional concrete patching methods. Since most of the delaminations are occurring in areas of original concrete and reinforcing and are highly contaminated with chlorides, repair materials should incorporate migrating corrosion inhibitors to mitigate future ring-effect delaminations.

S.R.2. Concrete Ceiling Repairs Ceiling: Delaminations should be repaired to preclude potential injury or damage from falling concrete. Ceiling delaminations are often associated with leaking cracks in the slab above, and in the course of repairs these should be identified and sealed where feasible.

S.R.3. Slab-On-Grade Repairs: Repair of slab-on-grade delaminations is recommended to maintain the structural integrity of the slabs.

S.R.4. Wall Spall Repairs: Most observed wall spalling is non-structural in nature. occurring as a result of restrain

S.R.5. Truck Ramp Wall Repairs: Wall delaminations should be repaired to restore structural integrity. See S.R.4 for related item.

S.R.6. Entry/Exit Ramp Concrete Repairs: As a minimum, deteriorated areas of the topping slab should be removed full depth and replaced to restore a safe and sound driving surface and to minimize intrusion of moisture to the underlying structural slab. See related preventative maintenance items below which provides for a more extensive treatment of the topping slabs on the ramps.

S.R.7. Entry/Exit Ramp Curb Repairs: Sections of curbing exhibiting cracking should be removed and replaced.
S.R.8. Supplemental Floor Drains & Piping: Spot areas of ponding water should be addressed by the installation of strategically located supplemental drains. Drain piping can be tied into the existing system where feasible. The elimination of ponding water is important since moisture is a primary driver of the corrosion process in reinforced concrete, this also lowers the potential for frozen water and slip hazards during the winter months.

**Recommended Improvements (Preventive Maintenance)**

S.I.1. Supported Level Waterproof Membrane: We recommend complete coverage of the supported level slabs with a urethane deck coating. This 40+ year old structure was extensively repaired 13 years ago. Our observations at this time indicate ongoing corrosion-related deterioration in the unrepaired portions, however it is expected that the same phenomenon will be repeat itself in the repaired areas within the next 5-10 years. Chloride levels in the newer concrete of the repaired areas, although generally still below the corrosion threshold, will continue to increase over time. Observed shrinkage cracking in the slabs will facilitate intrusion of moisture and chlorides to the level of the reinforcing steel as well. Since moisture is a required component of the corrosion process, a deck coating can significantly increase the time-to-corrosion in these circumstances, and would forestall another costly and disruptive slab rehabilitation program. See Appendix C for additional discussion on chloride testing.

S.I.2. Slab-On-Grade Sealer/Corrosion Inhibitor: Similar to the discussion above, it is recommended that protective measures be taken to mitigate the corrosion-related deterioration of the slabs-on-grade on the lower level. These slabs have significant reinforcing steel near the top surface and are prone to the same deterioration mechanism of the supported slabs.

S.I.3. Slab-On-Grade Crack Repair: Where through-slab cracks exist and are leaking, we recommend repair by injection of urethane grout to seal off the intrusion of moisture.

S.I.4. Truck Ramp Wall Crack Waterproofing: Leaking cracks in the truck ramp walls should be repaired by urethane grout injection. Once the intrusion of moisture is halted, spalled/delaminated surfaces can be repaired with the expectation that they should not reoccur.

S.I.5. Entry/Exit Ramp Topping Slab Replacement & Waterproofing: The entry/exit ramps consist of a topping slab over a structural slab. The original drawings indicate a waterproof coating was to be applied to the surface of the topping slab. Any waterproofing that existed on the slab surface has since been worn away, leaving the system vulnerable to moisture intrusion; in fact we observed leaks emanating from cracks on the underneath side of the ramps. Additionally, the embedded snow melt system is no longer operational. The recommended long term
repair of these ramps is to replace the topping slabs with new topping slabs, including a new waterproof membrane between the structural and topping slabs and provide a new glycol snow melt system embedded within the topping.

Estimated Costs

A cost estimate for implementation of the General Repair and Recommended Improvement Structural items is listed in Appendix A.

Limitations

It has been found that reinforced concrete that becomes contaminated by chloride experiences progressive corrosion induced deterioration. It must be recognized that, in our opinion, it is not economically feasible to remove the salt that has accumulated in the concrete. Restoration and protection of the structure can be performed and the rate of further deterioration reduced. However, we cannot guarantee that further deterioration will not take place with continued service-related exposure.

Effective ongoing maintenance can significantly reduce long-term maintenance costs. Monitoring of the facility can assist in scheduling future maintenance.

Specific repair procedures are not part of this evaluation. This report defines items in need of repair and presents conceptual procedures. Construction Documents are required to address all aspects of materials selection and methods for repair of the parking structure. Repair cost projections are based on deterioration quantities identified during our review. Quantities and costs are not intended to define a guaranteed maximum cost, and variations in final quantities should be anticipated.

The evaluation and restoration of existing buildings require that certain assumptions be made regarding existing conditions. Since some of these assumptions may not be confirmed without expending additional sums of money and/or destroying otherwise adequate or serviceable portions of the building, Carl Walker, Inc. cannot be helped responsible for latent deficiencies which may exist in the structure, but which have not been discovered within the scope of this evaluation.
IV. BUILDING SYSTEMS

Electrical Systems Summary

Power
The garage is fed by a dual 13kV service from PECO through two fused service entrance switches with a self contained metering compartment. The equipment appears to date from the early 1960’s when the garage was built. The service entrance equipment is located one level below the entrance level. All controls are manual and there is no ability for automatic switching of lines in the event of an outage.

There are two 13kv to 480 volt substations feeding the garage. The original 500kVA substation is located at the entrance level at the curve of the entrance ramp. This substation is fed by only one line. The substation consists of a 500kVA transformer with the 800main 480V distribution panel (by Penn Panel) built into the side of the unit. Most of the original load has been removed from the MDP. The transformer now feeds only the lighting, emergency loads, including lighting and a few miscellaneous loads. This substation has a 60kvar capacitor for power factor correction.

A new 750kVA 13kv to 480 volt substation is located one level below the original substation adjacent to the 13kV entrance switches. The substation includes two MCCs that feed the new exhaust and supply air fans. The MCC that feeds the supply fans is fed through the transfer switch that receives its emergency feed from the 150 amp enclosed breaker mentioned above. The substation was installed in 2004. There are 2 separate 13kV entrance switches feeding the single transformer.

Located on the levels near the core are light and power panels. The Square D panels date from 1992. These panels feed the regular lighting load. On levels 2 and 3 there is a 480/208/120 transformer with a panel that feeds the receptacle loads and miscellaneous 120V loads. It was noted that there a number of wall and ceiling mounted receptacles throughout the facility. All of the receptacles are standard non-GFI type.

Located outside the manager’s office across from the booth where payment is made are the emergency lighting and power panels. The panels are original, dating back to 1964.

Emergency Power
A 125kVA generator is located in the room with the 500kVA transformer. The generator is 42 years old. (Note: The company that provides service on the generator has in their records that the generator was manufactured in 1999. This is incorrect) According to the generator service company the batteries for the generator were replaced in 2004. The main fuel tank was over ¾ full at the time of the survey. The generator is connected to the emergency power system through a new transfer switch. The transfer switch feeds the original 225 amp Penn Panel emergency panel thru a 200 amp disconnect that powers the emergency loads in the building. Additionally a new 150 amp enclosed breaker is tapped off of the transfer switch to feed a transfer switch in the new substation.
Lighting
The lighting at the entrance level and one half of the next level down consists of vandal resistant fluorescent lights. The majority are new T-8 energy efficient fixtures. A few of the fluorescent fixtures on the entrance level are still the older T-12 fixtures and are in fair to poor condition. The other levels of the parking garage are illuminated by HPS (high pressure sodium) fixtures which provide excellent even lighting throughout the garage. The stairwells are lit with new T-8 energy efficient fixtures vandal resistant fluorescent fixtures that provided excellent lighting in all of the stairwells.

