CONDITION APPRAISAL
(FY 2020)

TEMPLE STREET PARKING GARAGE
NEW HAVEN, CONNECTICUT

NEW HAVEN PARKING AUTHORITY

PREPARED FOR:

NEW HAVEN PARKING AUTHORITY
232 GEORGE STREET
NEW HAVEN CONNECTICUT 06510

PREPARED BY:

DESMAN
Design Management

175 CAPITAL BOULEVARD, SUITE 402
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NHPA PROJECT NO. 20-001
DESMAN PROJECT NO. 20-19171.00-2

APRIL 2020

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Design Management

NEW HAVEN PARKING AUTHORITY

CONDITION APPRAISAL
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NEW HAVEN PARKING AUTHORITY FACILITIES
NEW HAVEN, CONNECTICUT

APRIL 2020

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1. INTRODUCTION

The Condition Appraisal of the Temple Street 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 Temple Street 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

Photo #1

Photo #2

Photo #3

Photo #4

The Temple Street Garage consists of 1,247 parking spaces. Opened on November 2, 1962, this garage consists of five (5) levels of split-level cast-in-place reinforced concrete decks, as well as a basement level, all in excess of 480,000 gross square footage of parking area. This 58 year old facility is in generally fair condition.

Currently there are six (6) projects in progress which represent a combined project cost of approximately $7,542,000 (including contingencies and design/management fees). Between 2021 and 2025, an additional expenditure of approximately **$10,067,350.00** can be expected to properly repair and maintain the Temple Street Garage over the next five years.

These figures are not inclusive of work associated with the implementation of repairs to George Street and its underlying support structure where George Street passes through the garage. Repairs to George Street, though, are the responsibility of the City, not NHPA's.

Changes in the projected five-year construction costs account for changes in economic climate and changes in the scope of repair work found to be necessary based on currently observed conditions. These increases also account for additional improvements to the facility requested by NHPA for implementation over the next (5) five year period. These improvements include the replacement and upgrade of the facility's revenue control equipment.

The Temple Street Parking Garage continues to perform well. The top surfaces of the supported decks were observed to be in relatively good condition except for the roof level (Level 9 & 10). Due to significant freeze-thaw conditions, repair work is required on the roof levels. **(*Photos #1 & #2*).**

As previously reported in past Condition Assessment Reports, this facility's overhead concrete surfaces are exhibiting increases in overhead deterioration. Continued overhead concrete repairs are anticipated for the future. **(*Photo #3 & #4*)**

Photo #5

Photo #6

Restoration work associated with the basement levels (Levels B2 & B3) was completed in 2005, but the garage basement is still experiencing extensive water intrusion along cracks and seams along the eastern foundation walls separating the parking facility from the adjacent truck tunnel/loading dock areas, and from the former Macy's and Malley's sites **(*Photo #5*)**, now home to Gateway Community College. Some repairs required to address this situation were addressed as part of the comprehensive repair project (2013), and were performed by a combination of work including, but not limited to, extensive negative side waterproofing and chemical grout injection. Although water infiltration has been greatly reduced, Desman recommends that the basement continue to be monitored since water infiltration continues to occur. DESMAN will continue to carry costs associated with additional periodic negative-waterproofing which can be reasonably expected to be recommended over the next five years

Modifications and improvements to the George Street pass-through were previously envisioned to be implemented in 1998 but could not be achieved due to budget limitations. The street is the responsibility of the City of New Haven to maintain and repair. Drainage problems had contributed to deterioration of the existing asphalt pavement, and the expansion joints along the perimeter of the pass-through (3 joints total) needed replacement **(*Photos #6 & #7*)**; moisture had been penetrating the deck, contributing to further deterioration to the underlying support structure. Recommended repairs had subsequently included the removal of the bituminous concrete pavement to expose the underlying concrete deck to better evaluate its condition and structural integrity; implementing any necessary concrete repairs, followed by the subsequent installation of new hot applied asphalt waterproofing and bituminous concrete pavement, along with the installation of several heavy-duty drains along each side of the street.

Photo #7

Photo #8

Photo #9

We understand the City Engineering Office had been pursuing a capital program for this work and certain repair work has now been completed, particularly with regard to the tunnel structure to the east and the street expansion joint on the east side of the garage**(*Photos #8 & #9*)**.

