





CONDITION APPRAISAL UNION STATION PARKING GARAGE

NEW HAVEN PARKING AUTHORITY FACILITIES NEW HAVEN, CONNECTICUT

APRIL 2020

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1. Introduction

The Condition Appraisal of the Union Station Parking Garage was performed by DESMAN in accordance with the executed agreement by and between the New Haven Parking Authority and DESMAN (NHPA Project No. 20-001).

The primary objectives of this appraisal are as follows:

- A. Perform a detailed, on-site inspection and observation of the Union Station Parking Garage in concert with DESMAN's applicable sub-consultants.
- B. Compare the results of the inspection with those addressed in the 2019 Condition Appraisal Report prepared previously by DESMAN.
- C. Prepare a report detailing the findings of the survey including, but not limited to, an update of the estimated construction costs, along with priorities for the various repairs, and recommended capital reserves (future repair and maintenance), to allow the New Haven Parking Authority flexibility in the implementation of structural repairs, mechanical and electrical modifications, and architectural improvements.





2. EXECUTIVE SUMMARY

The Union Station Garage consists of 887 parking spaces. Opened on January 27, 1988, this garage consists of six (6) levels of cast-in-place concrete beams and columns with post-tensioned concrete parking decks, in excess of 289,000 gross square footage of parking area. This 32 year old facility is in generally good condition.

Currently there are three (3) projects in design which represent a combined project cost of approximately \$2,470,000 (including contingencies and design/management fees). Between 2020 and 2024, an additional expenditure of approximately **\$2,881,150.00** can be expected to properly repair and maintain the Union Station Garage over the next five years.

This report also includes costs associated with the repair and maintenance of a supplemental surface parking lot located to the east of the parking facility.

The revised cost projections account for work planned to be performed this year (2020) also account for revisions in repair priorities and additional repairs and improvements to the facility as identified during this year's survey or which were otherwise requested by NHPA for implementation over the next five years.

This facility continues to perform well, but some critical concerns will need to be addressed to allow the continued safe usage of the facility. While limited areas of the supported concrete deck of this parking facility have been repaired, concrete deck deterioration will be an on-going matter to monitor. Application of a corrosion inhibitor on all supported concrete decks has been applied as well.

Although no problems have been identified with the facility's P/T pockets, continued observation is recommended as part of each year's assessment work.

Miscellaneous waterproofing repair, inclusive of crack and construction joint repair, and repairs to existing areas of traffic bearing waterproofing membrane will also be required, especially considering the post-tensioned concrete deck construction of this garage.



Photo #1





The storefront associated with this facility's roof level has been replaced (*Photo #1*), while the lower level storefront construction remained essentially unchanged.

The costs associated with the implementation of future repairs and preventative maintenance for this garage is presented in more detail later in this report. The majority of the future repairs consist largely of ongoing preventative maintenance issues which would need to be performed on any parking facility of similar size and construction.

The Capital Projects currently in progress consist of the following:

| PROJECT NUMBER | PROJECT TITLE | OPINION OF COST* | STATUS | | |
|-------------------|---|-------------------|-----------|--|--|
| 16-006 | Exterior Architectural Coating | \$600,000 | In Design | | |
| 18-016 | Miscellaneous Concrete Repairs , Waterproofing & Drainage Repairs | \$120,000 | In Design | | |
| 19-016 | Decorative Precast Façade Repairs | \$1,750,000 | In Design | | |

* Rounded, Inclusive of Contingencies, Engineering and Program Management costs.

The costs associated with the implementation of future repairs and preventative maintenance for this garage is presented in more detail later in this report.

The repairs recommended to be performed over the next five years have been prioritized into three courses of action: Prioritized Repairs (FY 2021), Early Repairs (FY 2022), Programmed Repairs (FY 2023), and Long-Term Repairs (FY 2024 - 2025). The table below is a summary of DESMAN's estimated construction cost for each category of work.





| RECOMMENDED REPAIR PROGRAM | ESTIMATED CONSTRUCTION COST | | | | |
|--------------------------------------|-----------------------------|--|--|--|--|
| Prioritized Repairs (FY 2021) | \$0.00 | | | | |
| Early Repairs (FY 2022) | \$856,950.00 | | | | |
| Programmed Repairs (FY 2023) | \$597,400.00 | | | | |
| Long-Term Repairs (FY 2024– 2025) | \$1,426,800.00 | | | | |
| TOTAL ESTIMATED COST | \$2,881,150.00 | | | | |

To further summarize, the projected costs may be split into the following discipline categories, in accordance with the associated percentages, as represented by the following pie chart:

Concrete Repair: 21.14%

Architectural: 40.06%

Mechanical/Electrical: 3.88%

Elevators: 0.20%

Waterproofing: 5.59%

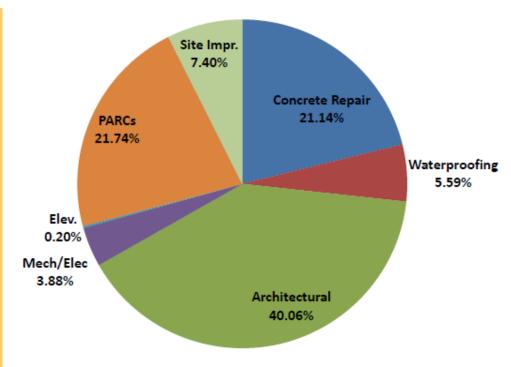
PARCs: 21.74%

Site Improvements: 7.40%

100.00%







Recommended Repairs & Improvements split into Disciplines





3. DESCRIPTION OF THE STRUCTURE



Photo #2



Photo #3

The six level, free standing parking facility (*Photo #2*) is located on Union Avenue adjacent to the Union Station Transportation Center Building (Railroad Station) in New Haven, Connecticut. This facility remains in relatively good structural condition, but conditions exist which should be addressed to preserve and protect it.

The Union Station Garage primarily services railroad patrons (both daily and monthly patrons), but also services employees working within the Union Station Center building itself.

The facility is rectangular in shape with a longitudinal dimension of 277 feet and a transverse dimension of 174 feet with five supported levels (i.e., structural slabs) and one slab-on-grade. The facility's structural configuration consists of two non-sloping exterior parking bays (*Photo #3*) and one sloping interior parking bay providing vehicle access between parking levels. Traffic flow within the facility is clockwise with one-way traffic on the exterior parking bays and two-way traffic flow on the interior bay.

The parking facility's entrance/exit lanes are located at the east end and north side (side facing Union Avenue) of the structure. Both entrances/exits are accessed from Union Avenue.

The east-end entry/exit lane is the primary access point for transient customers and provides a reservoir for off-street queuing of vehicles. During the evening rush hour, the east-end entry/exit lanes are operated as exit lanes exclusively with entry provided at the Northwest corner of the facility.

The facility's structural system typically consists of 7½" thick post-tensioned concrete slabs spanning 27 feet between 57-foot long post-tensioned concrete beams.





Two expansion joints are provided at opposite ends of the facility running in the North-South direction. Each supported level of the structure contains these expansion joints at column line "4" and "9" respectively. The structure on either side of these expansion joints is supported at a double column. The post-tensioning anchors and stressing pockets are located at either side of the expansion joints to allow sequencing of the original construction.

The facility has two stair towers located at either end of the structure; two elevators are positioned at the end of the garage closest to the Union Station Transportation Center Building.

The parking facility's façade, along Union Avenue, features architectural pre-cast concrete elements supported by the facility's structural frame (*Photo #4*).

The storm water collection system consists of floor drains on flat parking bays and trench drains at the base of the sloping bays.

The main lighting system was replaced in 2017 and consists of surface mounted LED lighting fixtures wired through embedded electrical conduit, and features an automatic lighting control system capable of being programmed to adjust lighting levels throughout the facility. The facility's perimeter lighting may be shut down in response to exterior ambient lighting conditions. The emergency lighting system installed subsequent to the facility's original construction is wired through surface mounted electrical conduit.

The facility is equipped with an emergency call box (blue light) intercom system that operates via radio transmission allowing for increased operating flexibility and easy monitoring of the facility security.

The existing fire-protection system is a dry system consisting of standpipes with a Siamese connection at the street (Union Avenue).



Photo #4





The facility is equipped with a dedicated pressurized garage wash-down system which provides sufficient water pressure and volume on all levels of the garage to allow NHPA operations and maintenance staff to periodically wash-down the facility and to flush away accumulated chlorides of the deck, thus helping to prevent further chloride contamination of the concrete decks.

The facility has had periodic repairs and maintenance performed on traffic bearing waterproofing membrane installed in several areas of the garage (i.e., above the maintenance area, garage manager's office) The traffic bearing waterproofing membrane previously installed on the garage's roof deck was eventually removed.

Floor plans, displaying the basic grid and architectural layout of the garage are included in Appendix A – Schematic Floor Plans.

- 1998 The facility's expansion joints were replaced with more durable winged expansion joint glands. This work involved the removal of preexisting pre-molded elastomeric expansion joint glands and rebuilding or otherwise modifying the existing expansion joint block-outs to accept the new expansion joints glands.
- 1999 Various improvements were made to the facility's signage and graphics, particularly as it relates to vehicular traffic and how it is directed through the garage to the various vehicle exits. The signage is controlled via computer and has various software interlocks to prevent sign directions from conflicting with one another.
- 2002 The Garage's entire revenue control system and lane control equipment (i.e., ticket machines, traffic gates, card readers, loop detectors, cashiering equipment etc.) were replaced.







Photo #5



Photo #6



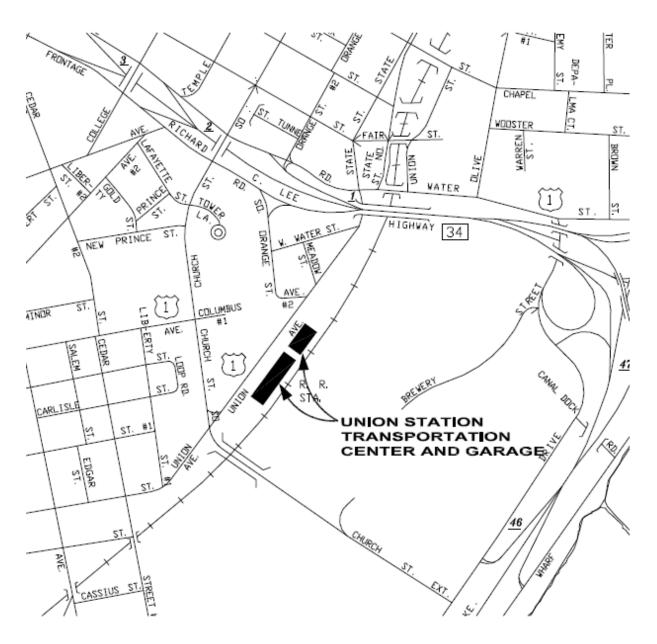
Photo #7



- Various concrete repairs were performed to address posttensioned concrete deck deterioration and to address vertical and overhead concrete deterioration. The traffic bearing waterproofing membrane installed on the facility's roof level was removed due to difficulties with adhesion. The facility's concrete roof deck and exterior architectural precast façade was treated with a clear penetrating concrete sealer.
- A limited amount of expansion joint repair work was performed to address leaking joints and to repair the elastomeric expansion joint nosing material. The balance of the facility's supported concrete deck was treated with a clear penetrating concrete sealer. This sealer application was a supplement to a similar sealer applied to the facility's roof level previously.
- The construction and installation of a bicycle parking area, at the west end of the Union Station Garage (*Photo #5*), was started late 2010 and was completed Spring 2011. This work incorporated the construction of a concrete paved area, entry/exit aprons, individual bicycle shelters, and installation of bike racks, site lighting, fencing, landscaping, and various signage improvements.
- 2015 A comprehensive repair and improvement project was started in Spring 2014 and was completed Fall 2015. Work consisted of concrete repair, waterproofing repairs, masonry repairs (*Photo #6*), plumbing repairs, storefront repairs and replacement, painting and re-striping.
- 2017 A comprehensive electrical and lighting project was completed in 2017. Work consisted of lighting fixture replacement, conduit & wire replacement, installation of new elevator lobby lighting, lighting control system installation and modifications, and miscellaneous electrical repairs.
- 2019 Miscellaneous concrete sidewalk repairs were addressed, as well as the installation of additional electric vehicle charging stations.







Site Plan





STRUCTURAL DATA

Union Station Parking Garage New Haven, Connecticut

Legend: Square Feet SF

Pounds Per Square Inch
Pounds Per Square Foot
PSF

Date of Completion: 1988

Age of Structure:

Plan Dimensions:

174 FT x 277 FT
Typical Bay Size:

27 FT x 58 FT

Typical Floor to Floor Height: 10'-6"
Floor Area: Slab-on-Grade: 42,000 SF

Supported Slab: 211,000 SF Total: 253,000 SF

Parking Capacity: 887 Vehicles

Parking Efficiency: 285 SF/Vehicle

Note: All values listed above are approximations of actual values

Structural System: Cast-in-place post tensioned concrete slab and beam construction with pre-

cast concrete architectural façade.