Luminance Levels

<table>
<thead>
<tr>
<th>Location</th>
<th>Existing (fc)</th>
<th>Recommended by Lighting Handbook (fc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First and second level areas with fluorescent</td>
<td>Low 1.7, High 8.2 (30 directly under fixture)</td>
<td>Low 0.5, High 1.0, Maximum recommended ratio 10:1</td>
</tr>
<tr>
<td>Other levels with High Pressure Sodium fixtures</td>
<td>Low 1.2, High 2.2 (22 to 26 directly under fixture)</td>
<td>Low 0.5, High 1.0, Maximum recommended ratio 10:1</td>
</tr>
<tr>
<td>Stairways</td>
<td>Landings 39-46, Halfway 20</td>
<td>Average of 2.0</td>
</tr>
</tbody>
</table>

Light readings taken at center of driveway and parking spaces except as noted.

Emergency Lighting
The emergency lighting on the levels with HPS lights are easily identifiable by their trapezoidal shape compared to the cylindrical shape of the standard lights. The HPS lights on the emergency system have a quartz re-strike. They are also a few inches deeper than the standard lights and therefore hang a few inches lower. On the levels lit with fluorescent lighting, it was not possible to determine which lights were on the emergency circuits as there are no identifiable markings. The survey revealed that there were an adequate number of new LED type exit signs that were easily viewable from everywhere in the lot and were appropriately located to point toward the exit stairs.

Fire Alarm System.
The new EST system control is located in the manager’s office with 6 booster power supplies located one level below in the sprinkler room. There are pull stations at each exit with an adequate number of horn/strobes located throughout the garage and in the equipment rooms. The average distance between horn/strobe units appeared to be approximately 60 feet. It was noted that there were heat detectors in each of the two main electrical rooms. The facility is fully equipped with sprinklers, except for the main electrical room.

Elevators
The elevators have been out of service for many years. There is no equipment that is reusable in those rooms. It was noted that a new 1” EMT conduit was run from a central source to each of the rooms. The conduit is empty.
Electrical Systems Recommendations

All recommendations for addressing the Electrical Systems have been broken down into two categories: General Repairs (E.R.#.), and Recommended Improvements (E.I.#). Similar to previous sections of this report, General Repairs should be completed to ensure the garage remains in service, and there are no safety concerns to garage users.

General Repairs

E.R.1. The emergency HPS lights hang a few inches lower than the standard lights. During the survey it was noticed that four of them were damaged, apparently from being struck by racks on the top of tall vehicles. This is a major concern since damage to one of these fixtures could knock out an emergency circuit. It is recommended that either these fixtures be replaced with ones that match the height of the non-emergency fixtures or that the barrier at the entrance be lowered to prevent tall vehicles that will strike these fixtures from entering the facility.

E.R.2. The generator does not have a main breaker. The original 200 amp fused disconnect (fuse size unknown) that is connected to the transfer switch in addition to the new 150 enclosed breaker that was also tapped off of the transfer switch do not provide protection from overload. This size generator should be protected by a 200amp fuse or breaker, not a total of 350amps. This leaves the possibility for generator overload. It is recommended that the loading on the generator be checked to assure that it will operate properly in an emergency. In addition, it is recommended that a breaker be installed at the generator to protect it from potential overloads since the addition of the 150 amp breaker makes overloading a real possibility.

E.R.3. It is recommended that the accessible restroom receptacles be changed to GFI or that a cover be placed over them as a safety issue.

Recommended Improvements

E.I.1. Most of the lighting in the facility is in excellent condition. As noted in the survey there are a few very old T-12 fluorescent fixtures on the upper level. Since the vast majority of the fixtures were recently replaced, it is unclear as to why these fixtures were not replaced. Since they are in fair to poor condition, replacement should be considered.
Other Considerations

The generator is 42 years old and has been regularly maintained for the past six years by Emergency Systems Inc. The generator is near the end of its useful life. It is recommended that the maintenance records be examined to determine if replacement should be considered to assure reliability of the emergency system.

All of the lighting panels were replaced in 1992. The emergency panels which are the most critical are original dating back to 1964. Some of them were tested in 2003. This is a life safety issue. It is recommended that all of the emergency panels be tested as soon as possible to assure reliability of the life safety systems.

The exit signs were prominently placed and provide adequate coverage for the facility. No changes are recommended other than removing the exit signs on Levels 2 and 3 at Stair No. 2 (See Section II Architectural/Code Compliance)

The fire alarm system is new. The devices are located per the current code and no changes are recommended at this time.

The original 500kVA substation transformer is lightly loaded since the fan loads were removed and placed on the new 750kVA substation. It is recommended that an infrared scan be performed. Because the loading on this transformer has been reduced, its life expectancy should increase.

The 13kV entrance equipment is old but in good condition. It is recommended that an infrared scan and test be performed. Since this equipment requires manual operation of the switches to switch the lines, the operator of the garage should have qualified individuals available for an emergency and a detailed set of switching instructions should be prominently posted in the room with the equipment. In addition, the door to the room should be repaired as it is very difficult to open.
13KV SERVICE ENTRANCE EQUIPMENT

LIGHT & POWER PANELS - LEVEL 2

MAIN DISTRIBUTION PANEL MOUNTED ON THE SIDE OF 500 KVA TRANSFORMER

NEW MCC'S FOR FANS
NEW GENERATOR TRANSFER SWITCH WITH 200 AMP DISCONNECT AND 150 AMP ENCLOSED BREAKER

TYPICAL FIRE ALARM EQUIPMENT AND EXIT SIGN

125 KVA EMERGENCY GENERATOR

DAMAGED EMERGENCY FIXTURE
HVAC Systems Summary

The parking garage is an underground enclosed parking facility with four levels below ground and similar to rectangular in shape – totaling 336,700 square feet area with gross parking area approximate 321,600 square feet.

The ventilation system consists of four exhaust fan systems located near the four corners of the facility. Each corner has one exhaust shaft connecting all four levels and an exhaust fan is located in the duct shaft (picture 1). A concrete chase was built along the perimeter of the garage to form a four zoned exhaust passage. Exhaust grilles are located at the concrete walls to allow the exhaust air to flow from space to the chase (picture 2). The exhaust fans will pull air from chase to the shaft and then push it out through a separate exhaust duct running up to the street level.

Outside air for upper two levels is coming from ramp area (picture 3). Two supply air fan systems located at the center of the facility is supplying outside air to the lower two levels through air duct chases (picture 4).

The original ventilation system was built in 1963. The ventilation system is all located within the facility and is an independent system.

Present Ventilation System

A. Garage Exhaust Fan System:
A renovation project was performed in 2004 to replace all exhaust fans and supply air fans. Capacity of the newly renovated exhaust fans total 435,200 CFM. Supply fan for the east supply chase is 93,460 CFM and west supply chase is also 93,460 CFM. The outside air is not heated.

All present exhaust fans, supply air fans, motorized dampers and fire dampers are in excellent condition (picture 5).