The City's Downtown Crossing Phase 3 project will impact the Temple Street Parking Garage, mainly due to the loss of the exit onto Rev. Dr. Martin Luther King Jr. Boulevard. This will require modifications to the remaining entrances and exits particularly Crown Street, George St North and George St South passageways. These modifications will be designed and constructed by NHPA at the request of the City.

The Capital Projects currently in progress consist of the following:

PROJECT NUMBER	PROJECT TITLE	OPINION OF COST*	STATUS
15-004B/ 19-006	Lighting & Electrical Repairs & Improvements	$2,210,000	In Design
16-008/ 17-006/ 18-007/ 19-009	Repairs & Improvements	$4,700,000	In Design
18-009	Mechanical Repairs & Improvements	$410,000	In const.
18-030	Repairs to Concrete Light Standard	$90,000	In const.
20-006	Replacement of Metal Stair System	$132,000	In Design

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

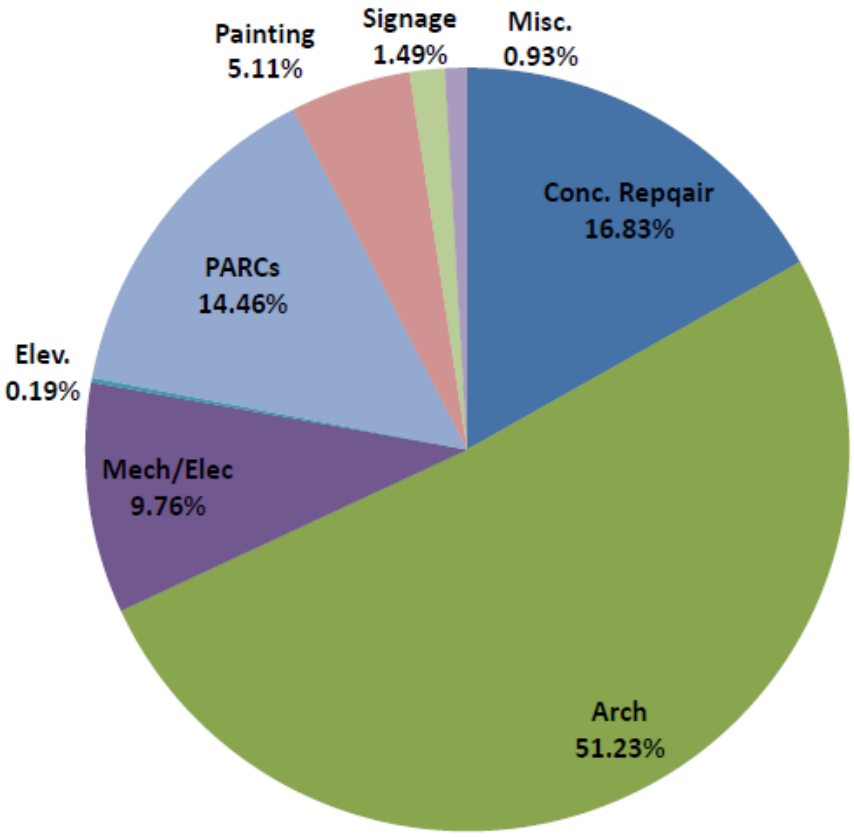
The costs associated with the implementation of future repairs and preventative maintenance for this garage is presented in more detail later in this report.

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)	$6,668,550.00
Programmed Repairs (FY 2023)	$1,162,900.00
Long-Term Repairs (FY 2024 – 2025)	$2,235,900.00
TOTAL ESTIMATED COST	**$10,067,350.00**

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:	**11.71%**
Architectural:	**22.09%**
Mechanical/Electrical:	**3.73%**
Elevators:	**41.03%**
Painting:	**5.31%**
PARCs:	**4.48%**
Signage:	**8.24%**
Miscellaneous:	**0.29%**
	100.00%