Foundation System: Piles

Design Loads: Parking & Driving Areas 50 PSF

Parking & Driving Areas (Roof) 70 PSF

Material Strengths: Slab-on-Grade f'c = 4,000 PSI

Supported Slabs & Beams f'c = 5,000 PSIReinforcing Steel fy = 60,000 PSIPre-stressing Steel fpu = 270,000 PSI

Concrete Cover: Beams (Main Bars) 1-1/2"

Slabs Top Bars 1-1/2"

Bottom Bars 1"





4. VISUAL OBSERVATIONS & REPAIR RECOMMENDATIONS



Photo #8



Photo #9



Photo #10

A visual examination of the facility's structural, mechanical, and electrical components was performed as part of DESMAN's review of the Union Station Parking Garage again this year.

CONCRETE REPAIR:

Partial Depth Concrete Repair: Miscellaneous concrete spalling had been located throughout the garage (*Photo #8*). Repair of concrete deck deterioration and vertical and overhead concrete deterioration, throughout the interior of the garage, has been addressed as part of Project no. 08-016 B, and additional miscellaneous repair will be addressed as part of Project No. 18-016 currently in design. However, DESMAN has observed additional shallow deterioration occurring throughout the garage and so recommends that continued repair be programmed accordingly, consisting of a combination of shallow-depth and partial-depth repair approaches.

The facility's exterior has shown only a nominal amount of visible concrete deterioration, mainly limited to delamination of the thinly applied concrete repair mortar which was utilized during the facility's original construction to cover surface blemishes in the concrete surface exposed after removal of the original formwork. The condition has been cosmetic-in-nature, and repairs costs are still considered as nominal in comparison to the cost of the recommended application of an approved architectural coating which is outlined later in this report.

<u>Pre-cast Concrete Facade</u>: The original design of the architectural facade panels, while aesthetically pleasing, has hard attachments to the garage structure on either side of the facility's expansion joints, and so stranded cable supports have been installed to provide an additional level of safety. Thermal movement of the structure tends to rack the face; fortunately, the facade seems to be flexible enough to withstand this movement successfully. The condition should continue to be monitored periodically (*Photos #9 & #10*). All connections and hardware should be cleaned and cold-galvanized to maintain their structural integrity (*Photo #11*); cold-galvanization of the connections and hardware is planned to be addressed as part of NHPA Project No. 16-006.







Photo #11

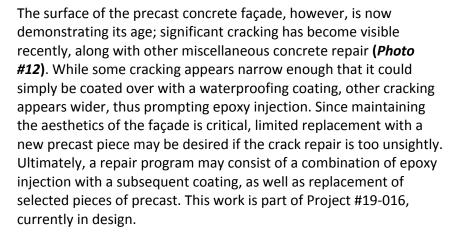




Photo #12





WATERPROOFING ISSUES:

Expansion Joint Repairs: The expansion joints throughout the garage have all been replaced (*Photo #13*) as part of Project no. 08-016 B.



Photo #13

Crack Repair/Control/Construction Joint/Cove Joint Repair: A significant amount of polyurethane sealant material has been installed historically throughout the garage to seal leaking cracks, and control/construction joints. Some of this sealant material had been showing signs of deterioration consistent with exposure to higher volumes of vehicular traffic, or in certain instances, was worn or damaged due to exposure to direct sunlight (UV degradation) or because of damage caused during snow removal operations (*Photo #14*).







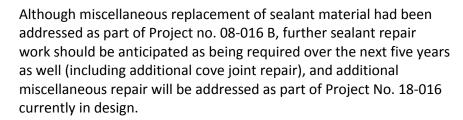
Photo #14



Photo #15



Photo #16



<u>Topically Applied Corrosion Inhibitor:</u> There has been a program in place for the periodic application or re-application of clear penetrating concrete sealers on exposed concrete deck surfaces of this parking facility, but due to the age of the structure and the measurable levels of chloride contamination, it had been determined that the utilization of topically applied corrosion inhibitors would be recommended in order to raise the chloride threshold levels necessary to support active corrosion of embedded reinforcing steel within the supported decks.

Not only do these materials inhibit corrosion, they also offer the additional benefit of penetrating concrete sealers, acting as moisture and chloride screens. Because these materials are unable to bridge cracks in concrete, similar to the inability of penetrating sealers to bridge cracks, the application of corrosion inhibitors needs to be done in conjunction with a program of crack and control/construction joint repair and quite possibly combined with the application of an elastomeric traffic bearing waterproofing membrane in certain areas.

The facility's roof level waterproofing membrane was removed and a penetrating concrete sealer was applied in 2004. Besides the fact that traffic bearing waterproofing membranes are costly to maintain, and are sometime problematic when installed on exposed roof decks, re-application of a membrane is not recommended. Application of a corrosion inhibitor was advisable instead. Application of a corrosion inhibitor has now been addressed, as part of Project no. 08-016 B, with renewal planned again for 2024.

A waterproofing membrane system had been in place over the garage office and over the mechanical room on the ground level, and the system should remain in these locations. The membrane systems had reached the end of their useful lives and have now been repaired and re-coated (*Photo #15*). This work was addressed as part of Project no. 08-016 B.





ELEVATORS AND STARS TO LINE WHITE THE PARTY OF THE PARTY

Photo #17

Photo #18



Photo #19

ARCHITECTURAL IMPROVEMENTS:

<u>Miscellaneous Storefront Repair:</u> This facility's storefront located at the stairwell and elevator lobbies had been in relatively poor condition, particularly those installed on the facility's roof level. The roof level store front systems were replaced as part of Project no. 08-016 B (*Photos #16 & #17*).

Although miscellaneous repair was addressed as part of Project no. 08-016 B, continued moisture has further deteriorated the storefront systems (*Photo #18*). DESMAN therefore now recommends that full replacement be considered, incorporating a raised concrete curbing similar to the storefront systems installed at the roof level, or perhaps the existing storefronts be removed and replaced with a typical guardrail system mounted on a raised curb (since the stairs are no longer required to be enclosed), all to avoid exposure to moisture and continued deterioration.





Miscellaneous Door Repair: This work relates to the need to repair damaged doors and door hardware periodically. The majority of these repairs are typically required almost exclusively due to corrosion of the doors, door frames, normal wear and tear, or to address damage due to vandalism. Miscellaneous door repair/replacement has been addressed as part of Project no. 08-016 B. As noted above, however, the stairs are no longer required to be enclosed; therefore, DESMAN recommends that consideration be given to removal of the doors, in conjunction with replacement and/or removal of the storefront systems.

It is DESMAN's opinion that door repair is in reality an operating expense and doors and associated door hardware should be replaced on an as-needed basis, this is particularly true for those doors serving primary means of egress.







Photo #20



Photo #21



Photo #22

<u>Bicycle & Motorcycle Parking Improvements:</u> A bicycle parking area was created and installed at the west end of the Union Station Garage (*Photo #19*); a motorcycle parking area was planned to be constructed within the East End Surface Lot (Reference East End Surface Lot section), but in discussions with the JAC, this work will not move forward at this time as CDOT will soon commence construction of a second garage on the site.

East Façade Enhancements/ Exterior Architectural Coating: As mentioned previously, this facility as originally constructed had significant areas of the exposed concrete façade repaired with a thin concrete repair mortar to cover surface blemishes in the concrete surface left after removal of the original formwork. Minor reworking of the surface repairs is required (*Photos #20, #21 & #22*) and application of an approved architectural coating is recommended. Utilization of the correct coating will not only enhance the appearance of the garage, it will also protect the repaired surfaces and the balance of the facility's concrete façade. This work is currently included in NHPA Project No. 16-006 now in design.

Recently, with NHPA's re-branding efforts fully underway, additional opportunities, as well, have developed that could assist in revitalizing the garage. Enhancements, such as signage and lighting, combined with rebranding graphics as well as installation of a sculptural screen cladding that could break up the monolithic scale of the blank concrete façade (on the east elevation as a minimum), could assist in transforming the garage (various concepts as follows). Such enhancements would, of course, require proper review and coordination with the State Historic Preservation Office.







<u>Main Elevator Lobby Improvements:</u> As an effort to enhance the pedestrian experience throughout the garage, Desman suggests that the main pedestrian route be considered.







Photo #23



Photo #24



Photo #25

Desman recommends that certain aesthetic improvements be considered at the main lobby area, specifically the first level lobby which is the most visible public area of the garage (*Photo #23*). Various options include:

- 1. Removal of the existing pavers and placement of a decorative stamped/textured concrete,
- 2. Painting of the walls and ceiling with a reflective coating,
- 3. Enhancement with new and/or supplemental decorative lighting, illuminated bollards could provide additional lighting as well as an architectural enhancement
- 4. Installation of additional informational signage and graphics.
- 5. Replacement of the glazing and storefront system for the office that is more consistent with the historic character of the Station. (*Photo #24*)
- 6. Various concepts as follows.







In addition to the various options for architectural enhancements, NHPA has requested that DESMAN consider incorporation of a storefront system that would provide a protective vestibule (from the weather) for the elevators [due to the modernization work recently completed]. A supplemental vestibule could be constructed that would blend and respect the overall architectural enhancements accordingly.

<u>Pedestrian Route Enhancements (southern walkway):</u> The pedestrian pathway provided from the East Lot to the main lobby may be improved as well (*Photos #25 & #26*). In conjunction with the installation of decorative lighting already programmed, the existing asphalt may be removed and a decorative stamped/stenciled concrete may be placed, providing an aesthetically enhanced pathway highlighting the route to the Station.







Photo #26



Photo #27



Photo #28

Additional enhancements could include limited landscape of the zone between the train tracks and the garage with local plantings, tall grasses, and flowering trees, installation of a low architectural screen or fencing along the bays to divide the plantings and landscaped space from the vehicles in the garage. (various concepts as follows)







<u>Vehicular Entrance Enhancements:</u> As an effort to enhance the visitor's experience upon entering the garage, cost-effective improvements may be considered as well (*Photo #27*). Application of a high-reflective coating across the ceiling and surrounding vertical surfaces, in conjunction with improved lighting (already programmed) and supplemental signage and graphics, may be programmed accordingly.

<u>Manager's Office:</u> The existing space being used as a Manager's Office would benefit from certain aesthetic improvements (*Photo #28*). Enhancements, such as new flooring, ceiling with new lighting, and painting, as well as renovations of the bathroom, could be programmed accordingly.

Epoxy Flooring/Supplemental Treads within West Stair: Aesthetic improvements may be considered throughout the stair towers, as well (*Photo #29*). Besides the re-painting of the handrail/guardrail system already programmed, Desman suggests that decorative flooring, such as supplemental treads or an epoxy coating system, be considered that could provide an aesthetic enhancement as well as non-slip resistance.

In the meantime, DESMAN recommends that the condition of the stairs be monitored and repaired as may be required. Some stair repair has been included for the upcoming budget year, as part of Project No. 18-016 currently in design.







Photo #29



Photo #30



Photo #31

<u>Garage Cleaning:</u> As mentioned previously, it is an important that this facility be cleaned periodically to remove accumulations of sand and other debris that is not only unsightly, but is also a hindrance to proper deck drainage and the durability and longevity of the various waterproofing components (i.e. expansion joint glands). The garage has a washdown system in place that provides a generous quantity of water at a relatively high pressure. It is DESMAN's opinion that facility cleaning is in reality an operating expense which should be performed on an as-needed basis. The costs associated with this work are not included within our projected repair costs. However, it can become appropriate for a comprehensive cleaning (with industrial-strength cleaning products) to be necessary which may not be readily performed with in-house staff; it may be necessary to program it as a capital improvement. Therefore, DESMAN recommends that a comprehensive cleaning be programmed accordingly; depending on scheduling of other programmed work, it may be appropriate for cost-savings if the cleaning can be scheduled simultaneously as other work that requires cleaning of the related substrates.

ELEVATOR IMPROVEMENTS:

Elevator Modernization: The elevators have been renovated and modernized as part of Project no. 13-012 B (*Photo #30*). New controllers, power units, and door upgrades were among the improvements as well as improvements to the elevator machine room HVAC, inclusive of the installation of an air conditioning system and supplemental heating. Illuminated level annunciators, call buttons, and other miscellaneous design features were installed to enhance the visual appearance of the elevators (*Photo #31*) and to meet changing building and ADA code requirements.

In order to assist PNH in the ongoing execution of its Maintenance Agreement with Schindler Elevator Corp., DESMAN recommends that PNH program the services of DESMAN and its elevator subconsultant, Sterling Elevator Consultants, to oversee an elevator maintenance audit on a regular basis.







Photo #32



Photo #33



Photo #34

PAINTING:

<u>Painting Facility Doors:</u> This work relates to the need to periodically re-paint the facility doors surfaces as an enhancement to general aesthetics and to protect ferrous materials from rust and corrosion. Previously painted surfaces can degrade over time depending on environmental exposure, vandalism and abuse, and normal wear and tear. This work has been addressed as part of Project no. 08-016 B.