Existing Equipment (All using 480V/3Ph/60HZ Electricity):

<table>
<thead>
<tr>
<th>Exhaust Fan</th>
<th>Service</th>
<th>CFM</th>
<th>S.P. (WG)</th>
<th>HP</th>
</tr>
</thead>
<tbody>
<tr>
<td>EF-1</td>
<td>N.W Garage</td>
<td>105,625</td>
<td>2”</td>
<td>100</td>
</tr>
<tr>
<td>EF-2</td>
<td>N.E. Garage</td>
<td>69,750</td>
<td>3”</td>
<td>75</td>
</tr>
<tr>
<td>EF-3</td>
<td>N.E. Garage</td>
<td>69,750</td>
<td>3”</td>
<td>75</td>
</tr>
<tr>
<td>EF-4</td>
<td>S.E. Garage</td>
<td>109,035</td>
<td>2”</td>
<td>100</td>
</tr>
<tr>
<td>EF-5</td>
<td>S.W. Garage</td>
<td>81,040</td>
<td>2.5&quot;</td>
<td>75</td>
</tr>
</tbody>
</table>
### Exhaust Fan Service

<table>
<thead>
<tr>
<th>Supply Fan</th>
<th>Service</th>
<th>CFM</th>
<th>S.P. (WG)</th>
<th>HP</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA-1A</td>
<td>3rd, 4th Level, West</td>
<td>46,730</td>
<td>1.5”</td>
<td>25</td>
</tr>
<tr>
<td>SA-1B</td>
<td>3rd, 4th Level, West</td>
<td>46,730</td>
<td>1.5”</td>
<td>25</td>
</tr>
<tr>
<td>SA-2A</td>
<td>3rd, 4th Level, East</td>
<td>46,730</td>
<td>1.5”</td>
<td>25</td>
</tr>
<tr>
<td>SA-2B</td>
<td>3rd, 4th Level, East</td>
<td>46,730</td>
<td>1.5”</td>
<td>25</td>
</tr>
</tbody>
</table>

Exhaust air per level is:

<table>
<thead>
<tr>
<th>Level</th>
<th>Floor Area (Sq. Ft.)</th>
<th>CFM</th>
<th>CFM/Sq. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>102,900</td>
<td>124,645</td>
<td>1.21</td>
</tr>
<tr>
<td>2</td>
<td>86,800</td>
<td>117,885</td>
<td>1.36</td>
</tr>
<tr>
<td>3</td>
<td>86,800</td>
<td>128,700</td>
<td>1.48</td>
</tr>
<tr>
<td>4</td>
<td>45,100</td>
<td>63,970</td>
<td>1.42</td>
</tr>
<tr>
<td>Total</td>
<td>321,600</td>
<td>435,200</td>
<td>1.35</td>
</tr>
</tbody>
</table>

**B. Carbon Monoxide Monitoring System:**

A new carbon monoxide monitoring system was also installed in all four levels of the facility in 2004 (picture 6, 7). Together with the new digital control system and damper system in the duct chase, the control system is able to adjust the exhaust air amount in accordance to the CO concentration in the parking space. The area is divided to different zones so that it is able to reduce the exhaust air amount in low CO concentration zone and increase the exhaust air amount in the higher CO concentration zone.

Alarm set points are: High level CO alarm 200 ppm; Low level CO alarm 100 ppm.

**C. Cashier Booth and Office Space Ventilation and Air Conditioning:**

A new supply air fan (150 CFM) and ductwork was installed in 2004 to supply outside air to two cashier booths and the office. There is an electric duct heater in the outside air duct to heat the outside air in the winter. The outside air is used to pressurize the two booths and office space.

One existing window type air conditioning unit is at the short term ticket booth for air conditioning (picture 8). The monthly ticket booth has no air conditioner (picture 9). Window type air unit is also used for the office space (picture 10). There is not enough cooling for the office space due to small size air conditioner. Heating for cashier booths and office is by electric heaters (picture 11).

**D. Rest Room Exhaust:**

A new toilet exhaust fan (700 CFM) was installed in 2004 for the Men and Women Rest Room near the entrance ramp. New ductwork was also installed to exhaust air from the locker room. The exhaust system is adequate.
E. Stairwell:
There are four staircases in the facility. The staircase near the entrance ramp is connected to the bathroom exhaust system. The other three staircases have transfer grilles (24”x18”) installed at each level (picture 12). One louver is installed at the street level (picture 13).

Code Compliance:

A. Ventilation: For enclosed parking facilities, ANSI/ASHRAE Standard 62-1989 specifies a fixed ventilation rate of 1.5 cfm per square foot of gross floor area. However, some model code authorities allow the ventilation rate to vary and be reduced to save energy if carbon monoxide (CO) demand controlled ventilation is performed. The acceptable level of contaminant concentrations varies significantly from code to code. Unfortunately, Standard 62 does not address the issue of ventilation control through contaminant monitoring for an enclosed garage.

Presently, the exhaust flow rate is 435,200 cfm/321,600 sf = 1.35 cfm/sf.

A floor to floor analysis of the exhaust amount reveals that the lower third and fourth level have better exhaust rate than the upper two levels.

B. Carbon Monoxide Detection System:

Since the motor emission rates for CO are typically higher than those for NOx (nitrogen oxides) and VOCs (volatile organic compounds). Therefore, it is generally accepted that if CO level is maintained within an acceptable range, all other pollutants are also within safe level.

The ASHRAE standard limits the CO exposure level to 35 ppm for one hour and to 9 ppm for eight hours.

The International Conference of Building Officials (ICBO) states that automatic carbon monoxide (CO) sensing devices may be employed to modulate the ventilation system to maintain a maximum average concentration of CO of 50 ppm during any eight-hour period, with a maximum concentration not greater than 200 ppm for a period not exceeding one hour. Connecting offices, waiting rooms, ticket booths, and similar uses shall be supplied with conditioned air under positive pressure.

(The above CO limits are referenced from article: Overview of existing regulations for ventilation requirements of enclosed vehicular parking facilities by Krarti.; Ayari, A.M. published in 1999, July 01.)

The facility CO alarm is set at 200 ppm (high level alarm) and 100 ppm (low level alarm), so the setting is in line with the U.S. and International Standard and Code.

In conclusion: The facility is ventilated at 1.35 CFM/sq. ft. exhaust rate. The new ANSI/ASHRAE Standard 62.1-2004 only requires 0.75 CFM/sq. ft. exhaust air for the parking garage. The
ventilation rate is higher than the Standard requirement so meets the Code requirement. Since the Carbon Monoxide monitoring system is presently installed in the facility, this also help to maintain the acceptable level of contaminant concentrations in space.

**Deficiencies:**

A. Presently, the emergency power supply is not connected to the exhaust fans. In case of lost power, there will be exhaust gas built-up in the space. Since the power consumption of the exhaust fans are very high, it is recommended to have at least two exhaust fans be connected to the emergency power. The exhaust fan EF-1 and EF-2 will exhaust air from both ends of the space and will draw 175,375 exhaust air at the rate of about 0.55 CFM/square foot. Motor horse power for the two fans total, 175 HP.

B. The original hot water snow melting system for the entrance and exit ramp is no longer in operation. Snow and ice removal is now by plow truck or manual operation. If structural repairs are completed to the ramp, a new snow melt system can be incorporated.

C. The wall mounted heating radiator in the emergency generator room located on first level near entrance and exit ramp is in bad shape and may not be operable (picture 14). Heating is required for this room in the winter. Therefore, a new electrical unit heater with 5KW heating capacity is recommended to be installed in this room. The ventilation fan for this room was renewed in 2004 and in good condition. The supply fan for the generator room is rated at 4000 CFM with a 1.5 HP motor (picture 15).