Recommended Repairs & Improvements split into Disciplines The

3. DESCRIPTION OF THE STRUCTURE

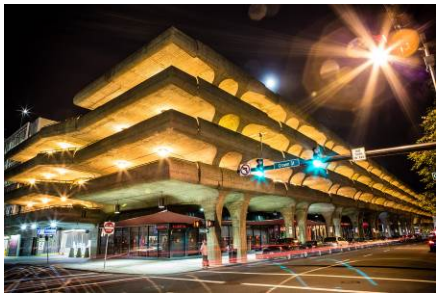


Photo #10

Photo #11

Photo #12

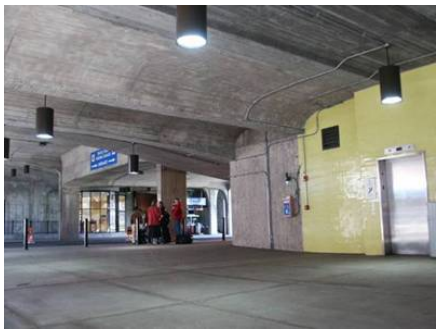


Photo #13

The multi-story Temple Street Garage **(*Photo #10*)** is a freestanding parking structure with a total parking capacity of 1,235 vehicles. It services New Haven's downtown retail, business, and entertainment district. The structure occupies two city blocks and spans both across and below George Street where this street passes through the garage.

The majority of the street level, north of George Street, is occupied retail space. South of George Street, an area formerly occupied by the Malley's Tire Center, has been modified to provide a pedestrian congregation area at the southeast corner of Temple Street and George Street, to provide access to a new elevator and handicap access to the western bay of the garage. The remaining portion of the grade level located to the south of George Street is currently being utilized as a monthly permit parking area and for the Gateway Community College day care center pick-up and drop-off.

The facility is connected to the adjacent Temple – Medical Center by an enclosed pedestrian bridge which crosses Temple Street **(*Photos #11 & #12*)**.

The facility can be entered or exited from Crown Street, George Street or Rev. Dr. Martin Luther King Boulevard (formerly known as North Frontage Road). The facility's configuaration, location and operational flexibility (changeable entry/exit lanes) integrates well with surrounding traffic patterns and provides reasonable vehicle access to those traveling east, north, west and south. However, the City's Downtown Crossing Phase 3 project will necessitate modifications to the internal traffic controls as the exit to Rev. Dr. Martin Luther King Boulevard will be permantently closed.

The rectangular shaped structure is roughly 733 feet long by 118 feet wide. The facility is a split level facility with each floor level staggered into two individual trays, interconnected by six vehicle ramps on most levels.

Photo #14

Photo #15

Photo #16

The facility has three elevator cores; two of these elevator cores are located to the north of George Street and have two elevator cabs each and are original to the facility serving the eastern parking bays of the facility. The other elevator core is located south of George Street, has only one elevator cab, and is not original to the facility having been installed as part of the comprehensive repairs and renovations to the facility completed in 2002 **(*Photo #13*)**. The new elevator does not provide access to the facility's basement level or roof, while the original elevators do. The facility also provides pedestrian access between floors via four individual stairwells distributed along the length of the garage.

Expansion joints have been provided between column lines 6 & 7, 14 & 15, and 26 & 27 to allow for thermal movements within the structure **(*Photo #14*)**.

In the Fall of 1990, Spring 1991, and the facility restoration of 2000-2002, structural modifications were made to eliminate approximately half of the total linear footage of expansion joints within the garage. This was accomplished by eliminating the 8 foot wide floating slabs which previously rested on a 3" wide ledges cast integrally with the cantilever concrete slab on either side. As part of this modification, one of the two joints, within each pair, was eliminated.

The supported slabs of the parking garage vary in thickness from 6 to 12 inches and are arch shaped **(*Photo #15*)**. Slabs typically span 10 to 28 feet and frame into 24-inch deep floor beams. The slab is cantilevered along the perimeter of the structure and at the expansion joints. The majority of the 1st, 2nd, 3rd and 4th levels above the commercial space (retail area) and former tire center consist of structural concrete slabs with an intermediate waterproofing membrane and a cast-in-place concrete topping/overlay. It should be noted that the floating slabs within the overlay areas described above still retain the double expansion joint configuration. No modifications where made here as the structure has been performing well, and extensive repairs in these locations has not been necessary or recommended. Similarly the same deck configuration, with the double expansion joints and floating slab still exists on the facility's two roof decks (Levels 9 and 10).