Painting Storefront & Stairwell Handrails (Stairwell & Elevator Lobbies): This work relates to the need to periodically re-paint the stairwell and elevator lobby storefronts (*Photo #32*) and stairwell handrails as an enhancement to general aesthetics and to protect otherwise exposed metal surfaces prone to the effects of corrosion. Previously painted surfaces can degrade over time depending on environmental exposure, vandalism and abuse, and normal wear and tear. This work has been addressed as part of Project no. 08-016 B.

<u>Painting Interior & Exterior Handrail:</u> This work relates to the need to periodically repaint the interior column line protective handrails as well as the exterior perimeter handrails as an enhancement to general aesthetics and to protect otherwise exposed metal surfaces prone to the effects of corrosion (*Photos #33 & #34*). Previously painted surfaces can degrade over time depending on environmental exposure, vandalism and abuse, and normal wear and tear. This work has been performed as part of Project no. 08-016 B.

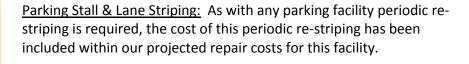
<u>Cleaning and Painting of Standpipe and Storm Drainage Piping:</u> This work relates to the need to periodically repaint facility piping as an enhancement to general aesthetics and to protect otherwise exposed metal surfaces prone to the effects of corrosion.

- All horizontal fire protection piping should be cleaned and painted.
- All exposed drain piping should be cleaned and painted

Previously painted surfaces can degrade over time depending on environmental exposure, vandalism and abuse, and normal wear and tear. This work has been performed as part of Project no. 08-016 B.

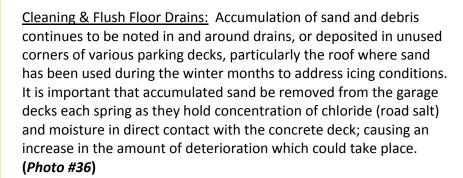






MECHANICAL/PLUMBING WORK:

The trench drain at the base of the ramp (grade level) has deteriorated beyond the ability to clean and repair and thus is now in need of full replacement (*Photo #35*). DESMAN recommends that the existing cast iron frame body be removed in its entirety and a new hot-dipped galvanized body and frame be installed with all new grates. At this time, consideration can also be made for the removal of the trench drain at the northwest entry/exit portal; since the concrete slab has a positive slope regardless, the trench drain system has proven to be an unnecessary maintenance expense and can be removed, repairing the concrete slab afterwards (DESMAN notes that the trench drain system at the southeast entry/exit portal has already been removed). This work will be addressed as part of Project No. 18-016 currently in design.



Sand carried into the storm drains can clog drains and associated drain lines. In combination with periodic garage wash down, it is imperative that the facility's drainage system be kept clean and operational. The costs associated with the flushing of the facility's drainage system has been included within our estimated repair and preventative maintenance costs scheduled to be performed in the future as associated with related construction, but the drains should also be cleaned periodically as an operating expense. The costs associated with cleaning and flushing down the deck surfaces as an operational cost is not included within projected repair and preventative maintenance costs.



Photo #35



Photo #36





Fire Protection Standpipe System:

The standpipe system was replaced as part of Project no. 08-016 B.

The State Fire Safety Code requires periodic maintenance and testing of Fire Protection Systems in accordance with the provisions of NFPA 25 – "Standard for the Inspection, Testing and Maintenance of Water Based Fire Protection Systems". At a minimum, owners' maintenance personnel should conduct a quarterly visual inspection of piping, fire department connections and hose valves to ensure that systems have not been damaged. A more thorough detailed inspection should be conducted annually to verify that all system piping and components are in proper working order which should include testing and inspection of all valves and components. Flow tests should be conducted every five years at a minimum. Additional requirements for inspection testing and maintenance of Standpipe Systems are outlined in NFPA 25.

Miscellaneous Mechanical/Plumbing Repairs:

- Damaged drains and their associated hardware (i.e. grate covers) should be replaced and/or repaired to prevent potential trip hazards and prevent accumulation of debris within the drains (*Photo #37*).
- Damaged and deteriorated piping insulation was also noted to varying degrees throughout the garage; Desman recommends that this remaining insulation be removed since it is no longer necessary.

<u>Elevator Machine Room HVAC</u>: The installation of new electronic elevator controls, as mentioned previously, required modifications and improvements to the elevator machine room HVAC, inclusive of the installation of an air conditioning system and supplemental heating, as part of NHPA Project No. 13-012, as well as additional controls to manage the exhaust fan as it relates to cooling, as part of NHPA Project No. 15-003B.

<u>Mechanical Preventative Maintenance</u>: DESMAN recommends the periodic maintenance and repair of various components of the buildings mechanical systems; the costs are considered operational costs and are therefore not included as separate and



Photo #37





distinct items within our projected repair and preventive maintenance costs. Periodic maintenance and service of the mechanical systems should be in accordance with the O&M requirements for the individual systems and include but are not limited to the following:

- Facility Washdown System
- Collection Booth HVAC Systems.
- Split System Air Conditioning Serving Maintenance Area and Security Offices
- Elevator Machine Room HVAC Equipment



Photo #38

ELECTRICAL WORK:

The work described in this electrical work section is scheduled to be addressed in the near future.

<u>Lighting Fixture Replacement:</u> The garage light fixtures were replaced as part of NHPA Project No. 08-016 C (*Photos #38 & #39*). Many of the facility's existing light fixture lenses became yellowed, and high voltage ballasts were starting to malfunction, indicative of a need to replace all of the facility's lighting fixtures.

LED lighting was chosen as there are now a reasonable number of good quality LED garage lighting fixtures available at this time. Many of these fixtures have a proven track record of reliability and good photometric performance. Use of LED lighting will reduce energy use and maintenance expenses.

As noted, replacement of the existing light fixtures with new LED fixtures was performed as part of Project no. 08-016 C, now complete.

<u>Lighting Control System Replacement:</u> The Leviton lighting control relays in the Maintenance Area were functionally obsolete and it was difficult to find replacement components when failures occur. The control system and relays were replaced with a new system.



Photo #39







Photo #40

<u>Lighting/Signage Control System Programming & Adjustments with Related Training:</u> A new control system was installed and recently updated as part of NHPA Project No. 08-016C. Given the significant operational costs that can go along with their proper operation, DESMAN recommends that PNH coordinate with LC&D for regularly scheduled updating, oversight and training.

<u>New Elevator Lobby Lighting:</u> The pre-existing fluorescent fixtures serving the elevator landings have now been replaced as part of the lighting replacement project **(Photo #40)**.

Should NHPA wish to consider the aesthetic enhancements noted previously, select locations and fixtures, such as the ground level, can be replaced with more decorative fixtures.

<u>Vehicular Entrance Enhancements:</u> The existing light fixtures at the vehicular entrances have been replaced. However, should NHPA wish to consider the aesthetic enhancements noted previously, more decorative and/or supplemental light fixtures could be installed to highlight the entry areas as well as accent certain designated signage, such as the "Union Station Parking Garage" text above the entrance.

<u>Miscellaneous Electrical Repairs:</u> Several of the light fixture lenses, on the Bike Parking shelters, were observed to aging and failing; DESMAN recommends that the lenses all be replaced.

Installation of Emergency Electrical Generator: The Union Station Garage currently does not have an emergency generator, and therefore NHPA has questioned the feasibility and practicality of installing a generator to serve minimum garage lighting, elevator access and revenue and access control at the vehicle entry/exit areas. Since the load requirements are currently unknown and thus the size of the generator and subsequent cost of installation cannot yet be determined, DESMAN recommends that a study first be performed to determine the specification requirements of the generator, followed by subsequent installation, programmed as required. If a new generator is being supplied for the new proposed garage, consideration should be given to also powering the existing garage.







Photo #41



Photo #42



Photo #43

<u>Fire Alarm Panel Replacement</u>: In conjunction with the replacement of the fire standpipe system, current code requirements have prompted the installation of new addressable modules for monitoring the new tamper switches. Therefore, installation of a new fire alarm panel had become warranted, and was performed as part of Project no. 08-016 B.

<u>Transformer Replacement:</u> The "voltage regulation" transformer in the electrical room adjacent to the Garage Office was at its end of useful life. The unit was noisy and had a low efficiency compared to currently available transformers. This transformer has been replaced as part of NHPA Project no. 08-016 C.

Surge protection: Concern about surge protection for the electrical distribution system had been raised. Such protection can help prevent damage to equipment connected to the system and limit power outages. Protection can be provided at any point in the distribution system and is typically designed based on the level of protection desired at any point. Multiple levels of protection are often implemented with devices installed at the incoming service, at select subpanels and at the sensitive equipment. Additional surge protection was provided as part of NHPA Project No. 15-003B.

<u>Decorative lighting:</u> Outdoor rated, linear, colored LED fixtures are available from a number of reliable manufacturers. These fixtures could be used for aesthetic appeal and level identification (*Photos #42 & #43*). Color changing effects can be included to provide season-appropriate lighting. The scope and cost for this type of lighting can vary greatly. A study of acceptable effects, potential installed locations and associated costs may be performed prior to implementation. (various concepts as follows)













Photo #44



Photo #45



Photo #46

Although the light fixtures throughout the parking garage were recently replaced with new LED fixtures, certain miscellaneous fixtures were not replaced; these include the lights in the bike shelter to the east of the garage, as well as the lights in the paystation kiosk. DESMAN recommends that these fixtures be monitored and replaced when appropriate.





SECURITY ENHANCEMENTS:

NHPA has requested that DESMAN review the opportunities for enhancing security at the Union Station Garage, including opportunities for video surveillance, access control and audio communication systems (*Photos #44 & #45*); improvements may include a control room and may be coordinated with other facilities.

DESMAN performed a study of potential security enhancements as part of NHPA Project No. 15-002.

SIGNAGE IMPROVEMENTS:

A comprehensive signage replacement program (*Photos #46 & #47*) is part of NHPA Project no. 15-003 D. In conjunction with NHPA's current branding program, the signage will be updated with new graphic faces to be more in keeping with NHPA's logo and graphic standards. This project was designed but then canceled due to the imminent construction of an adjacent second garage which will impact the signage needs.







Photo #47



Photo #48

In addition to periodic signage repair requirements, conditions may change where additional signage may be required to address changes in patron usage, or new building development in close proximity to the facility which dictates that additional signage needs to be installed.

REVENUE CONTROL EQUIPMENT REPLACEMENT:

The existing revenue control and parking access equipment was replaced in 2013, including the cashier booths. However, due to new and improved technology, DESMAN recommends that PNH review the current system for potential enhancements and/or replacement, and plan accordingly. In conjunction with CDOT's planned new garage to be constructed adjacent to the garage, DESMAN would recommend that any new equipment be coordinated accordingly so as to be fully compatible and perform as a single system. The need to modify the existing system, therefore, may need to advance sooner.

SURFACE PARKING LOT IMPROVEMENTS (EAST LOT) AND RELATED SITE IMPROVEMENTS:

Sidewalk Replacement: NHPA had recently addressed some miscellaneous sidewalk repair, in front of the decorative masonry wall along Union Avenue, as part of Project No. 08-016B (*Photo #48*). However, the decorative pavers continued to heave and deteriorate, due to freeze-thaw and related contaminants, contributing to failure of the cove joint along the wall, and miscellaneous deterioration of the sidewalk continued. Certain miscellaneous sidewalk repair has now been addressed, as part of Project No. 18-011 B. DESMAN recommends that the sidewalk continue to be monitored for further repairs as may be needed.







Photo #49



Photo #50

East End Surface Lot:

The work described in this East End Surface Lot section, and as previously discussed in the Architectural Improvements section, have been put on hold by CDOT due to the planned new garage on this site. Should the new garage construction be delayed for any significant time, DESMAN recommends the following items of work be considered:

- The condition of the east end parking lot is such that it is recommended that the entire lot be milled down and overlain with 1-1/2" to 2" wearing course (*Photo #49*). Significant settlement exists in certain locations which catches and holds water creating a nuisance to pedestrians and is also detrimental to the ongoing condition of the pavement remaining.
- In addition to the Lot's asphalt, the asphalt around the main cashier booth island should be replaced; replacement will incorporate installation of new loop detectors and catch basin frames.
- Several sections of curbing are damaged (*Photo #50*). In the interim, before repairs can be implemented it is suggested that all loose pieces be removed from the site along with all other accumulated debris.
- The barrier fence along the railroad tracks along the east end parking lots, as well as all perimeter fencing, should be inspected periodically and repaired as required.
- Due to recent development by UI within the adjacent property, which had previously been the recipient of drainage from the East Lot, it has now become recommended to install a supplemental retention system with drywalls to support the drainage requirements of the Lot. However, the construction of a garage in this location will prompt different drainage requirements. Implementation of the related drainage work shall, therefore, be modified accordingly.