D. There is a deficiency of ventilation arrangement in the electrical room located in the second level. A new supply air fan (7110 CFM) was installed in 2004 to blow air to the new electrical room for ventilation and controlled by room thermostat (picture 16). However, there is no exhaust opening in this room. The room is over pressurized and air flow is poor. This room is connected to the old electrical room which has opening to outside. It is recommended to cut a new opening at the wall between these two rooms to allow air to flow from new electrical room to the old electrical room and improve the air flow path and ventilation efficiency. A fire damper is required in the opening and transfer grille could be installed in front of the fire damper.

E. The cold supply air from two large supply fans to the lower two levels has created some freezing problem for the nearby sprinkle lines in the winter. The problem is only affecting the un-drained sprinkle line section across from the supply air shaft. The drain section of the piping shall be drained thoroughly and pipe insulation could be installed at the pipe section.

F. The monthly ticket booth has no air conditioner. A new window type heat pump unit shall be provided for the booth immediately. There is an indication that condensate water from air conditioner in the short term ticket booth is dripping into inside of the booth. Corrective action is required to let the condensate water drip outside the booth. There is not enough cooling for the office space due to small capacity unit.
G. Staircase ventilation by transfer grilles only is not effective.

Recommendations:

*General Repairs*

V.R.1. Provide Emergency power to exhaust fans EF-1 and EF-2.

V.R.2. Install a 5 KW electrical unit heater in the generator room.

V.R.3. Provide a new wall opening (30” x 30”) and install a grille and fire damper in the new electrical room.

V.R.4. Insulation on piping

V.R.5. A one ton window type heat pump unit is recommended for the long term ticket booth. The unit will provide both heating and cooling. A two ton split system heat pump unit is recommended for the office space. The unit could also provide heating and cooling.

V.R.6. The transfer grilles for the three staircases are not very effective. It would be recommended to install a supply fan for each of the four staircases. Air will be drawn from street level and blow down to all four levels. The fan will be located near the street level and inside the triangular shape duct chase.

*Recommended Improvements*

V.I.1. Install a new snow melt system in Arch Street Entrance/Exit ramp topping slab.
PICTURE 1 – DUCT SHAFT AT CORNER OF GARAGE

PICTURE 2 - EXHAUST GRILLE AT DUCT CHASE WALL

PICTURE 3 – AIR INTAKE LOUVERS

PICTURE 4 – SUPPLY AIR GRILLES AT SUPPLY CHASE
PICTURE 5 – EXHAUST FANS

PICTURE 6 - CO MONITORING PANEL

PICTURE 7 - CO MONITOR

PICTURE 8- BOOTH AIR-CONDITIONER

PICTURE 9 – MONTHLY TICKET BOOTH

PICTURE 10 - AIR CONDITIONER FOR OFFICE
PICTURE 11- UNIT HEATER IN OFFICE

PICTURE 12 - STAIRWAY TRANSFER GRILLE

PICTURE 13- STAIRWAY INTAKE LOUVER

PICTURE 14- HEATER IN GENERATOR ROOM

PICTURE 15 – SUPPLY FAN IN GENERATOR ROOM

PICTURE 16 - ELECTRICAL ROOM SUPPLY
Plumbing and Fire Protection Systems Summary

**Fire Protection:**
A. The garage is a completely sprinkled area with an independent 10” fire main service entering on the north wall approximately in center to a sprinkler room that consists of a detector check valve and two (2) dry pipe alarm valves manifold into 3 zones with an air compressor supplying each of the 6 valves with distribution throughout the different garage levels with a dry sprinkler system. See photos 1, 2, 3 & 4.

B. Some parts of the system have been replaced and some of the piping is showing the age of its years in service. The system should continue to be maintained and tested per city Fire Prevention Code requirements and NFPA 13 standards.

**Plumbing:**
1. There are men and women toilet rooms on the first level adjacent north wall and 16th street entrance ramp. The toilet rooms and fixtures look to be well maintained. The janitor space behind the locker room has a janitor service sink with the water handles missing and the trap seal has dried out and sewer gases are entering the room. This room also has an electric hot water heater for water to the lavatories. See photos 5, 6, 7 & 8.

2. The general floor areas have floor drains and rainwater conductors to 3rd and 4th levels where there are sump pumps that take this drainage on discharge into the city sewer system.

3. The cleanout caps are missing from some of the rainwater conductors and the piping is blocked with sediment thus is not allowing the discharge of the water to various sumps that will discharged it to combination city sewers. Instead, the water is discharged onto the floor and creating pockets of stagnate water which is a health hazard as well as potential slipping conditions. See photos 9 thru 16.
4. The domestic water enters adjacent to the 10” fire service and is distributed to plumbing fixtures and various hose bib locations.

Recommendations

General Repairs

P.R.1. The immediate attention should be focused on the under slab drainage piping and system blockages. A plumbing contractor should be hired to rod out the existing rainwater conductor below level 3 and 4. Any standing water needs to be vacuumed for disposal and cleanout plugs inserted to the rainwater conductor base.

P.R.2. The plumbing fixtures are not in compliance with ADA for public or private fixtures. The toilet rooms and fixtures shall be renovated and updated in order to meet the governing code standards.

Recommended Improvements

P.I.1. Signs of corrosion and deterioration are showing in some areas of the sprinkler system. The system should be investigated to determine the soundness of the piping systems.
PHOTO 1 SECOND LEVEL SPRINKLER ROOM

PHOTO 2 DETECTOR CHECK VALVE
PHOTO 3 DRY ALARM VALVES

PHOTO 4 NEW COMPRESSOR FOR ALARM VALVES
PHOTO 5 WOMEN'S TOILET ROOM

PHOTO 6 WOMEN'S TOILET ROOM LAVATORY
NO ADA FIXTURES

PHOTO 7 MEN'S TOILET ROOM - NO ADA FIXTURES
PHOTO 8 HOT WATER HEATER & SERVICE SINK
(WITHOUT WATER TRAP SEAL)

PHOTO 9 (3RD LEVEL) COL 11&K –
RAINWATER CONDUCTOR WITH MISSING PLUG & STANDING WATER
PHOTO 10 LEVEL 3 COL 11&K DUPLEX SUMP PUMP

PHOTO 11 RAIN WATER CONDUCTOR AT STAIR NO 2 (LEVEL 4) MISSING CLEAN OUT PLUG

PHOTO 12 SUMP PIT & PUMP LEVEL 4
PHOTO 13 SUMP PIT & PUMP

PHOTO 14 LEVEL 4 SUMP PIT & PUMP COLUMN 14

PHOTO 15 LEVEL 4 16TH STREET & JFK COLUMN 4 &H
Estimated Costs

A cost estimate for implementation of the General Repair and Recommended Improvement items for Building Systems is listed in Appendix A.
V. ENVIRONMENTAL ASSESSMENT

Brinkerhoff Environmental Services, Inc. (Brinkerhoff) performed a Phase I Environmental Site Assessment (ESA) and Environmental Hazardous Materials Survey of the JFK Plaza Garage Facility. The assessment was accomplished by performing an on-site inspection, reviewing historical use, and conducting a review of available government files pertaining to the development of the property. The Phase I ESA is conducted in accordance with professional standards set forth in American Society for Testing and Materials (ASTM) published Standard Practices for Phase I Environmental Site Assessments (ASTM E-1527-05), and has been modified to include an Environmental Hazardous Materials Survey including a Visual Asbestos-Containing Material (ACM) Survey, Visual Microbial Matter Survey, and Lead-Based Paint Survey of the subject property. The full Phase I ESA is included as a separate volume to this report.