The facility's main lighting system consists of 3 rows of surface mounted, high pressure sodium (HPS) lighting fixtures wired through surface-mounted electrical conduit **(*Photo #16*)**. The garage was entirely rewired and re-lighted, and a computer operated lighting and signage controlled system was installed. This system provides enhanced operating flexibility and operating efficiencies not previously available with the manually operated lighting system.

The entire parking facility is mildly reinforced cast-in-place concrete, having a distinctive architectural appearance, which is the result of having been constructed using what has been described as drop-down ship-lap custom form-work. The concrete parapet walls and columns all gracefully curve into the structure creating an aesthetic and unique appearance that is considered rare and atypical for a structured parking deck.

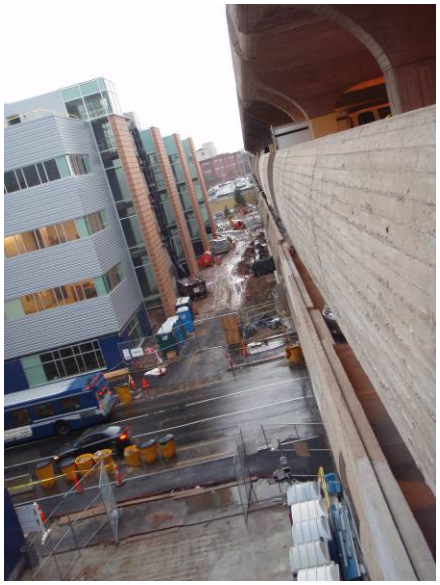


Photo #17

Although it is unfortunate that certain portions of the facility along the eastern façade were not constructed using the same drop-down ship-lap custom form-work described previously, as this entire façade was entirely exposed upon the demolition of the Malley's or Macy's buildings **(*Photo #17*)**, most of the eastern facade is now be re-covered due to the Gateway Community College.

Storm water collection consists of floor drains spaced periodically along the interior column line of each parking tray. Vertical stacks or standpipes are hidden from view, having been cast integrally within the facility's concrete columns. While the placement of the storm drainage standpipes make an assessment of their current condition difficult, they are working acceptably and there is no indication of distress to the structure indicative of an underlying problem within the embedded piping.

Photo #18

Below is a summary of work which has been performed on this facility historically:

1986 Levels 9 and 10 of the facility were entirely reworked to eliminate the preexisting concrete overlay and underlying waterproofing membrane **(*Photo #18*)**. Upon removal of the original concrete overlay and the underlying waterproofing, a new "bonded" concrete overlay was placed directly onto the

structural deck, and a traffic bearing waterproofing membrane was installed. This waterproofing membrane was subsequently removed during the restoration project completed in 2002, due to it having become severly debonded from the concrete substrate.

1989 Structural repairs and waterproofing work was performed on the cantilevered slabs on the north and south ends of the facility.

1992 Structural repairs were performed on the northern half of levels 5, 6, 7, and 8.

2000 An extensive restoration and renovation project was initiated within the Temple Street Parking Garage; this work was completed in 2002. The work included, but was not limited to, the following:

- Extensive cleaning of the interior and exterior surfaces was performed throughout the garage.

- Miscellaneous street and sidewalk improvements included entry/exit apron modifications for enhanced handicap accessibility. Additionally a new elevator entry platform and annex area was created at the southeast corner of George and Temple Streets **(*Photo #19*)**.

- Structural repairs were performed consisting of partial and full depth concrete deck repair, fire damage repair in the former Malley's Tire Center area, miscellaneous overhead concrete repair, miscellaneous concrete stair tread and stair landing repair, and miscellaneous concrete scaling repair. The structural repairs were not inclusive of the facility's basement levels or the portion of the structure supporting the George Street pass-through.

- New expansion joint seals were installed on all levels of the facility. Other waterproofing included crack repair, control/construction joint detailing, and cove joint installation.

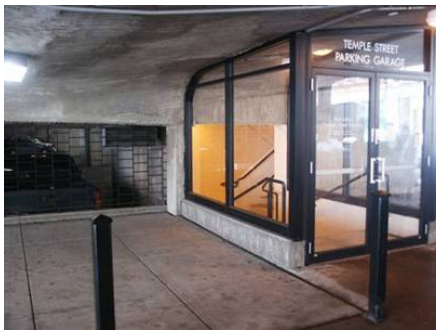


Photo #19

Photo #20

Photo #21

Photo #22

- Architectural improvements were implemented to various stair and elevator lobbies **(*Photos #20 & #21*)**.