Photo #51



Photo #52

MISCELLANEOUS CONSIDERATIONS:

<u>Ice-Melt and Snow Removal</u>: **DESMAN** has regularly observed excessive amounts of ice-melt materials being used (*Photos #51 & #52*). **DESMAN** does understand that winters in New England can be challenging, however we caution any operator to take care when using ice-melt materials in excess. The large size of the aggregate (being driven over and walked upon) in combination with the chemical-makeup of the particles, can be harmful to the concrete structure and metal components of the garage.

DESMAN notes that chloride-based ice-melt products can be detrimental to the long-term durability of the concrete matrix, and Desman therefore recommends that an alternative product be used. While Desman does not specifically endorse a specific product or manufacturer, Desman does suggest that in lieu of a calcium chloride product, an alternative product such as Cryotech NAAC®, as manufactured by Cryotech Deicing Technology, of Fort Madison, IA (tel: 800-346-7237, www.cryotech.com) be used.

However, we do acknowledge that use of an alternate product can be more expensive (Cryotech NAAC® is used frequently at airports), and many snow-removal vendors have not budgeted and are not prepared to obtain and use the alternate product. Since PNH is performing its snow/ice removal operations inhouse, PNH may be able to find an equal product in mind by forwarding a performance-based requirement to various sources and that the source provide simply a non chloride-based product (not necessarily Cryotech NAAC®).

As a final option, should it be necessary that PNH use a chloride-based ice-melt, we strongly recommend that PNH continue to remove the ice-melt product immediately after the snow and ice is melted, and the slabs be washed clean as soon as temperatures allow.

Regardless, **DESMAN** strongly recommends that the facility be cleaned and washed at least twice a year, using the washdown system installed for that purpose, typically coinciding with the spring season and fall season, to remove contaminants and specifically remove the excess ice-melt materials (used over the





winter) from the garage. For that purpose, **DESMAN** has included a sample "Seasonal Washdown Checklist" that can be used to track each scheduled washdown.

UPDATING OF RECORD DOCUMENTS:

Given the need to perform regular maintenance and the need to correctly oversee future repair and preventative maintenance projects, NHPA will benefit from the continuous updating of a set of record drawings. Such drawings will identify the locations of previously repaired concrete, installation of membrane systems and expansion joint glands, as well as urethane sealants, so that NHPA will be able to readily determine the age of the applicable product and the applicability of any such warranties. Such drawings will also identify the locations and ratings of all electrical distribution components, locations and manufacturers of fire alarm and security systems, and the location and circuiting of all regular lighting, emergency lighting, and exit signs.

Mechanical systems (boilers, fans, HVAC equipment, pumps and sprinkler systems) would also be documented. Desman recommends that the record documents be updated as required.

In conjunction with the benefit of preparing Record Drawings, it is becoming more cumbersome and inefficient for NHPA to maintain a hard-copy set of the original/past documents from the garage's original construction. The documents are becoming more aged and the paper more susceptible to damage. Considering the valuable nature of the historic documentation with regards to future repair work, Desman recommends that NHPA arrange for the scanning of all documentation into electronic (PDF) format; converting the documents into electronic format would allow for easier sharing of documents, as well, which can then easily be transmitted via e-mail as required.

A recommended maintenance schedule and associated facility checklists which can be used or referenced in the preventative maintenance of this parking facility are included in Appendix B – Maintenance Schedules and Checklists.

In summary, DESMAN recommends that the above outlined repair and preventative maintenance program be implemented to assure the continued safe usage and long-term durability of the structure.





5. PRIORITIZED REPAIR PROGRAMS & ESTIMATED COSTS

A revised repair and preventive maintenance program has been developed to assure the long-term durability of the Union Station Parking Garage. The repairs required have been prioritized into three courses of action:

- Prioritized Repairs (FY 2021)
- Early Repairs (FY 2022)
- Programmed Repairs (FY 2022)
- Long-Term Repairs (FY 2023 2024)

Below is a summary of the estimated construction cost for each category.

| RECOMMENDED REPAIR PROGRAM | ESTIMATED CONSTRUCTION COST |
|--------------------------------------|-----------------------------|
| Prioritized Repairs (FY 2021) | \$0.00 |
| Early Repairs (FY 2022) | \$856,950.00 |
| Programmed Repairs (FY 2023) | \$597,400.00 |
| Long-Term Repairs (FY 2024– 2025) | \$1,426,800.00 |
| TOTAL ESTIMATED COST | \$2,881,150.00 |





A detailed cost estimate is provided in the table on the following page, entitled "Projected Five Year Construction Costs."

The construction costs are based on current prices in the New Haven area for labor, equipment and materials. The estimated construction costs also include a 20% contingency factor to account for uncertainties in the restoration market at the time of bidding, and a preliminary design, construction management fee and program management fee estimated at 25% of total construction cost has been provided for budgeting purpose.





Table 1 Union Station Parking Garage Projected Five Year Construction Cost

(FY 2020)

| | Work Description | | Prioritized Repairs (FY 2021) | | Early Repairs (FY 2022) | | Programmed Repairs (FY 2023) | | Long-Term Repairs (FY 2024-2025) |
|---------|---|-------------|-------------------------------------|------|-------------------------------|----------|------------------------------------|--------------|--|
| A. Cond | crete Repair: | | | | | | | | |
| 1 | Partial Depth Concrete Deck Repair | \$ | - | \$ | 160,000.00 | \$ | - | \$ | 18,000.00 |
| 2 | Misc. Vertical Concrete Repair (i.e. column bases) | \$ | - | \$ | 34,000.00 | \$ | - | \$ | 4,000.00 |
| 3 | Miscellaneous Concrete Curb/Sidewalk Repair | \$ | _ | \$ | 20,000.00 | \$ | _ | \$ | 3,000.00 |
| 4 | Miscellaneous Concrete Facade Repair | \$ | - | \$ | - | \$ | - | \$ | - |
| 5 | Miscellaneous Stair Repair | \$ | - | \$ | - | \$ | - | \$ | - |
| 6 | Concrete Scaling Repair/Application of Healer/Sealer | \$ | - | \$ | 163,000.00 | \$ | - | \$ | 18,000.00 |
| | erproofing Repair: | , | | ÷ | | <u> </u> | | H | |
| 1 | Crack Repair | \$ | - | \$ | 5,000.00 | \$ | - | \$ | 1,000.00 |
| 2 | Construction Joint Repair | \$ | - | \$ | 5,000.00 | \$ | - | \$ | 1,000.00 |
| 3 | Cove Joint Repair/Replacement | \$ | - | \$ | 89,000.00 | \$ | | \$ | 10,000.00 |
| 4 | Decorative Precast Façade - Waterproofing Coating (incl. concrete repair/epoxy injection) ALLOWANCE | \$ | | \$ | - | \$ | | \$ | - |
| | itectural Improvements: | - 1 * | | Ψ, | | <u> </u> | | Ť | |
| 1 | Exterior Architectural Coating | I s | - | I \$ | - | \$ | | \$ | _ |
| 2 | Main Lobby Enhancements (Elevator Lobby, Ground Level only) | \$ | | \$ | | \$ | | \$ | 210,000.00 |
| 3 | Vehicular Entrance Enhancements (painting of ceiling and vertical surfaces) | \$ | | \$ | | \$ | | \$ | 17,000.00 |
| 4 | Epoxy Flooring/Supplemental Treads within Stairs (west stair only) | \$ | | \$ | 64,000.00 | \$ | - | \$ | 17,000.00 |
| 5 | Comprehensive Cleaning | \$ | | \$ | 04,000.00 | \$ | - | \$ | 105,000.00 |
| 6 | Replace Stair Storefronts, Lower Levels | \$ | | \$ | | \$ | 400,000.00 | | 105,000.00 |
| | | ψ | | φ | | φ | 400,000.00 | Ψ | |
| D. Weci | hanical/Plumbing/Electrical Work: Drain Flushing (w/ Construction) | \$ | _ | \$ | _ | \$ | - | s | |
| 2 | Misc. Mechanical/Plumbing Repairs | \$ | | \$ | | \$ | | \$ | |
| | - : | | | _ | | _ | | _ | |
| 3 | Main Lobby Enhancements (Elevator Lobby, Ground Level only) | \$ | | \$ | | \$ | | \$ | 14,000.00 |
| 4 | Vehicular Entrance Lighting Enhancements | \$ | - | \$ | | \$ | - | \$ | 14,000.00 |
| 5 | Elevator Machine Room HVAC Contorol | | - | - | - | · | - | | |
| 6 | Surge Protection | \$ | | \$ | | \$ | | \$ | |
| 7 | Miscellaneous Electrical Repairs | \$ | - | \$ | <u> </u> | \$ | - | \$ | |
| 8 | Lighting/Signage Control System Programming & Adjustments with Related Training | \$ | - | \$ | - | \$ | - | \$ | |
| 9 | Replacement of Lighting at Bike Shelters | \$ | | \$ | 45,000.00 | \$ | - | \$ | - |
| 10 | | \$ | - | \$ | 4,000.00 | \$ | - | \$ | - |
| E. Elev | vator Upgrades and Improvements: | | | | | | | _ | |
| | Maintenance Audit (Bi-Ennial) | \$ | - | \$ | 2,000.00 | \$ | - | \$ | 2,000.00 |
| | enue Control Equipment Renewal & Replacement | | | | | | | | |
| 1 | Study for the Replacement of the Revenue Control Equipment | \$ | - | \$ | - | \$ | 12,000.00 | - | - |
| 2 | Replacement of the Revenue Control Equipment | \$ | - | \$ | - | \$ | - | \$ | 420,000.00 |
| F. Sec | urity Improvements | | | | | | | | |
| | Installation of Security System (i.e. Cameras and other components) | \$ | - | \$ | - | \$ | - | \$ | - |
| G. Sign | age Improvements: | | | | | | | | |
| | | \$ | - | \$ | - | \$ | - | \$ | - |
| H. Site | Improvements: | | | | | | | | |
| | Sidewalk Replacement (including stenciled concrete) | \$ | - | \$ | - | \$ | - | \$ | 147,000.00 |
| I. File | Management | | | | | | | | |
| 1 | Preparation of Record Drawings | \$ | - | \$ | - | \$ | - | \$ | - |
| 2 | Scanning of Original Drawings | \$ | - | \$ | - | \$ | - | \$ | - |
| | Sub-Total | | \$0.00 | | \$591,000.00 | l - | \$412,000.00 | 1 | \$984,000.00 |
| | 20% Contingencies (Except Depicted Otherwise) | | \$0.00 | 1 | \$118,200.00 | | \$82,400.00 | t | \$196,800.00 |
| | 25% Engr. & Construction Management, incl. Program Management (Unless Depicted Otherwise) | | \$0.00 | | \$147,750.00 | | \$103,000.00 | | \$246,000.00 |
| | Total Phased Construction Costs with Contingencies: | - | \$0.00 | + | \$856,950.00 | - | \$597,400.00 | \leftarrow | \$1,426,800.00 |
| | | | | | | | | | |

TOTAL Construction Cost with Contingencies:

\$2,881,150.00

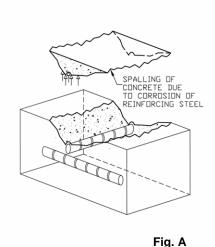
Note 1: Costs Presented do not Include Typical Operational & Maintenance Costs Except as Noted.

Note 2: Costs include a 15% allowance for General & Special Conditions.

Note 3: Future costs incorporate a cumulative 5% inflation for all costs, to be adjusted annually







6. DETERIORATION MECHANISMS

Reinforced concrete deterioration is typically caused by one or more factors of deterioration mechanisms including corrosion of reinforcement, water penetration, freeze-thaw cycling, volume change, or chemical attack. Any one or combination of these deterioration mechanisms can adversely affect the behavior/performance of a reinforced concrete structure. These adverse impacts include corrosion-induced distress, loss of reinforcing cross section, scaling, leaking, cracking, and delamination of concrete. The following is a brief discussion of each of the mechanisms noted above, and their effect on reinforced concrete structures.

WATER PENETRATION:

The primary cause of the majority of reinforced concrete deterioration within parking structures is directly related to the penetration of water into the concrete. Reinforcing corrosion, concrete scaling, water leakage, leaching, and concrete delamination are all caused at least partially by water penetration.

Concrete is a porous material, susceptible to water penetration which can result in increased potential for deterioration. Corrosion of reinforcing steel is an electrochemical process accelerated by the presence of water acting as an electrolyte. In addition, water penetrating into concrete (*Fig. A*) can carry water-soluble chlorides (de-icing salts) to the reinforcing. The combination of chlorides and water further accelerates this corrosion process.

Scaling is also directly related to water penetration into concrete. Scaling is a surface deterioration resulting from pressures by freeze-thaw cycling of saturated concrete. These pressures within the pore structure cause progressive failure of the cement/sand paste. This progressive failure begins with degradation of the exposed surface, advances to the exposure of coarse aggregate, and in severe cases, causes paste failure surrounding the coarse aggregate, destroying the paste/aggregate bond.