The following is a summary of potential environmental concerns identified:

Potential Impacts from Surrounding Properties
According to information provided in the EDR data package, there are known contaminated waste sites situated within a one (1)-mile radius of the subject property. The potential exists for neighboring contaminated sites to impact the subject property; however, evidence suggesting that neighboring properties have impacted the subject property (i.e. monitoring wells on the subject site) was not identified.

Generator and Sprinkler Rooms
At the time of the site visit, staining was noted in the area of the 275-gallon AST and on the floor in the northeast corner of the generator room. Staining was identified in the storage/old heater room beneath a water holding tank and pump. Staining was also noted on the underlying concrete beneath two (2) air compressors and four (4) 1-quart bottles of compressor oil, with what appeared to be hardened roofing tar on the concrete beneath the sprinkler system in the sprinkler room. The integrity of the underlying concrete appeared sound in these areas. Additionally, these areas are underlain by the Second Level of the parking garage rather than soil. As a result, further investigation into these areas of staining is not recommended.

Elevators
At the time of the site visit, approximately six (6) 1-gallon and four (4) 2-gallon containers of hydraulic oil were noted in the elevator service room adjacent to the western stairwell. Staining was identified in the corner of the room, around the hydraulic oil containers, and beneath the pump reservoir. It is recommended that the hydraulic oil be removed and properly disposed, and soil borings be performed in the stained area in order to assess the subsurface conditions. Sampling and testing may be warranted based on the conditions encountered in the borings.

Two (2) elevators are located at the site. Both elevators have been out of service since approximately 1988. It is recommended that soil borings be performed in each of the elevator pits in order to assess the subsurface conditions in these areas. Prior to the performance of these borings, the elevator cars
must be either raised and supported, or removed in order to access the elevator pit. Sampling and testing may be warranted based on the conditions encountered in the borings.

**Old Transformer Room**
At the time of the site visit, a disconnected transformer was observed in the old transformer room. This transformer is no longer in use, and has been replaced with a new system in the new transformer room. Electrical starter boxes are located outside the sump room on the Fourth Level and outside the ventilation rooms containing fans on the Second and Third Levels. Evidence of spillage/staining was not noted in these areas. If the transformer and electrical starter boxes are to be removed during future renovations, it is recommended that the units and any internal liquids be properly disposed. Documentation regarding whether the transformer and/or electrical starter boxes contain polychlorinated biphenyls (PCBs), a dielectric fluid, was not provided at the time of the site visit. Sampling of internal liquids may be required in order to confirm the proper disposal method. Fees associated with the sampling/testing and removal/disposal of the transformer can be provided if deemed necessary.

**Visual Asbestos Survey**
A Visual Asbestos Survey was conducted in the accessible areas of the subject property on June 14, 2006 to investigate the presence of potential Asbestos Containing Materials (ACMs). Representative samples were collected from suspect materials in all accessible areas and laboratory analyzed. According to laboratory analytical results, asbestos was detected above AHERA guidelines in the pipe insulation located on the former steam pipes above the First Level of the garage, and in the peach nine (9) inch square floor tile located in the manager's office. Vibration collars were noted in the two (2) supply fan rooms on the First Level of the garage. Due to safety concerns, samples could not be collected from these collars. Historically, vibration collars have been manufactured from ACMs, and the potential exists that the vibration collars on-site may contain asbestos above AHERA guidelines. It is recommended that nonfriable abatement specifications be prepared for the floor tile, and friable asbestos abatement specifications be prepared for the pipe insulation. All abatement activities should be conducted by a state-licensed Asbestos Abatement Contractor and monitored by a third-party Asbestos Monitor in accordance with applicable regulations.

**Visual Microbial Matter Survey**
A Visual Microbial Matter Survey of the accessible areas of the subject property was conducted on June 29, 2006 to investigate the presence of potential microbial matter. Moisture and potential microbial growth was identified in the following areas: throughout all four (4) stairwells, in localized areas along the perimeter walls and floors, on the ceiling near the cashier's booths, and near the door to the subway access tunnel. Areas of potential microbial growth on the fourth floor include: an area around a number of small holes and nearby sump room, on a pipe protruding from the wall in the southern portion of the garage, and near the sump pump in the northwest corner of the garage. At the time of the site visit, access was not granted to any of the locked storage, maintenance, or ventilation areas, however, Brinkerhoff was able to observe potential microbial growth on the walls and on the materials in these areas through ventilation openings. Further sampling is recommended in the areas of suspected microbial growth to delineate the extent of microbial impacts on the garage. It is further recommended...
that the source of the water infiltration be identified and repaired prior to the performance of any microbial remediation, as microbial growth is linked with elevated moisture conditions at the site.

**Lead-based Paint Survey**
A Lead-based Paint Survey of the accessible areas of the subject property was conducted on June 29, 2006 to investigate the presence of potential lead-based paint. A LPA-1 XRF Spectrum Analyzer was utilized to determine the presence and location of lead-containing building components. The survey revealed that lead-based paint is present in the interior of the JFK Plaza Garage on all levels. Concentrations of lead above the EPA/HUD Interim Guidelines were found primarily in the orange and the yellow paints throughout the structure. Areas of lead-based paint were not found in JFK Plaza. Brinkerhoff recommends interim management or lead abatement for the locations where lead-based paint was detected in order to reduce or eliminate lead exposure hazards. All abatement activities should be conducted by a state-licensed Lead Abatement Contractor and monitored by a third-party Lead Abatement Monitor in accordance with applicable regulations. Actual costs depend on the total square footage of surfaces impacted by lead-based paint. During future renovations of the garage, it is recommended that all contractors be advised of the locations of detected lead-based paint prior to the commencement of work. Furthermore, the information in this report must be disclosed to future buyers and/or tenants in accordance with the Lead Disclosure Rule (Code of Federal Regulations Part 35, Subpart A [HUD’s Rule] and Part 745 Subpart F [EPA’s Rule]).

**Recommendations**
Recommendations for addressing environmental concerns noted above have been divided into two categories: General Repairs (EV.R.###) and Recommended Improvements (EV.I.###). General Repairs represent items that present immediate concern and should be addressed in the near future. Recommended improvements are items that could be implemented in future garage renovation projects, or if areas of concern will be disturbed.

**General Repairs**

**EV.R.1** The conditions noted in the western elevator service room and elevator pits is an immediate concern (General Repairs). The extent of potential impacts to the site and/or surrounding properties is currently unknown, and should be investigated through the performance of soil borings. Based on these findings, further investigation or remediation may be deemed necessary. As noted, appropriate steps must be taken prior to any investigative action to gain access to the elevator pits.

**EV.R.2:** Depending on the type and strain of microbial matter located in the facility, health hazards may exist. Further sampling to assess the extent and types of microbial matter is an immediate concern (General Repairs). Based on these findings, further delineation or remediation may be deemed necessary. As noted, any remediation following sampling should not take place until moisture and water infiltration problems at the site are resolved.
Recommended Improvements

EV.I.1, EV.I.2: Unless the confirmed Asbestos Containing Materials and Lead-based Paint located at the site are disturbed by future renovation or maintenance, abatement of these hazardous materials is not considered an immediate concern based on current conditions. Abatement of these hazardous materials is considered Recommended Improvements for the facility until the time at which these materials are or may be disturbed.

EV.I.3: Unless the disconnected transformer located in the Old Transformer Room is decommissioned, or staining or leakage is discovered originating from the transformer, sampling and/or disposal of internal liquids is not considered an immediate concern (Recommended Improvements).