- A new Temple Street Garage Management Office for the New Haven Parking Authority was constructed with new drywall partitions, new suspended ceiling, new flooring (tile and carpet), new bathrooms and all other associated architectural finishes **(*Photo #22*)**.

- Miscellaneous steel fabrications were installed throughout the garage, including decorative steel fencing, decorative steel railing, new handrails, and steel bollards.

- Elevator repairs were performed which included the replacement of elevator cabs and doors in four preexisting elevators and the installation of a new hydraulic elevator at the southeast corner of George Street and Temple Street, and installation of roof level elevator lobby vestibules.

- Miscellaneous painting was performed which included the painting of concrete and masonry surfaces, stairwell walls and ceilings, miscellaneous interior and exterior plaster and/or stucco surfaces, painting of all exposed steel and aluminum surfaces, and parking stall and lane striping.

- Mechanical repairs and improvements were performed which consisted of the installation of a new dry pipe sprinkler and standpipe system within the basement portions of the garage as well as the garage office space, installation of a new garage management office HVAC system, new heating and ventilating systems for the elevator lobbies, heating and ventilation for the elevator machine rooms, new cashiers' booth HVAC systems, along with various drainage improvements.

Photo #23

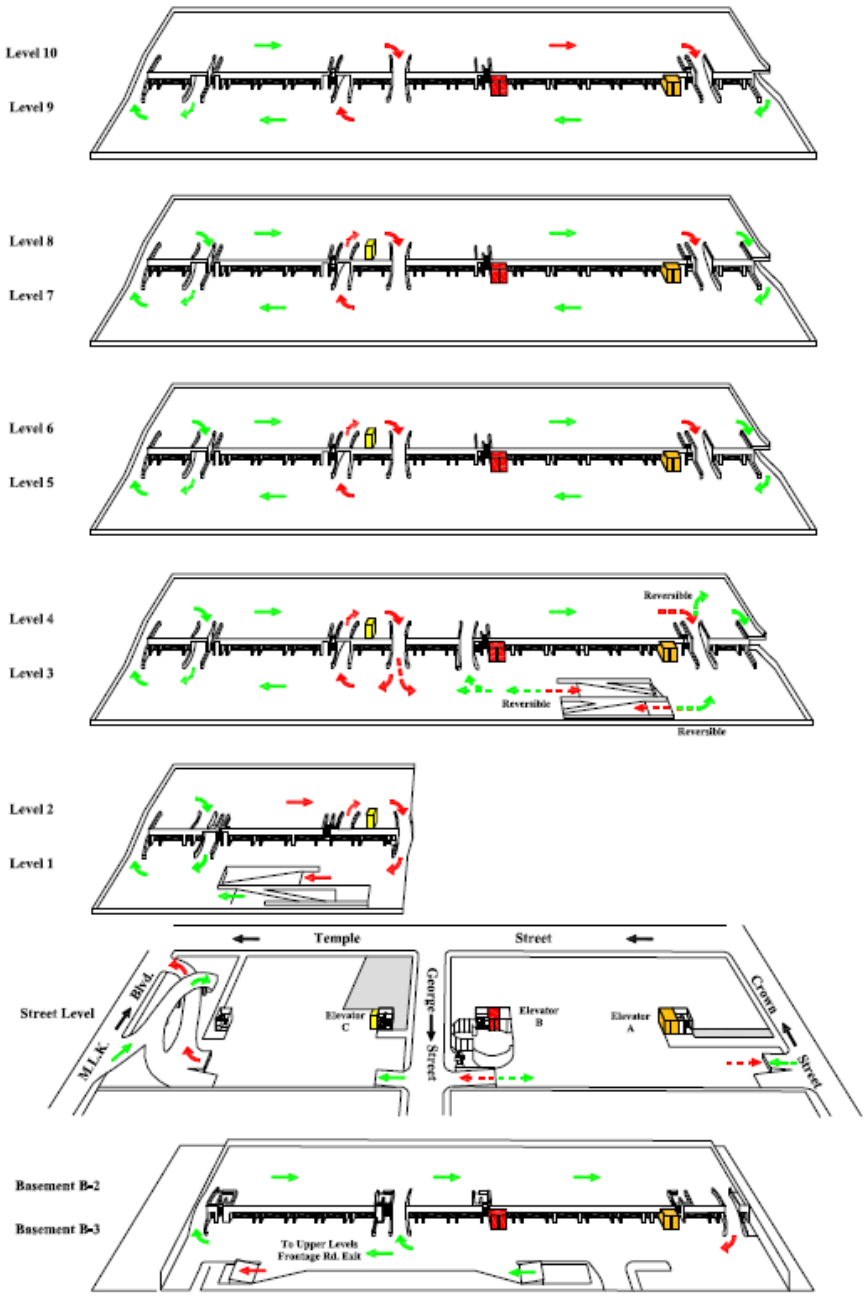
Photo #24

- Electrical repairs and improvements were performed which included the replacement of the facility's entire electrical distribution system, installation of new garage lighting and a new lighting and signage control system, installation of a new fire alarm system, installation of a new emergency callbox system, installation of new exit signs, and installation of a new emergency lighting system.

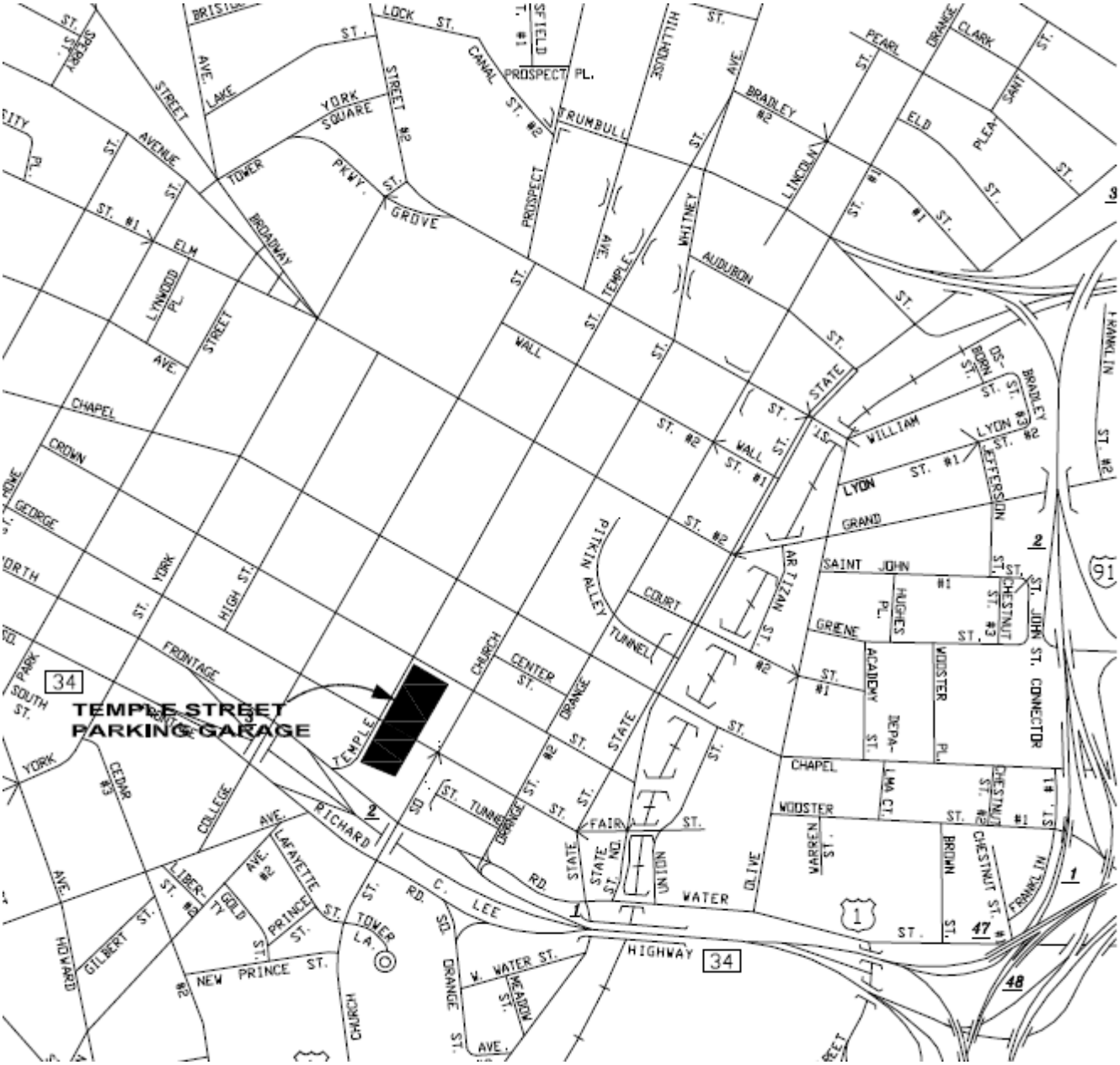
- Signage improvements included the installation of pedestrian signage and graphics (level designation signage, elevator bank identification signage, pedestrian information/directional signage, and vehicle directional signage, etc.). The installation of vehicular signage included both non-illuminated, changeable (computer controled) illuminated vehicular signage and vehicle entry clearance bars **(*Photos #23 & 24*)**.