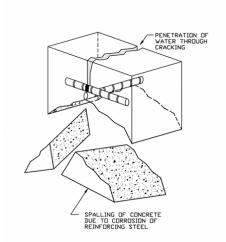


Fig. B

Water penetration through a concrete section, cracked or not, can cause leaching of minerals from within the concrete matrix. Leaking of the parking deck exposes embedded reinforcing steel and underlying structural members to water and chloride ions (road salt) resulting in structural deterioration and potentially a loss of load carrying capacity of these building elements. Leaching is the result of frequent water penetration carrying water-soluble products from within the concrete to the surface below. Leached materials that tend to collect on overhead concrete surfaces are unsightly and potentially damaging to patron's vehicles using the parking facility.

Water penetration can also cause delamination of concrete along subsurface fractures through pressures generated during freezethaw cycling.

CORROSION OF REINFORCEMENT:

Corrosion of reinforcing steel or other embedded ferrous items such as electrical conduit is a second major factor contributing to deterioration of reinforced concrete (*Fig B*).

The corrosion process is an electrochemical process, which produces iron oxide (rust) and other by-products. These by-products occupy a minimum of 250% of the volume of the parent metal. This increase in volume produces tensile stresses within the surrounding concrete.

Because concrete has poor tensile strength properties, cracking occurs within the concrete matrix allowing additional moisture and chlorides to reach the reinforcing causing acceleration of the corrosion process. The deterioration caused by this corrosion includes the reduction of cross sectional area of the reinforcing, and the delamination of concrete surrounding the reinforcement.

Freeze-Thaw Damage:

Concrete deterioration caused by freeze-thaw cycles is a third major deterioration mechanism. The mechanism occurs within saturated





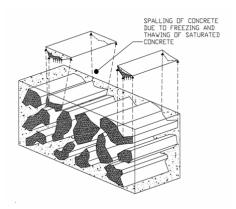


Fig. C

concrete subjected to freezing and thawing due to the pressures generated within the pores of the concrete paste resulting from the volume changes of water during the freeze/thawing process. These pressures are even greater in the presence of de-icing chemicals/chlorides as these chemicals reduce the freezing point and indirectly increase the pore pressures.

As previously mentioned, these pressures can cause progressive failure of the cement paste and result in scaling of the concrete, and delamination of concrete along subsurface fracture planes (Fig. C).

VOLUME CHANGES:

Volume changes are a fourth major contributing factor of deterioration of reinforced concrete structures. These volume changes occur in both plastic and cured concrete. These volume changes can cause various types of cracking within the concrete member.

These cracks allow access for water and contaminants to the concrete and reinforcing, resulting accelerated deterioration to occur. The cracking most often associated with plastic concrete is shrinkage cracking produced by the reduction in volume of the concrete during curing. Improper detailing, proportioning, placement, or curing of the concrete can affect the extent of this cracking, but the primary cause is the volume change that occurs during curing.

Volume changes due to thermal movement, shrinkage, creep, and loading can also contribute to the deterioration of reinforced concrete. These volume changes will produce stress in restrained members, often resulting in cracking of the member (*Fig. D*). These cracks also provide access to water and other deterioration mechanisms to attack the member.

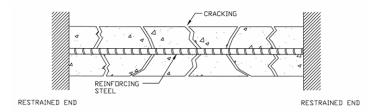


Fig. D





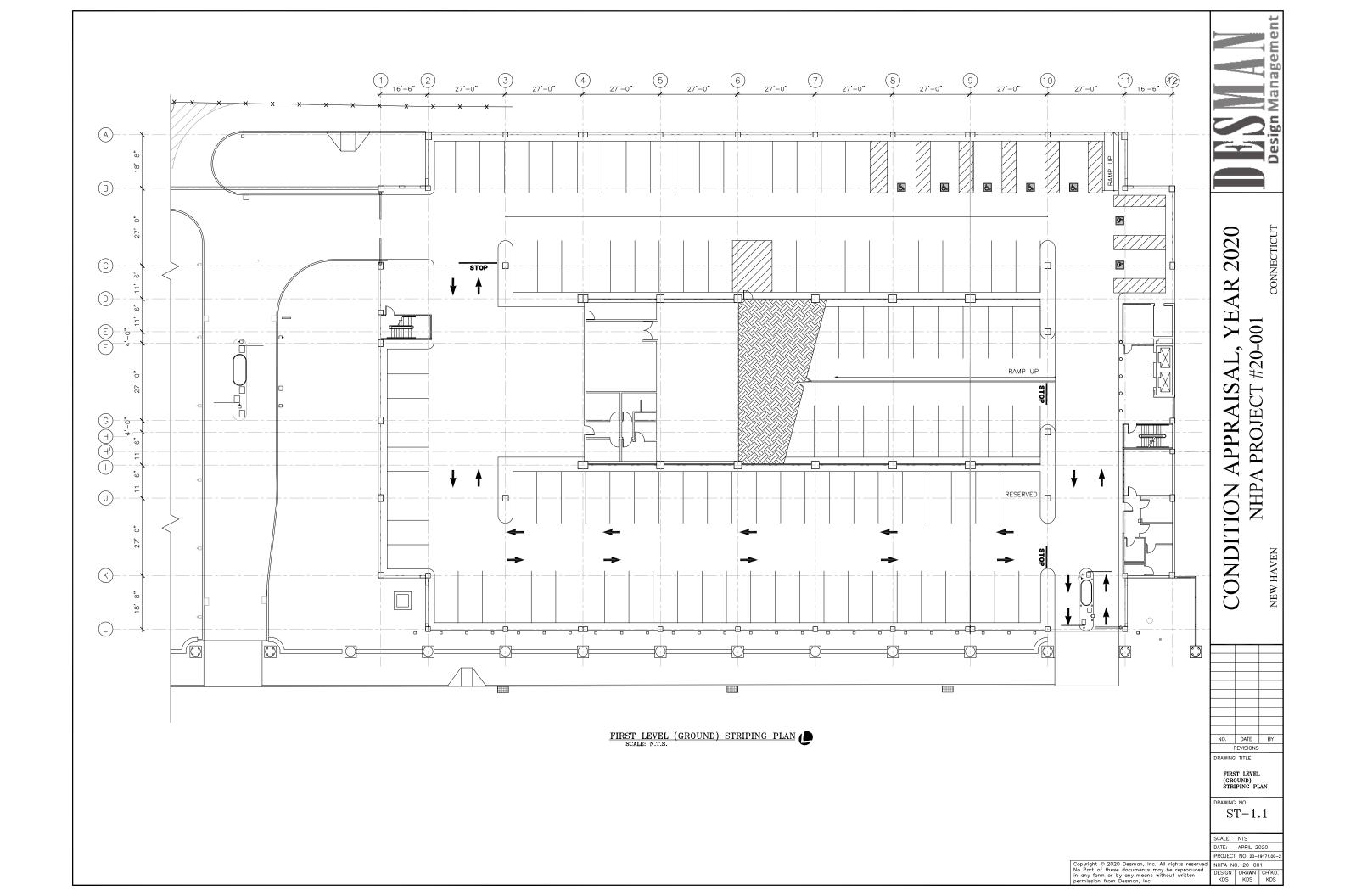
CHEMICAL ATTACK:

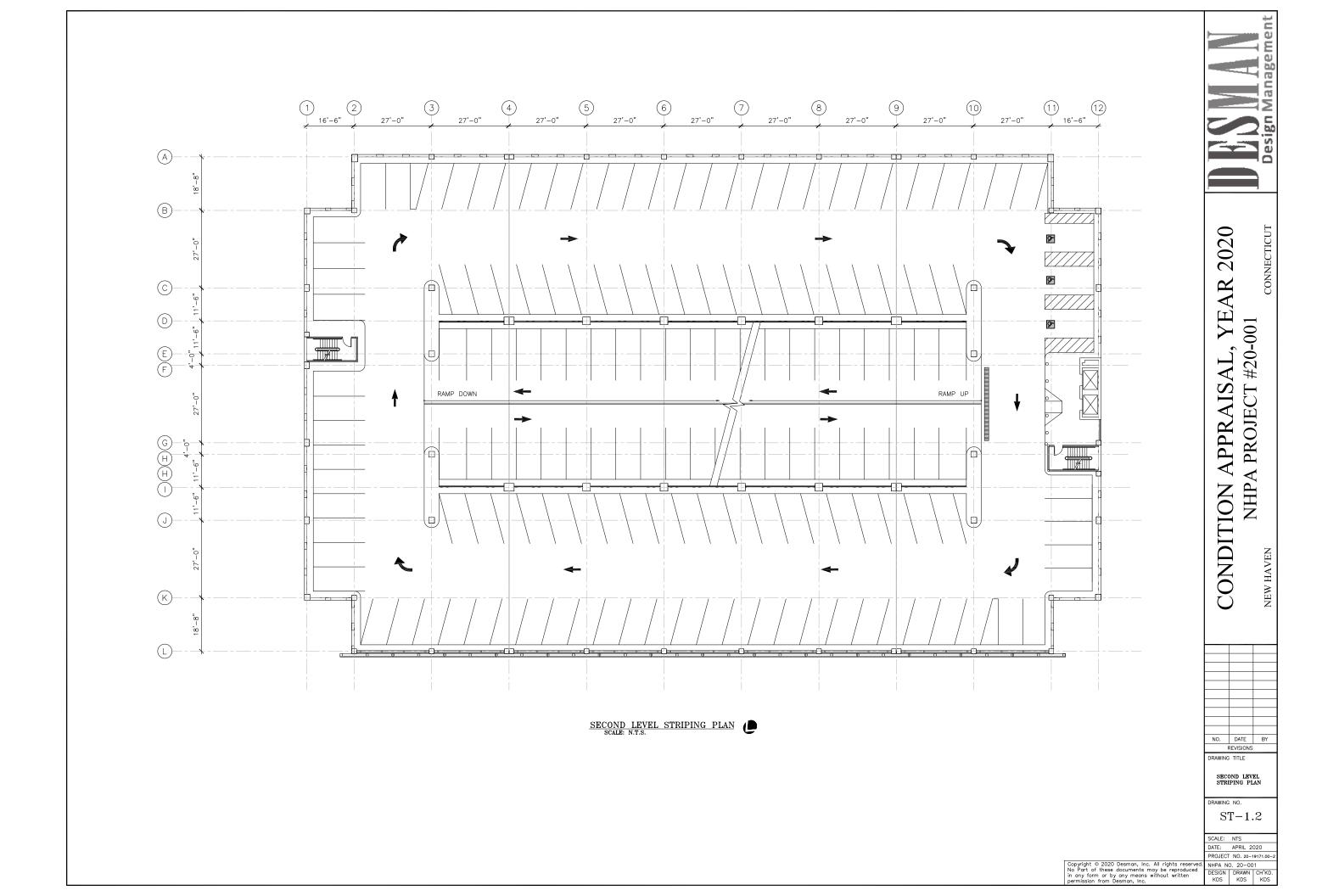
Chemical attack is a fifth major deterioration mechanism affecting the performance of reinforced concrete. The effect of de-icing chemical/chlorides upon reinforcing steel and scaling is one example of chemically influenced deterioration. Severe exposure to other chemicals, notably sulfates and acids, can also cause deterioration of cement paste, cement paste/aggregate bond, and reinforcing steel. Chemical properties occurring within certain types of aggregates can also cause an adverse reaction with the cement paste. The resulting volume changes can cause cracking of the concrete.