Estimated Costs

The expected costs for hazardous materials remediation are listed in Appendix A.
VI. GARAGE OPERATIONAL ASSESSMENT

Garage Review and Parameters

The JFK Plaza “Love Park” Garage Facility is currently striped to hold approximately 810 cars, although parking counts reveal that 840 to 850 cars are actually parked in the facility. The layout of this garage is a single thread helix system using opposing ramps for vehicular access between the four garage levels. Parkers utilizing the JFK Plaza Garage facility, are made up of both monthly (prepay) and Daily (Transient) users.

Vehicle access to this facility is provided from Arch and Cherry Streets. Access from Arch Street is direct to the First Level. The Cherry Street entrance leads parkers down to the third level and works in conjunction with the loading dock for the adjacent Municipal Services Building. Both entrance/exit locations provide a total of two inbound traffic lanes and three outbound pay lanes in the facility.

Traffic flow throughout the JFK Plaza Garage is typically one way due to the traffic control equipment locations and the layout of the ramping between levels. Parking stalls are typically at 90 degrees to drive aisles with some stalls parallel along ramp walls. The stalls along ramp walls create a tight drive aisle at the turn bays but assists in directing traffic. It is unlikely that additional parking could be gained by changing the parking and equipment layout or direction of traffic.

Although (14) ADA Handicap parking spaces are currently provided in the parking structure, the present garage does meet ADA guidelines. The current ADA parking spaces are located along the first level ramp. As noted in the Architectural/Code Compliance review, this is not acceptable and will require relocation and re-striping. In addition to re-striping/relocating the handicap parking spots, an elevator would also be required to provide pedestrian access for ADA patrons.

Due to garage clearance being posted at 6’-0”, parking for ADA vans or tall vehicles can not be accommodated. Signage announcing this deficit should be located prior to ascending the ramp to prevent backing out. This can be included with signage for General Repair item A.R.1 in the Architectural Code/Compliance Section.

Current Parking Access and Revenue Control (PARC’s) systems for this garage are considered “pay-on-exit” for daily parkers and “prepay” for monthly parkers. The current pay-on-exit system requires having a person stationed at each of the garage exits to collect cash. The prepay access/exit is handled by a proximity card reader at each exit booth (also pay-on-exit booth). From review of leasing information provided by the Philadelphia Parking Authority (PPA), the existing access control equipment is approximately 30 years old with some updates and typical maintenance since.

Parking Access and Revenue Control Recommendation:

If a new headhouse extending to the plaza level will be installed, a new type PARC referred to as pay-on-foot is recommend for transient garage users. Pay-on-foot is a modern system that is being accepted throughout the City. It uses ticket dispensing machines at the vehicular entrances to issue time dated tickets (similar to the existing pay-on-exit system) but directs the transient user to pay at strategically placed vending machine style pay stations. The pay-on-foot machine can accept either credit card or
cash for payment, then provides a validated ticket in order for the exit gate to open. This system can help streamline exiting by placing the time intensive payment process at a remote location. The pay-on-foot systems will change equipment required, Pay stations and ticker verifiers are used instead of cashiers, fee computers and booths. If desired, a credit card reader can also be installed at the exit gates, but this is less desirable since it can slow up vehicles exiting the facility and assumes everyone has a valid credit card available.

A pay on foot system has to be identified by the parker at the entrance, usually by audio message. Signage throughout the parking facility should reinforce this, and pay stations should be located so patrons can easily find them. The Quantity of pay stations is dependent on the number of users and arrival times. Two pay stations are the minimum recommended, additional communication ports and power can be installed initially if a third station is needed later on. Pay stations should also be located in a secure environment (new head house and at Arch Street garage entry exit).

The types of systems available for monthly parking accounts have increased in the recent years. The technology used for monthly systems can vary from swipe cards and proximity cards (similar to the current system) to radio frequency devices such as Automatic Vehicular Identification System (AVI). Do to the low headroom and configuration of the garage we do not recommend investigating the use of an AVI. A proximity card system similar to what is currently in service should be for monthly parkers.

If a new head house were to be provided at the Alternate No. 1 Location described in the Architectural/Code Compliance Section of this report, a new PARC/manager office will need to be constructed. This location should be near the main garage exit so quick attention can be provided to problem transactions. The office should be constructed of CMU with ample storefront to offer security and observation of the exiting traffic. The PARC’s computer will be placed in the office with an intercom system and internet communications. CCTV should be installed to help in monitoring the remote areas of the garage, the lower portal (Cherry Street entrance/exit) and pay stations.

Equipment specifications

The pay-on-foot system described above will be integrated with the proximity card reader system used for monthly parker. The inbound lanes will include ticket dispensers with an audio message welcoming patrons to the facility. Activation of the equipment including the welcome message will be by a control loop embedded into the floor. Transient patrons depress a button to receive a time/date stamped ticket, while monthly patrons will access the garage by using a proximity card. Once the transaction is validated by the parking control system, an automated gate will open.

Exiting of the garage by transient patrons is performed by payment of the account at a pay station upon returning to the facility. Insertion of a ticket into the pay station will allow calculation of the parking fee based on the time and data embedded on the ticket. Payment can be completed at the pay station via cash, debit or credit. Once the transaction is completed the ticket is validated and returned to the patron with a grace time noted for use at the exit island. At the actual garage exit, transient patrons can insert the validated ticket into the ticket verifier which in turn signals the exit gate to open. Similar to the action required to enter the garage, Monthly patrons would use a proximity card to activate the gate and exit the garage.
The following describes the anticipated Parking Control Equipment in each lane:

Lane Types:
- Monthly & Transient Entrance Lane (2 lanes)
- Monthly & Transient Exit Lane (3 lanes)

Equipment List Pay on Foot:
- Gate with automatic safety reverse and 10' folding arm (5 total)
- Digital self-tuning vehicle detector saw cut into floor (10 minimum)
- Ticket Dispenser with Intercom (2 total)
- Card Reader with Intercom (5 total)
- Ticket Verifier with Intercom (3 total)
- Pay Stations with Intercom (2 ~ 3 total)
  (5 total)

Office Equipment
- Installer shall provide computer meeting the requirements for properly running the installed Parking Access and Revenue Control System and software. Computer shall have internet capabilities.
- Dual Master Intercom Station.
- If card reader is installed with ticket machines one intercom for both pieces will be sufficient.

Because the existing parking control equipment is still functional, General Repairs (immediate concerns) which need addressed are minimal concerning Operation of the JFK Parking Garage Facility. The Recommended Improvements are intended create a more efficient system for auditing, collecting revenue. Wayfinding signage is also included in Recommended Improvements to clearly direct garage patrons to landmarks and destination points around the facility.

**General Repairs**

O.R.1 Revise existing ADA handicap parking locations to level areas within the parking facility. If the garage will be upgraded with an elevator, a total of 15 handicap parking spaces should be provided within the garage.

O.R.2 Provide signage at entrance to facility indicating garage is not ADA Van accessible. (2) dedicated spots to accommodate ADA van parking should be located on the street level around the perimeter of the garage.

**Recommended Improvements**

O.I.1 New PARC office: Provide approximately 700 s.f. of office constructed of CMU and storefront with climate control features. Office is to house the PARC’s computer and interface with the internet. Relocation of the operations office is only required if the stair/elevator tower in Alternate 1 is selected.

O.I.2 Pay on Foot Equipment: New revenue and access control equipment as defined above.