2005 Repairs were implemented to the facility's basement level as a supplement to the restoration work completed in 2002 to allow this portion of the facility to be reopened for use. Extensive slab-on-grade concrete slab repairs were performed. The basment level electrical system was entirely reworked to increase lighting levels and to tie this portion of the garage lighting system into the facility's lighting control system. Work also included a comprehensive repair and improvement to the basement's ventilation system, inclusive of a new electronic CO monitoring and fan control system. New signage and graphics, for both pedestrian and vehicle access, were provided.

2013 A comprehensive repair program, started in Spring 2011 and completed in 2013 included, but was not limited to, concrete repair, membrane repair, application of a corrosion inhibitor, miscellanoues expansion joint repair, miscellaneous negative-waterproofing repairs, miscellaneous architectural repairs and improvements, installation of new parapet railings, miscellaneous electrical repairs, miscellaneous plumbing and mechanical repairs and improvements, and miscellaneous painting.



Garage Isometric


TEMPLE STREET
PARKING GARAGE
TEMPLE
CHURCH
CENTER
ORANGE
STATE
TUNNEL
COURT
PITKIN ALLEY
ARTIZAN ST.
YORK
HIGH ST.
FRONTAGE
CHAPEL
CROWN
GEORGE
WALL
GROVE
PROSPECT
TRUMBULL
YORK SQUARE
TOWER PKWY.
BROADWAY
ELM
LYNWOOD PL.
AUDUBON
WHITNEY
LINCOLN
WILLIAM
LYON
GRAND
SAINT JOHN
GREENE
HUGHES PL.
CHESTNUT
WOOSTER
ACADEMY
DEPA-
LMA CT.
ST. JOHN ST. CONNECTOR
FAIR
UNION
OLIVE
WATER
WARREN ST.
BROWN
FRANKLIN
RICHARD
COLLEGE
CEDAR
LAFAYETTE
PRINCE
NEW PRINCE ST.
GILBERT ST.
HOWARD
TOWER LA.
C. LEE RD.
W. WATER ST.
MEADOW ST.
ORANGE ST.
HIGHWAY 34
34
91
1
2
3
47
48

Site Plan

Structural Data

Temple Street Parking Garage
New Haven, Connecticut

Legend:	Square Feet	SF
	Pounds Per Square Inch	PSI
	Pounds Per Square Foot	PSF
Date of Completion:		1962
Age of Structure:		58 Years
Plan Dimension:		118 FT x 733 FT
Typical Bay Size:		10 FT x 55 FT & 28 FT x 55 FT
Floor to Floor Height:		10' - 0"
Floor Area:	• Slab-on-grade	78,000 SF
	• Supported slab	505,000 SF
	• Total	588,000 SF
Parking Capacity:		1,235 Vehicles
Parking Efficiency:		467 SF/Vehicles

Note: All Values Listed Above are Approximations of Actual Values

Structural System: Conventionally reinforced cast-in-place, concrete slabs, beams and columns.