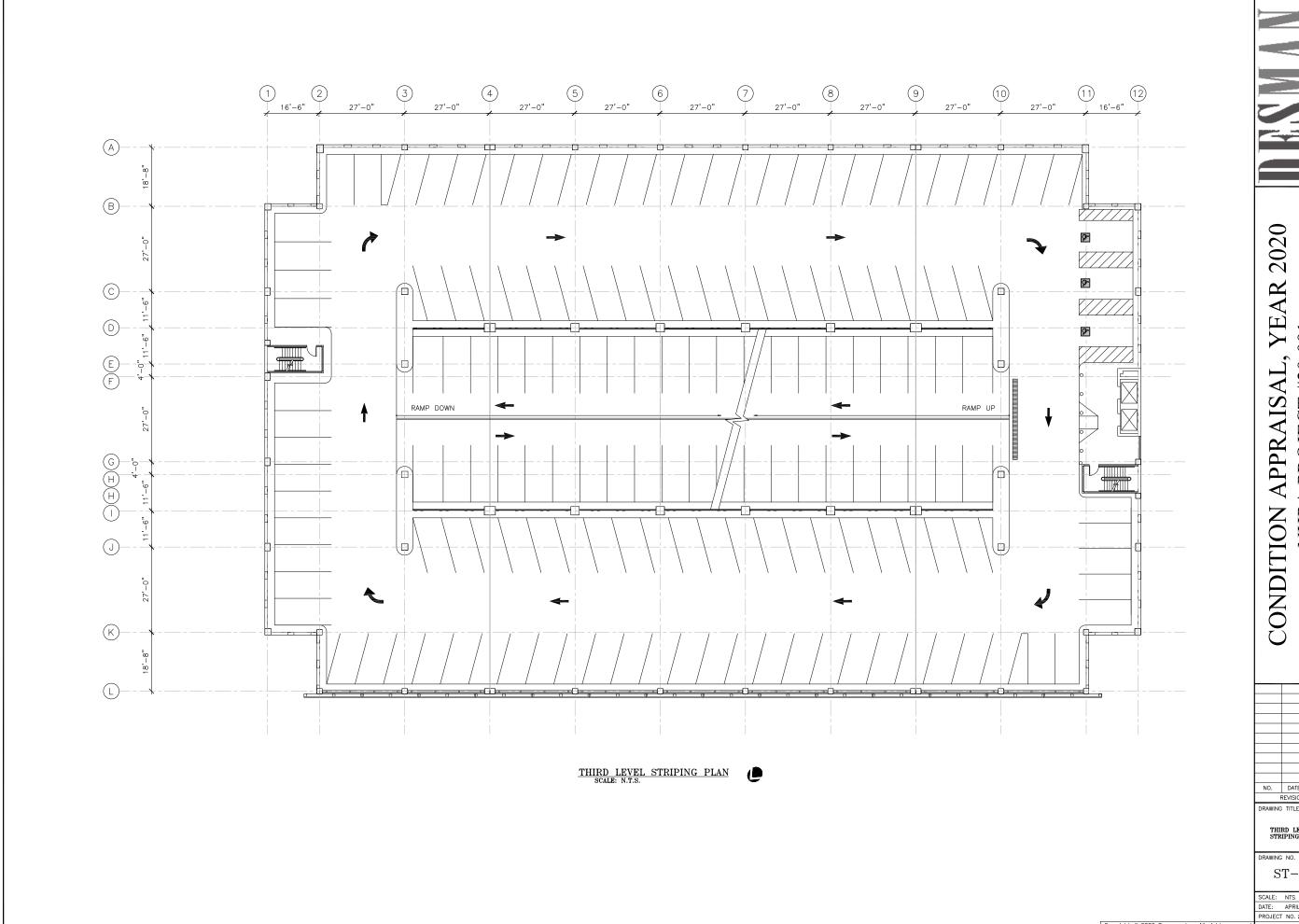


8. APPENDIX A – SCHEMATIC FLOOR PLANS









CONNECTICUT YEAR 2020 NHPA PROJECT #20-001 CONDITION APPRAISAL,

NEW HAVEN

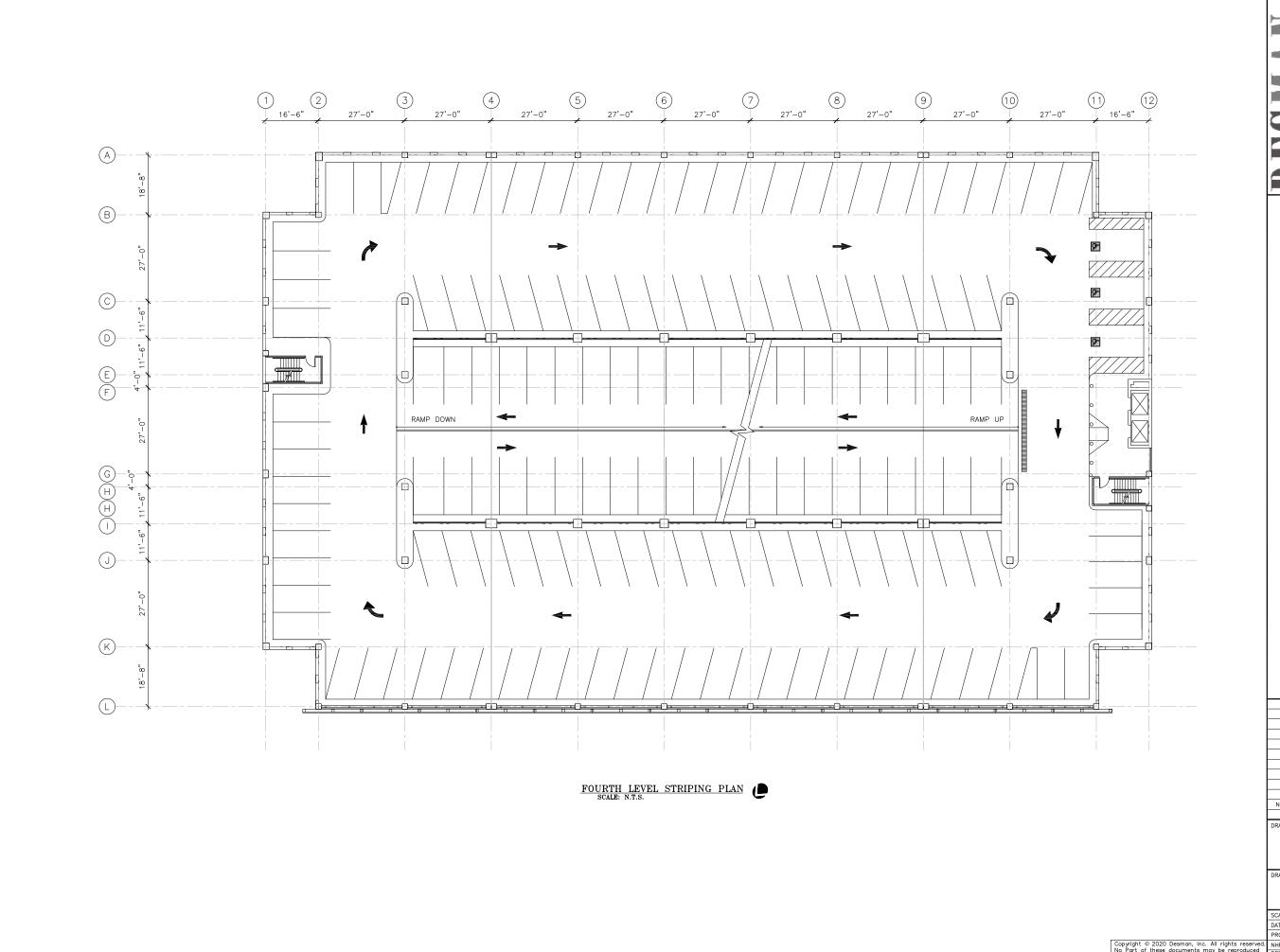
NO. DATE BY REVISIONS

THIRD LEVEL STRIPING PLAN

ST-1.3

| SCALE: NTS | DATE: APRIL 2020 | PROJECT NO. 20-19171.00-2 | NHPA NO. 20-001 | DESIGN | DRAWN | CH'KD. KDS | KDS

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CONNECTICUT YEAR 2020 NHPA PROJECT #20-001 CONDITION APPRAISAL,

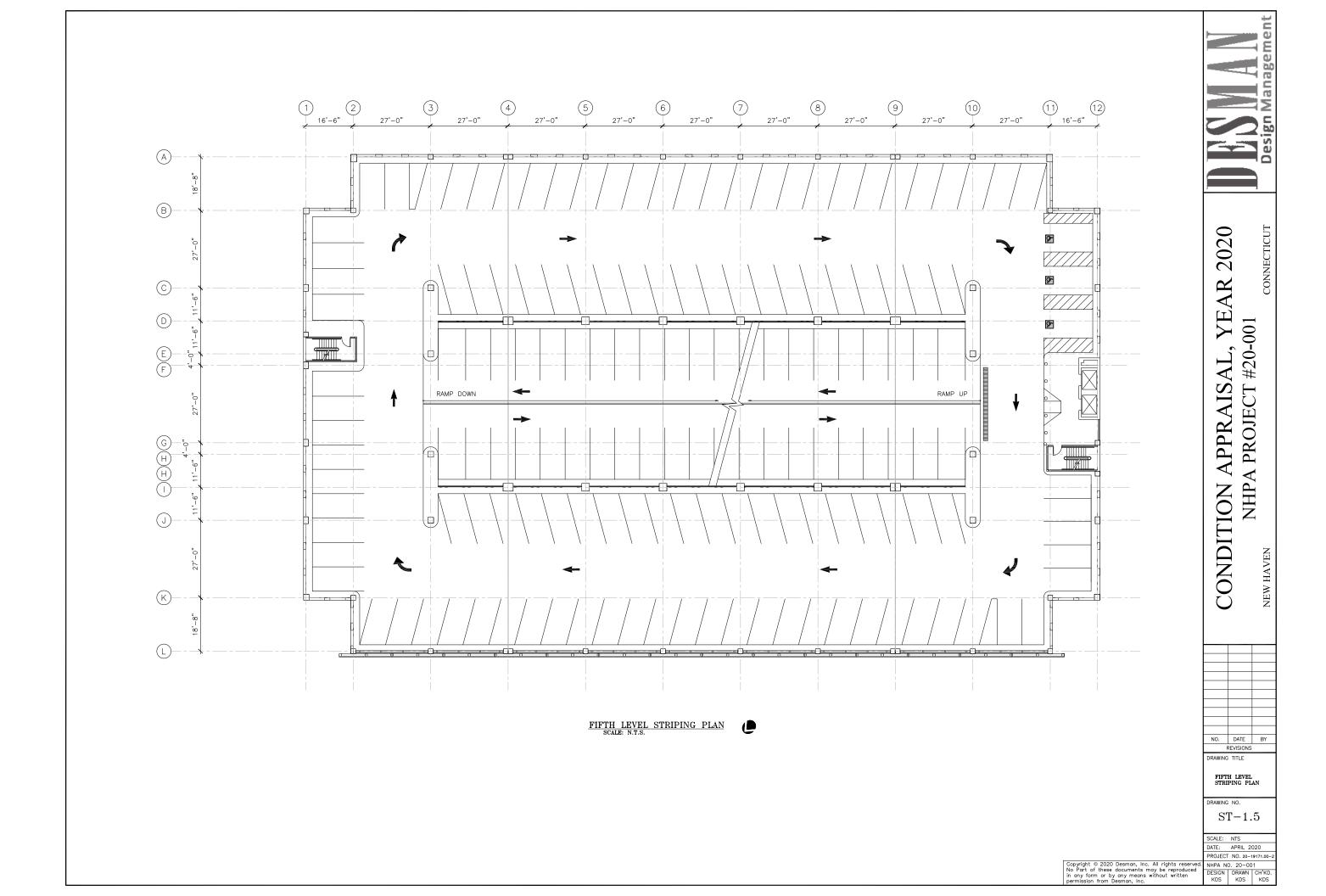
NEW HAVEN

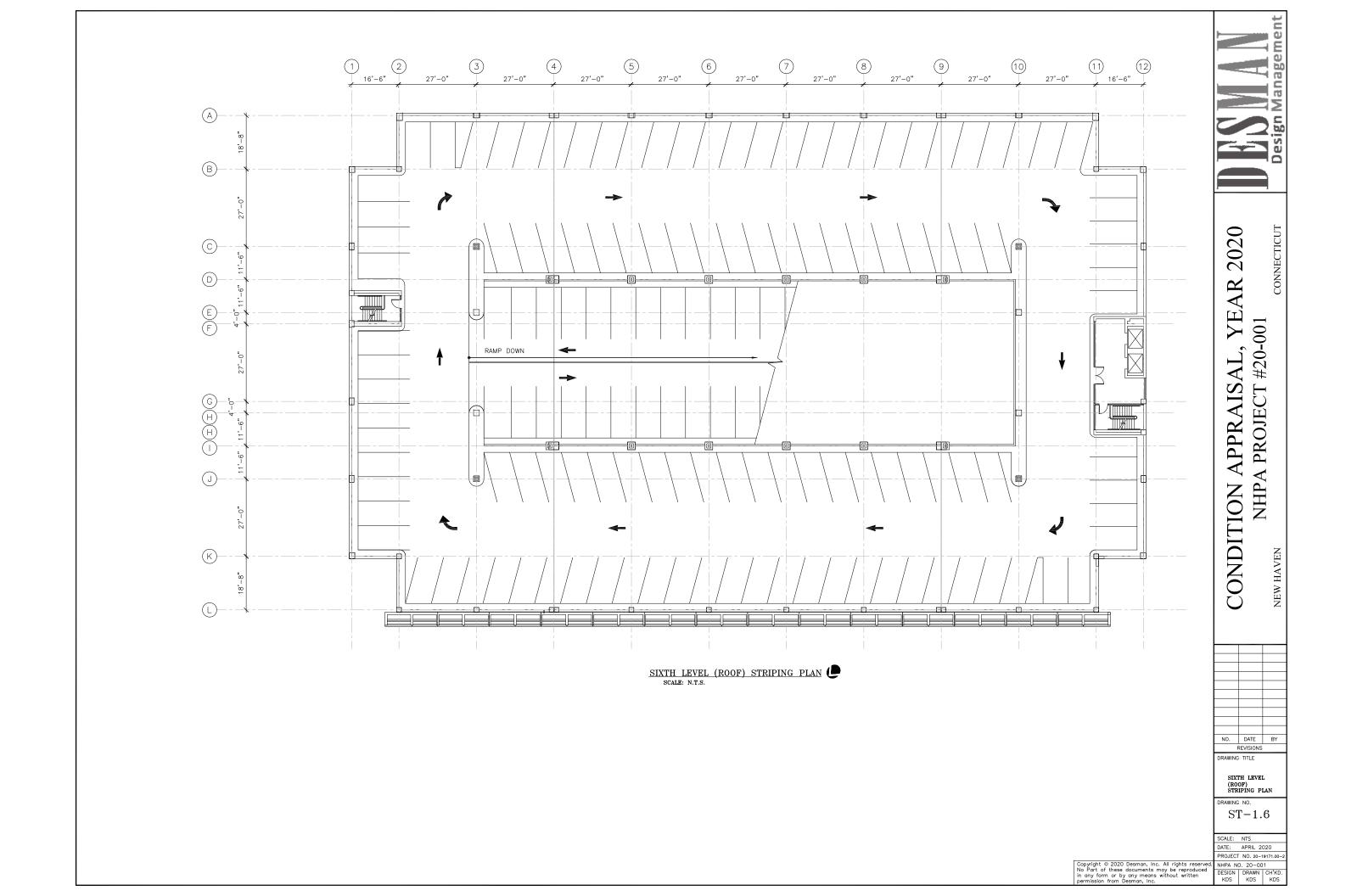
NO. DATE BY REVISIONS FOURTH LEVEL STRIPING PLAN

DRAWING NO. ST-1.4

| SCALE: NTS | DATE: APRIL 2020 | PROJECT NO. 20-19171.00-2 | NHPA NO. 20-001 | DESIGN | DRAWN | CH'KD. KDS | KDS

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9. APPENDIX B – MAINTENANCE SCHEDULES AN D CHECKLISTS/
SEASONAL WASHDOWN CHECKLIST





| A. Cleaning: | Daily | Weekly | Monthly | 4 Month Interval | 6 Month Interval | Yearly | Other |
|---|-------|--------|---------|---------------------|---------------------|--------|--------|
| 1. Sweeping - Localized | R | М | | | | | |
| 2. Sweeping - all Areas (including curbs) | | R | М | | | | |
| 3. Expansion Joints | | R | М | | | | |
| 4. Empty Trash Cans | R | M | | | | | |
| 5. Restrooms: | | | | | | | |
| a. Floors | R | M | | | | | |
| b. Fixtures | | M | | | | | |
| c. Walls | | R | M | | | | |
| 6. Cashier's Booths: | R | | | | | | |
| a. Floors | | M | | | | | |
| b. Fixtures | | M | | | | | |
| c. Walls | | R | М | | | | |
| d. Windows | R | R | М | | | | |
| 7. elevators: | | | | | | | |
| a. floors | R | M | | | | | |
| b. Doors | | R | М | | | | |
| c. Door Tracks | | M | | | | | |
| d. Windows (if glass back elevator): | | | | | | | |
| - Interior Elevator Glass | | R | М | | | | |
| - Exterior Elevator Glass (exterior of cab/interior of shaft) | | | | | | R/M | |
| 8. Stairs: | | | | | | | |
| a. Floors | | R | М | | | | |
| b. Handrails | | R | М | | | | |
| c. Windows: | | | | | | | |
| - Interior Window Surfaces | | | R | М | | | |
| - Exterior Window Surfaces (inclusive of exterior of back elevator shaft) | | | | | | R/M | |
| 9. Offices (Management/Security): | | | | | | | |
| a. Floors | R | М | | | | | |
| b. Windows: | | | | | | | |
| - Interior Surfaces | | R | М | | | | |
| - Exterior Surfaces | | | R | М | | | |
| 10. Electrical/Mechanical Rooms | | | | | | | |
| 11. Wash Down Parking Decks | | | | | *R | *M | |
| 12. Wash Down Revenue Control Equipment | 1 | R | М | | | | Note 3 |





| B. Doors & Door Hardware: | Daily | Weekly | Monthly | 4 Month | 6 Month | Yearly | Other |
|--|-------|--------|---------|---------------------|---------------------|--------|--------|
| D. Boots a Boot Haraware. | • | , | Wonting | Interval | Interval | rearry | other |
| Doors close & Latch Properly | R | М | | | | | |
| 2. Mechanized Doors: | | | | | | | |
| a. Pedestrian Doors | R | M | | | | | |
| b. Rolling Grill Doors | R | M | | | | | |
| 3. Panic Hardware at Security Doors | R | М | | | | | |
| 4. Lubricate mechanized Doors: | | | | | | | |
| a. Pedestrian Doors | | | R | | M | | |
| b. Rolling Grill Doors | | | R | | М | | |
| C. Electrical System: | Daily | Weekly | Monthly | 4 Month Interval | 6 Month Interval | Yearly | Other |
| Check Lighting Fixtures | | R | М | | | | |
| 2. relamp Fixtures | | R | | M | | | |
| Replace Fixture Ballasts | | | R | M | | | |
| 4. Inspect - Specialized Electrical Equipment: | | | | | | | |
| a. Time Clocks | | | | R | М | | Note 3 |
| b. Photo Cells | | | | R | M | | Note 3 |
| c. Lighting Control Equipment | | | | R | М | | Note 3 |
| d. Other | | | | | | R/M | Note 1 |
| Electrical Distribution Panels | | | | | R | M | |
| 6. surface Mounted conduit | | | | | R | M | |
| 7. Sprinkler System Compressor | | | | | R | M | |
| 8. fire alarm System | | | | R | М | | Note 2 |
| D. Elevator Operation: | Daily | Weekly | Monthly | 4 Month Interval | 6 Month Interval | Yearly | Other |
| Check for Normal Operation | R | М | | | | | |
| 2. Check Elevator Indicator Lights: | | | | | | | |
| a. Interior | R | М | | | | | |
| b. Exterior | R | М | | | | | |
| 3. Check Audible Tones (ADA level enunciators) | | R | М | | | | |
| Elevator Service - Preventive Maintenance | | | | | R | M | Note 2 |
| E. Heating, Ventilation & Air Conditioning: | Daily | Weekly | Monthly | 4 Month Interval | 6 Month Interval | Yearly | Other |
| 1. Check for Proper Operation: | | | | | | | |
| a. Heating Equipment | | R | | М | | | Note 3 |
| b. Ventilation Equipment | | R | М | | | | Note 3 |
| c. A/C Equipment | | R | | М | | | Note 3 |
| 2. Check Filters | | | | | | R/M | Note 1 |
| | 1 | 1 | 1 | 1 | 1 | | |





| F. Painting: | Daily | Weekly | Monthly | 4 Month | 6 Month | Yearly | Other |
|--|-------|--------|---------|---------------------|---------------------|--------|--------|
| | | | , | Interval | Interval | • | |