**Estimated Costs**

A cost estimate for implementation of the *Recommended Improvement Items* is listed in Appendix A.
VII. MUNICIPAL SERVICES BUILDING/GARAGE INTERFACE

The truck ramp from Cherry Street entering the third level of the garage and the adjacent area, approx 6500 square feet, of truck loading and unloading area for the City Municipal Service Building (MSB) is separated form the garage with an open mesh fence and a gate. A storm drainage trench is located at the bottom of the ramp. The building systems in this area are fed from the garage utilities. In addition to lighting, power and sprinkler the storm trench drain is piped to the garage storm drainage system. The ventilation is an integral part of the garage ventilation system. Exhaust fans at the north east corner provide exhaust air for this area. A total of four exhaust grilles are in this area, two grilles are wall mounted and the other two are ceiling mounted.

The city is interested in separating the loading dock area from the garage by building a partition along the fence line and separating the utilities for each area.

Architectural/Structural
It is acceptable to separate the garage and the MSB Loading Dock areas. The separation must be a 2 hour rated assembly, which would include a masonry wall (floor to Level 2 Ceiling), and a rated overhead garage door. It is also recommended that a standard 36” wide rated door doorway be located along the masonry wall.

Building Systems
The separation of all utilities in this area involves the selective demolition, isolation and capping at the new partition, of all systems and installing new systems for the area. The source for the utilities and location of new equipment shall be further investigated. The following is a list of systems and the associated order of magnitude cost:

- The ventilation system including fans, shaft ways to street level and ductwork, exhaust and supply shall be investigated especially for the equipment location and routing of all the ductwork.
- A new carbon monoxide detection system shall be installed.
- The sprinkler system will require a new main feed, demolition of existing distribution and complete new installation.
- The trench drainage system consists of new sump and pump and piping tie to the existing storm drainage.
- The lighting and power system based on reusing the existing lighting and provide new feed to lighting and power panels for this area.
APPENDIX C: COST ESTIMATE SUMMARY

Cost Estimate Summary

Based on the foregoing recommendations and cost estimates for each discipline the following table provides a summary of the overall probable construction cost. As with each of the constituent costs, the overall cost estimate is conservative. Based on the scale and location of the project, the work may be able to be completed for less than indicated here. All costs are based on year 2006 dollars and do not include soft costs such as lost revenue during construction, bonding.

The General Repair Items address items required for general code compliance, safety of garage customers, and to ensure the garage remains in service for the near future.

Recommended Improvements are items that will bring the Garage facility up to current building code requirements, and help provide a comfortable and efficient parking for garage patrons and employees. These items also include aesthetics, entry/exit form the garage and ADA compliance issues.

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Repair Items</td>
<td></td>
</tr>
<tr>
<td>A Architectural/Code</td>
<td>$30,000.00</td>
</tr>
<tr>
<td>S Structural</td>
<td>$565,000.00</td>
</tr>
<tr>
<td>MEP Building Systems</td>
<td>$275,000.00</td>
</tr>
<tr>
<td>EV. Environmenta</td>
<td>N/A</td>
</tr>
<tr>
<td>O Operationa</td>
<td>N/A</td>
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<tr>
<td>Total General Repairs</td>
<td>$870,000.00</td>
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</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
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</thead>
<tbody>
<tr>
<td>Recommended Improvements</td>
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<td>A Architectural/Code</td>
<td>$3,440,000.00</td>
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<tr>
<td>S Structural</td>
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<tr>
<td>MEP Building Systems</td>
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<tr>
<td>EV. Environmenta</td>
<td>$85,000.00</td>
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<td>O Operationa</td>
<td>$395,000.00</td>
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<td>Total Recommended Improvements</td>
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<table>
<thead>
<tr>
<th>Item</th>
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</thead>
<tbody>
<tr>
<td>MSB/Garage</td>
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</table>

*All items include 15% Contingency and 10% Design/construction Administration costs
Architectural/Code Compliance Estimated Costs

A cost estimate for implementation of the General Repair and Recommended Improvement Architectural items is listed below.

<table>
<thead>
<tr>
<th>Estimated Construction Budget (2006 Dollars)¹</th>
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</thead>
<tbody>
<tr>
<td><strong>General Repair Items (Architectural)</strong></td>
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</tr>
<tr>
<td>A.R.1 Entrance Signage (Wheelchair Accessibility)²</td>
<td>$1,500.00</td>
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<tr>
<td>A.R.2 Park Office Ramp²</td>
<td>$2,000.00</td>
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<tr>
<td>A.R.3 Reconfigure Toilet Rooms³</td>
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<tr>
<td>A.R.4 Stair Landing Guardrail</td>
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<td>A.R.5 Stairway Ramps</td>
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<tr>
<td>A.R.6 Relocate Accessible Parking Spaces</td>
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<tr>
<td>A.R.7 Stair Tower Signage (No. 1 and 3)</td>
<td>$500.00</td>
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<tr>
<td>A.R.8 Stair Tower No. 2 Signage (Removal)²</td>
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<tr>
<td>A.R.9 Stair Tower No. 4 Modifications</td>
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<td><strong>Total General Repair Items</strong></td>
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<table>
<thead>
<tr>
<th><strong>Recommended Improvement Items (Architectural)</strong></th>
<th>Cost</th>
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<tbody>
<tr>
<td>A.I.1 Eliminate Stair Tower No.2</td>
<td>$40,000.00</td>
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<tr>
<td>A.I.2 Replace Stair Tower Nos. 1, 3, &amp; 4⁴</td>
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<tr>
<td>A.I.3 Provide Two New ADA Compliant Elevators⁵</td>
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<tr>
<td>A.I.4 Provide New Headhouse (Alt. No. 1)</td>
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<tr>
<td>A.I.5 Aesthetic Improvements</td>
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<td><strong>Total Recommended Improvement Items</strong></td>
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</tr>
</tbody>
</table>

Notes

1 All items include 15% Contingency and 10% Design/construction administration costs.
2 If recommended improvement items accepted, item may not be required.
3 Included in Building Systems costs, see Section IV.
4 Cost includes replacement of two stairs. If Alt. No. 1 is chosen, stair No. 3 will not be necessary.
5 Cost assumes (2) traction elevator systems, 200 fpm. Includes elevator pit, new machine room and relocation of existing ventilation shaft (Alt. No. 1).
Structural Estimated Cost

A cost estimate for implementation of the General Repair and Recommended Improvement Structural items is listed below.

<table>
<thead>
<tr>
<th>Estimated Construction Budget (2006 Dollars)(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Items</strong></td>
</tr>
<tr>
<td><strong>General Repair Items (Structural)</strong></td>
</tr>
<tr>
<td>S.R.1 Concrete Floor Repairs-Supported Levels</td>
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<tr>
<td>S.R.2 Concrete Ceiling Repairs</td>
</tr>
<tr>
<td>S.R.3 Slab-On-Grade repairs</td>
</tr>
<tr>
<td>S.R.4 Wall Spall Repairs</td>
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<tr>
<td>S.R.5 Truck Ramp Wall Repairs</td>
</tr>
<tr>
<td>S.R.6 Entry/Exit Ramp Concrete Repairs</td>
</tr>
<tr>
<td>S.R.7 Entry/Exit Ramp Curb Repairs</td>
</tr>
<tr>
<td>S.R.8 Supplemental Floor Drains &amp; Piping</td>
</tr>
<tr>
<td><strong>Total General Repair Items</strong></td>
</tr>
<tr>
<td><strong>Recommended Improvement Items (Structural)</strong></td>
</tr>
<tr>
<td>S.I.1 Supported Level Waterproof Membrane</td>
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<tr>
<td>S.I.2 Slab-On-Grade Sealer/Corrosion Inhibitor</td>
</tr>
<tr>
<td>S.I.3 Slab-On-Grade Crack Repair</td>
</tr>
<tr>
<td>S.I.4 Truck Ramp Wall Crack Waterproofing</td>
</tr>
<tr>
<td>S.I.5 Entry/Exit Ramp Topping Slab Rplcmnt &amp; Wtrpfg (^4)</td>
</tr>
<tr>
<td><strong>Total Recommended Improvement Items</strong></td>
</tr>
</tbody>
</table>