| Check for repaint Failure & Rusting: | | | | | | | |
| a. Doors & Door Frames | | | | R | M | | |
| b. Handrails & Guardrails | | | | R | M | | |
| c. Steel Bollards/Pipe Guards | | | | R | M | | |
| d. Exposed Piping (fire suppression system & storm drainage) | | | | | R | M | |
| e. Other Miscellaneous Metals | | | | R | M | | |
| 2. Check for Appearance: | | | | | | | |
| a. Striping | | | | R | M | | |
| b. Curbs | | | R | | M | | |
| c. Walls | | | | R | M | | |
| d. Ceilings | | | | | R | М | |
| e. Signs | | | R | М | | | |
| f. Touch-up Paint | | | R | | M | | |
| 3. Repainting | | | | | | R/M | Note 1 |
| G. Parking/Revenue Control Equipment: | Daily | Weekly | Monthly | 4 Month Interval | 6 Month Interval | Yearly | Other |
| Check for Proper Operation | R | М | | | | | |
| Parking/Revenue Control Equip - Preventive Maintenance | | | | | | | Note 3 |
| | | | | 4 Month | 6 Month | Yearly | |
| H. Plumbing/Drainage Systems: | Daily | Weekly | Monthly | Interval | Interval | | Other |
| 1. Check for Proper Operation: | | | | | | | |
| a. Sanitary Facilities | R | М | | | | | |
| b. Portable Water System | | | R | | M | | |
| c. Deck Wash down System | | | | | | | |
| d. Floor Drains/Storm Risers | | | | | R | M | |
| e. Fire Suppression Systems: | | | | | | | |
| - Sprinkler System | | | | | | R/M | Note 3 |
| - Dry Fire Standpipe System | | | | | | R/M | Note 3 |
| 2. Drain Down Systems for Winter | | | | | | R/M | Note 3 |





| I. Waterproofing: | Daily | Weekly | Monthly | 4 Month Interval | 6 Month Interval | Yearly | Other |
|--|-------|--------|---------|---------------------|---------------------|--------|-------|
| 1. Check for Leaks: | | | | | | | |
| a. Roofing | | | R | | M | | |
| b. Joint/Crack Sealants | | | R | | M | | |
| c. Expansion Joints | | | R | | M | | |
| d. Windows, Doors & Walls | | | R | | M | | |
| e. Parking Deck - Waterproofing Membrane | | | R | | M | | |
| 2. Check for Deterioration: | | | | | | | |
| a. Roofing | | | | | R | M | |
| b. Joint/Crack Sealants | | | | | R | M | |
| c. Expansion Joints | | | | | R | M | |
| d. Windows, Doors & Walls | | | | | R | M | |
| e. Parking Deck - Waterproofing Membrane | | | | | R | M | |
| J. Safety Checks: | Daily | Weekly | Monthly | 4 Month Interval | 6 Month Interval | Yearly | Other |
| 1. Handrails & Guardrails | | | R | М | | | |
| 2. Emergency Exit Signs | | R | M | | | | |
| 3. Emergency Lights | | R | M | | | | |
| 4. Tripping Hazards: | | | | | | | |
| a. Supported Concrete Slabs | R | M | | | | | |
| b. Concrete Slab-on-grade | R | М | | | | | |
| c. Stairs (interior & exterior) | R | М | | | | | |
| d. Sidewalks & Curbs (interior & exterior) | R | M | | | | | |
| K. Pedestrian & Vehicular Signage: | Daily | Weekly | Monthly | 4 Month Interval | 6 Month Interval | Yearly | Other |
| 1. Check Signs: | | | | | | | |
| a. Proper Placement/Positioning | | R | М | | | | |
| b. Clean | | | | R | M | | |
| c. Legibility | | | R | М | | | |
| d. Illuminated Signs or Changeable Information Signs | R | M | | | | | |





| L. Snow & Ice Removal: | Daily | Weekly | Monthly | 4 Month Interval | 6 Month Interval | Yearly | Other |
|---|----------------------------------|--------|------------|---------------------|---------------------|-----------------------------|-------|
| Check for Icy Spots (in season) | R/M | | | | | | |
| 2. Remove Snow & Ice (in season) | R/M | | | | | | |
| M. Structural System: | Daily | Weekly | Monthly | 4 Month Interval | 6 Month Interval | Yearly | Other |
| Check Structure for: | | | | | | | Ī |
| a. Soffit (overhead) Deterioration | | | R | M | | | |
| b. Floor Surface Deterioration (see safety checks) | | | | R | M | | |
| c. Wall & Column Deterioration | | | R | M | | | |
| d. Cracking Concrete | | | | R | M | | |
| e. Water Leakage | | | | R | M | | |
| f. Rusting Structural Steel | | | | R | M | | |
| g. Rusting Embedment's within Concrete | | | | R | M | | |
| h. Unusual and/or Unequal Settlement | | | | | R | M | |
| N. Repair | | | As per Eng | ineer's Recom | mendation | | |
| O. Repair and/or Replace Protective Concrete Coatings | As per Engineer's Recommendation | | | | | | |
| | Frequency | | | | | | |
| Notes for Maintenance Checklist: | · | | | | | R*=Spring & Fa M*=Spring | II |

- A frequency should be selected that is appropriate for that element in the specific parking garage. Spot repairs or replacements should be performed as needed.
- 2. This equipment should be under a service contract for regular preventative maintenance and emergency service. The equipment manufacturer's recommendations for inspection and preventative maintenance should be followed.
- This equipment should either be under a service contract for regular preventative maintenance and emergency service, or in-house staff should be specifically trained to provide the required service. The equipment manufacturer's recommendations for inspection and preventative maintenance should be followed.