**Notes**

1. All items include 15% Contingency and 10% Design/construction administration costs.
2. Supplemental Floor Drain Installation is separate from Building Systems Costs.
3. Waterproofing Membrane will require recoating at 6-10 year intervals. Assume 2.50/’SF for Recoating Costs.
4. Includes new ice melt system embedded in topping slab.
Structural Assessment Limitations

It has been found that reinforced concrete that becomes contaminated by chloride experiences progressive corrosion induced deterioration. It must be recognized that, in our opinion, it is not economically feasible to remove the salt that has accumulated in the concrete. Restoration and protection of the structure can be performed and the rate of further deterioration reduced. However, we cannot guarantee that further deterioration will not take place with continued service-related exposure.

Effective ongoing maintenance can significantly reduce long-term maintenance costs. Monitoring of the facility can assist in scheduling future maintenance.

Specific repair procedures are not part of this evaluation. This report defines items in need of repair and presents conceptual procedures. Construction Documents are required to address all aspects of materials selection and methods for repair of the parking structure. Repair cost projections are based on deterioration quantities identified during our review. Quantities and costs are not intended to define a guaranteed maximum cost, and variations in final quantities should be anticipated.

The evaluation and restoration of existing buildings require that certain assumptions be made regarding existing conditions. Since some of these assumptions may not be confirmed without expending additional sums of money and/or destroying otherwise adequate or serviceable portions of the building, *Cald Walker, Inc.* cannot be held responsible for latent deficiencies which may exist in the structure, but which have not been discovered within the scope of this evaluation.
MEP/Building Systems Estimated Costs

A cost estimate for implementation of the *General Repair* and *Recommended Improvement* items for Building Systems is listed below.

<table>
<thead>
<tr>
<th>Estimated Construction Budget (2006 Dollars)$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Items</strong></td>
</tr>
<tr>
<td><em>General Repair Items (Building Systems)</em></td>
</tr>
<tr>
<td>E.R.1  Repair Emergency HPS Lights</td>
</tr>
<tr>
<td>E.R.2  Install Breaker at Emergency Generator</td>
</tr>
<tr>
<td>E.R.3  GFI Receptacles in Restroom</td>
</tr>
<tr>
<td>V.R.1  Provide Emergency Power to Exhaust Fans</td>
</tr>
<tr>
<td>V.R.2  Generator Room Unit Heater</td>
</tr>
<tr>
<td>V.R.3  New fire Damper in Electrical Room</td>
</tr>
<tr>
<td>V.R.4  Insulate Piping</td>
</tr>
<tr>
<td>V.R.5  Conditioning of Ticket booth and Parking Office</td>
</tr>
<tr>
<td>V.R.6  Ventilation of Stair Towers</td>
</tr>
<tr>
<td>P.R.1  Cleanout Storm Drains and Lines</td>
</tr>
<tr>
<td>P.R.2  Upgrade Restroom to ADA Compliant</td>
</tr>
<tr>
<td><strong>Total General Repair Items</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Recommended Improvement Items (Building Systems)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>E.I.1  Replace Lighting on Level 1</td>
</tr>
<tr>
<td>V.I.1  Install New Snow Melt System in Arch Street</td>
</tr>
<tr>
<td>F.P.I.1 Replace Fire Protection Piping</td>
</tr>
<tr>
<td><strong>Total Recommended Improvement Items</strong></td>
</tr>
</tbody>
</table>

**Notes**

1. All items include 15% Contingency and 10% Design/construction administration costs.
2. Included in structural cost option S.I.5.
Environmental Estimated Costs

The expected costs for hazardous materials remediation are listed below.

<table>
<thead>
<tr>
<th>Estimated Construction Budget (2006 Dollars)¹</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Repair Items (Environmental)</strong></td>
<td></td>
</tr>
<tr>
<td>EV.R.1 Elevator Pit ²</td>
<td>-TBD-</td>
</tr>
<tr>
<td>EV.R.2 Microbial Matter ³</td>
<td>-TBD-</td>
</tr>
<tr>
<td><strong>Total General Repair Items</strong></td>
<td>-TBD-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recommended Improvement Items (Environmental)</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>EV.I.1 Asbestos Abatement</td>
<td>$6,000.00</td>
</tr>
<tr>
<td>EV.I.2 Lead Based Paint (Removal) ⁴</td>
<td>$79,000.00</td>
</tr>
<tr>
<td>EV.I.2 Transformer ³</td>
<td>-TBD-</td>
</tr>
<tr>
<td><strong>Total Recommended Improvement Items</strong></td>
<td>$85,000.00</td>
</tr>
</tbody>
</table>

**Notes**
1. All items include 15% Contingency and 10% Design/construction administration costs.
2. Further evaluation/testing and access to existing elevator Pits is required.
3. Further evaluation/testing is required to understand potential abatement cost implications.
Operational Estimated Costs

A cost estimate for implementation of the *Recommended Improvement Items* is listed below.

<table>
<thead>
<tr>
<th>Items</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Repair Items (Operational)</strong></td>
<td></td>
</tr>
<tr>
<td>O.R.1 Relocate ADA Handicap Parking</td>
<td>-N/A-</td>
</tr>
<tr>
<td>OR.2 ADA Van Sinage at Garage Entry</td>
<td>-N/A-</td>
</tr>
<tr>
<td><strong>Total General Repair Items</strong></td>
<td>$</td>
</tr>
<tr>
<td><strong>Recommended Improvement Items (Operational)</strong></td>
<td></td>
</tr>
<tr>
<td>OI.1 New Curbing for Equipment</td>
<td>$ 5,000.00</td>
</tr>
<tr>
<td>OI.2 Operational Managers Office</td>
<td>$ 90,000.00</td>
</tr>
<tr>
<td>OI.3 Office Equipments/Softwares</td>
<td>$ 25,000.00</td>
</tr>
<tr>
<td>OI.4 PARC's Computer &amp; Software</td>
<td>$ 25,000.00</td>
</tr>
<tr>
<td>OI.5 Pay On Foot Equipment</td>
<td>$ 250,000.00</td>
</tr>
<tr>
<td><strong>Total Recommended Improvement Items</strong></td>
<td>$ 395,000.00</td>
</tr>
</tbody>
</table>

**Notes**

1. All items include 15% Contingency and 10% Design/construction administration costs.
2. Included in Arch./Code Compliance Costs
Municipal Services Building/Garage Interface Estimated Costs

A cost estimate for implementing the separation of the municipal loading dock from the garage is listed below.

<table>
<thead>
<tr>
<th>Estimated Construction Budget (2006 Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items</td>
</tr>
<tr>
<td>New partition wall, strip foundation and overhead door system</td>
</tr>
<tr>
<td>Ventilation system (10,000 CFM exhaust air)</td>
</tr>
<tr>
<td>New carbon monoxide detection system</td>
</tr>
<tr>
<td>New sprinkler system</td>
</tr>
<tr>
<td>Trench drain separation and upgrade</td>
</tr>
<tr>
<td>Existing light separation and upgrade</td>
</tr>
</tbody>
</table>

*Total Recommended Upgrades and Replacements = $1,135,000.00*