MAINTENANCE CHECKLISTS DAILY CHECKLIST



| 1. Sweeping - Localized | A. Cleaning: | | | |
|--|---------------|------------|---|---|
| 3. Restrooms: a. Floors | 1. | Sweeping | g - Localized | |
| a. Floors b. Fixtures 4. Cashier's Booths: a. Floors b. Fixtures 5. Elevators: a. Floors c. Door Tracks 6. Offices (Management/Security): a. Floors B. Doors & Door Hardware: 1. Doors Close & Latch Properly 2. Mechanized Doors a. Pedestrian Doors b. Rolling Grill Doors 3. Panic Hardware at Security Doors C. Elevator Operation: 1. Check for Nornal Operation 2. Check Elevator Indicator Lights: a. Interior b. Exterior D. Landscaping: 1. Remove Trash C. Water/Irrigate (dependent upon time of year & type of planting) E. Parking/Revenue Control Equipment: 1. Check for Proper Operation F. Plumbing/Drainage Systems: 1. Check for Proper Operation a. Sanitary Facilities G. Safety Checks: 1. Tripping Hazards: a. Supported Concrete Slabs b. Concrete Slabs-on-Grade c. Slairs (Interior & Exterior) d. Sidewalks & Curbs (Interior & Exterior) H. Security System: 1. Check for Proper Operation b. Intercom System c. CITY Surveillance System 1. Check Signs: a. Illuminated Signs or Changeable Information Signs J. Snow & Ice Removal: 1. Check for Ipy Spots (in season) | 2. | Empty Tr | ash Cans | |
| D. Fixtures | 3. | Restroom | ns: | |
| 4. Cashier's Booths: | | a. | Floors | |
| a. Floors b. Fixtures 5. Elevators: a. Floors c. Door Tracks 6. Offices (Management/Security): a. Floors B. Doors & Door Hardware: 1. Doors Close & Latch Properly 2. Mechanized Doors b. Rolling Grill Doors c. Pedestrian Doors b. Rolling Grill Doors c. Pedestrian Doors c. Pedestrian Doors c. Pedestrian Doors c. Rolling Grill Doors c. Pedestrian Doors c. Rolling Grill Doors c. Pedestrian Doors c. Pedestrian Doors c. Rolling Grill Doors c. Ro | | b. | Fixtures | |
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| 1. Check for Proper Operation: a. Sanitary Facilities G. Safety Checks: 1. Tripping Hazards: a. Supported Concrete Slabs b. Concrete Slab-on-Grade c. Stairs (Interior & Exterior) d. Sidewalks & Curbs (Interior & Exterior) H. Security System: 1. Check for Proper Operation b. Intercom System c. CCTV Surveillance System I. Pedestrian & Vehicular Signage: 1. Check Signs: a. Illuminated Signs or Changeable Information Signs J. Snow & Ice Removal: 1. Check for Icy Spots (in season) 2. Remove Snow & Ice (in season) | | | | |
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| d. Sidewalks & Curbs (Interior & Exterior) H. Security System: 1. Check for Proper Operation | | b. | • • | |
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| 1. Check for Proper Operation b. Intercom System c. CCTV Surveillance System l. Pedestrian & Vehicular Signage: 1. Check Signs: a. Illuminated Signs or Changeable Information Signs J. Snow & Ice Removal: 1. Check for Icy Spots (in season) 2. Remove Snow & Ice (in season) | | d. | Sidewalks & Curbs (Interior & Exterior) | |
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| c. CCTV Surveillance System I. Pedestrian & Vehicular Signage: 1. Check Signs: a. Illuminated Signs or Changeable Information Signs J. Snow & Ice Removal: 1. Check for Icy Spots (in season) 2. Remove Snow & Ice (in season) | 1. | Check fo | r Proper Operation | _ |
| I. Pedestrian & Vehicular Signage: 1. Check Signs: a. Illuminated Signs or Changeable Information Signs J. Snow & Ice Removal: 1. Check for Icy Spots (in season) 2. Remove Snow & Ice (in season) | | b. | Intercom System | |
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| a. Illuminated Signs or Changeable Information Signs J. Snow & Ice Removal: 1. Check for Icy Spots (in season) 2. Remove Snow & Ice (in season) | I. Pedestrian | & Vehicu | lar Signage: | |
| J. Snow & Ice Removal: 1. Check for Icy Spots (in season) 2. Remove Snow & Ice (in season) | 1. | Check Si | gns: | _ |
| 1. Check for Icy Spots (in season) 2. Remove Snow & Ice (in season) | | | 5 5 | Ш |
| 2. Remove Snow & Ice (in season) | | | | |
| Supervisor: | | | | |
| | 2. | Remove | Snow & Ice (In season) | Ш |
| | | | | |
| | Superv | isor: | | |
| | - | | | |



MAINTENANCE CHECKLISTS WEEKLY CHECKLIST



| A. Cleanir | ng: | | |
|-------------|-------------|--|---|
| | 1. | Sweeping - All Areas (including curbs) | |
| | 2. | Expansion Joints | |
| | 3. | Restrooms: | |
| | | a. Walls | Ш |
| | 4. | Cashier's Booths: | |
| | | a. Walls | |
| | 5. | b. Windows Elevators: | Ш |
| | 5. | a. Doors | П |
| | | b. Windows (if glass back elevator): | |
| | | - Interior Elevator Glass | П |
| | 6. | Stairs: | _ |
| | | a. Floors | |
| | | b. Handrails | |
| | 7. | Offices (Management/Security): | |
| | | a. Windows: | |
| | | - Interior Surfaces | |
| | 8. | Wash Down Revenue Control Equipment | |
| B. Electric | cal S | | _ |
| | 1. | Check Lighting Fixtures | |
| | 2. | Relamp Fixtures | Ш |
| C. Elevato | - | | |
| D. Haatin | 1. | Check Audible Tones (ADA level annuciators) entilation & Air Conditioning: | Ш |
| D. Heating | y, ve 1. | Check for Proper Operation: | |
| | ١. | a. Heating Equipment | П |
| | | b. Ventilation Equipment | П |
| | | c. A/C Equipment | |
| E. Landso | capir | | |
| | 1. | Mow Lawns | |
| F. Safety | Che | cks: | |
| | 1. | Emergency Exit Signs | |
| | 2. | Emergency Lights | |
| G. Securi | ty Sy | | |
| | 1. | Check for Proper Operation | |
| | | a. Elevator Communication Equipment (Telephone) | Ш |
| H. Pedest | | & Vehicular Signage: | |
| | 1. | Check Signs: | |
| | | a. Proper Placement/Positioning | Ш |
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MAINTENANCE CHECKLISTS MONTHLY CHECKLIST



| A. Cleaning: | | |
|-----------------------------------|-------------------------------------|---|
| 1. Stairs: | | |
| a. | Windows: | |
| | - Interior Window Surfaces | |
| Offices (| Management/Security): | |
| b. | Windows: | _ |
| | - Exterior Surfaces | Ш |
| B. Doors & Door Hard | | |
| 1. Lubricate | e Mechanized Doors: | |
| a. | Pedestrian Doors | 닏 |
| b. | Rolling Grill Doors | Ш |
| C. Electrical System: | | |
| | Fixture Ballasts | Ш |
| D. Landscaping: | | |
| | andscaping | Ш |
| E. Painting: | | |
| | r Appearance: | |
| a. | Curbs | |
| b. | Signs | H |
| C. | Touch-up Painting | Ш |
| F. Plumbing/Drainage | | |
| | r Proper Operation: | |
| a. G Booting & Waterpr | Potable Water System | Ш |
| G. Roofing & Waterpr 1. Check fo | | |
| | | |
| a. b. | Roofing Joint/Crack Sealants | H |
| D. C. | Expansion Joints | H |
| d. | Windows, Doors & Walls | H |
| e. | Parking Deck Waterproofing Membrane | Ħ |
| H. Safety Checks: | Taking Book Waterproofing Membrano | _ |
| • | s & Guardrails | |
| I. Pedestrian & Vehicu | | |
| 1. Check Si | | |
| a. | Legibility | |
| J. Structural System: | 2-9-8 | _ |
| | tructure for: | |
| a. | Soffit (overhead) Deterioration | |
| b. | Wall & Column Deterioration | |
| | | |
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| | | |
| | | |
| | | |
| | _ | |
| Supervisor: | | |
| Date: | | |



MAINTENANCE CHECKLISTS QUARTERLY CHECKLIST



| A. Electri | cal Sys | stem: | | |
|------------|---------|----------|--|-------------------|
| | 1. | | - Specialized Electrical Equipment: | |
| | | a. | Time Clocks | |
| | | b. | Photo Cells | |
| | | C. | Lighting Control Equipment | |
| | 2. | Fire Ala | arm System | |
| B. Paintin | ıg: | | | |
| | 1. | Check | for Paint Failure & Rusting: | |
| | | a. | Doors & Door Frames | |
| | | b. | Handrails & Guardrails | |
| | | C. | Steel Bollards/Pipe Guards | |
| | | d. | Other Miscellaneous Metals | |
| | 2. | Check | for Appearance: | |
| | | a. | Striping | |
| | | b. | Walls | |
| C. Pedest | rian & | | ular Signage: | _ |
| | 1. | Check | | |
| | | a. | Clean | |
| D. Structu | ıral Sv | | | |
| | 1. | | Structure for: | |
| | | a. | Floor Surface Deterioration (See also Safety Checks) | |
| | | b. | Cracking Concrete | |
| | | C. | Water Leakage | |
| | | d. | Rusting Structural Steel | |
| | | e. | Rusting Embedment within Concrete | $\overline{\Box}$ |
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| Supervis | sor: | | | |



Date:





| A. Cleaning: | | 6 Month Interval | Yearly Interval |
|-----------------|--|---------------------|--------------------|
| 1. | Elevators: | | |
| | a. Windows (if glass back elevator): | | |
| | - Exterior Elevator Glass (exterior of cab and interior of shaft) | | |
| 2. | Stairs: | | |
| | a. Windows: | | |
| | - Exterior Window Surfaces (inclusive of exterior of | | |
| | elevator shaft if glass back elevator) | | Ш |
| 3. | Wash Down Parking Decks | Ш | |
| B. Electrical S | | | |
| 1. | Electrical Distribution Panels | | |
| 2. | Surface Mounted Conduit | H | |
| 3. | Sprinkler System Compressor | Ш | |
| C. Elevator Op | Elevator Service - Preventive Maintenance | | |
| | entilation & Air Conditioning: | | |
| 1. | Check Filters | | |
| 2. | HVAC Service - Preventive Maintenance | | Ħ |
| E. Landscapin | | | |
| 1. | Prune Trees | | |
| 2. | Trim Shrubs | П | _ |
| 3. | Fertilize | | |
| F. Painting: | | | |
| 1. | Check for Paint Failure & Rusting: | | |
| | a. Exposed Piping (fire suppression system & storm drainage) | | |
| 2. | Check for Appearance: | | |
| | a. Ceilings | | |
| 3. | Repainting | | |
| G. Plumbing/D | Orainage Systems: | | |
| 1. | Check for Proper Operation: | | |
| | a. Floor Drains/Storm Risers | | |
| | b. Fire Suppression Systems: | | |
| | - Sprinkler System | | 닏 |
| | - Dry Fire Standpipe System | | 님 |
| 2. | Drain Down Systems for Winter | | Ш |
| | Naterproofing: | | |
| 1. | Check for Deterioration: | | |
| | a. Roofing | H | |
| | b. Joint/Crack Sealants | | |
| | c. Expansion Joints d. Windows, Doors & Walls | H | |
| | d. Windows, Doors & Walls e. Parking Deck Waterproofing Membrane | | |
| I. Structural S | The state of the s | Ш | |
| 1. | Check Structure for: | | |
| | a. Unusual and/or Unequal Settlement | | |
| | a. a | | |
| | | | |
| | | | |
| Supervis | or: | | |
| Date: | | | |



SEASONAL WASHDOWN CHECKLIST:



FACILITY: UNION STATION PARKING GARAGE

| SEASON/YEAR: _ | | |
|------------------|-------|-------------|
| 6TH LEVEL NORTH: | Date: | Supervisor: |
| 6тн Level South: | DATE: | Supervisor: |
| 5TH LEVEL NORTH: | DATE: | Supervisor: |
| 5TH LEVEL RAMP: | Date: | Supervisor: |
| 5TH LEVEL SOUTH: | Date: | Supervisor: |
| 4TH LEVEL NORTH: | Date: | Supervisor: |
| 4TH LEVEL RAMP: | Date: | Supervisor: |
| 4TH LEVEL SOUTH: | Date: | Supervisor: |
| 3rd Level North: | Date: | Supervisor: |
| 3rd Level Ramp: | Date: | Supervisor: |
| 3rd Level South: | Date: | Supervisor: |
| 2nd Level North: | Date: | Supervisor: |
| 2ND LEVEL RAMP: | Date: | Supervisor: |
| 2ND LEVEL SOUTH: | Date: | Supervisor: |
| 1ST LEVEL NORTH: | Date: | Supervisor: |
| 1ST LEVEL RAMP: | Date: | Supervisor: |
| 1ST LEVEL SOUTH: | Date: | Supervisor: |
| | | |
| EAST STAIR: | DATE: | Supervisor: |
| WEST STAIR: | Date: | SUPERVISOR: |