Foundation System: Piles

Typical Floor: Slabs	85 PSF
Girders	50 PSF
Ground Floor: Slabs	120 PSF
Girders	120 PSF
Basement Slabs:	50 PSF
	50 PSF (Uplift)
Grade Beams	50 PSF

Note: Structural information was obtained from construction documents made available for this evaluation.

Photo #25

Photo #26

Photo #27

Photo #28

4. VISUAL OBSERVATIONS & REPAIR RECOMMENDATIONS

A visual examination of the facility's structural, mechanical and electrical components was performed as part of Desman Associates' review of the Temple Street Parking Garage this year.

CONCRETE WORK:

Partial Depth Concrete Repair: Although a capital project was completed in 2013, including the installation of a topically applied corrosion inhibitor to this facility's supported concrete decks, an extensive amount of shallow-depth/scaling deterioration has become evident throughout the garage, especially in the higher-wear travel lanes. Although not necessarily suggesting a structural concern, this wearing and related cracking **(*Photos #25, #26 & #27*)** should be addressed accordingly so as to avoid becoming a more significant and expensive repair. DESMAN recommends that an epoxy-based healer/sealer system may be more appropriate to accommodate the shallow cracking in lieu of more extensive demolition and concrete repair that may not be as durable due to its shallow nature. DESMAN recommends that the decks be monitored and NHPA budget accordingly.

DESMAN has observed an increase in deterioration associated with the Ground Level parking area however. DESMAN recommends that this area be programmed for repair accordingly.

While portions of this work are currently scheduled to be performed as part of NHPA Project No. 17-006, currently in design, DESMAN recommends that the decks be monitored and NHPA budget accordingly for further repairs in the near future.

Photo #29

Photo #30

Photo #31

Roof Concrete Overlay Repair: The roof level concrete overlay which was installed in 1986 is now over 34 years old. Although repairs were addressed as part of the 2013 comprehensive capital project, including the installation of a topically applied corrosion inhibitor to this facility's supported concrete decks, DESMAN is observing deterioration surrounding and in the vicinity of the recently performed repairs **(*Photos #28, #29 & #30*)**. Differences in chloride levels can provide differences in corrosion potential adjacent to a repair location, thus contributing to deterioration adjacent to a repair commonly referred to as the "halo" effect, as well as freeze-thaw damage along open cracks and control/construction joints where sealant material has deteriorated, along with excessive use of de-icing materials.

While DESMAN still considers the deterioration manageable, with work currently scheduled to be performed as part of NHPA Project No. 17-006 and currently in design, DESMAN recommends that the decks be monitored and NHPA budget accordingly for further repairs in the near future. Considering the pre-existing cracking and markings in the concrete (due to the past removal of a membrane system), DESMAN suggests that a more aggressive approach may be warranted, such as the subsequent installation (after repairs to the concrete) of an epoxy-based wear course/healer-sealer that could not only provide additional protection to the deck but also more permanently seal the cracking; further repair work is also scheduled to be addressed as part of NHPA Project No. 18-007 currently in design, now combined with Project No. 17-006.

Lower Level Concrete Overlay Repair: The lower level concrete overlay areas contain an underlying waterproofing membrane/underlying insulation. Although a capital project was completed in 2013, including the installation of a topically applied corrosion inhibitor to this facility's supported concrete decks, an extensive amount of shallow-depth/scaling deterioration has become evident throughout the garage, especially in the higher-wear travel lanes. Desman recommends that the decks be monitored and NHPA budget accordingly. This work is currently scheduled to be performed as part of NHPA Project No. 17-006, currently in design.

Photo #32

Photo #33

Photo #34

Vertical & Overhead Concrete Repair: The quantity of vertical and overhead concrete spalling observed throughout the facility has continued to increase **(*Photos #31 & #32*)**. While a significant amount of vertical and overhead concrete repairs were addressed in the (2013) comprehensive capital project, additional square footage remains.

The overall age of this parking structure, the lack of adequate concrete cover utilized in the original construction, increased concrete carbonation due to age and environment which allows greater corrosion in the embedded steel (increased concrete porosity and a decrease in alkalinity) and because the facility's original concrete is known to now contain a build-up of chlorides all contributes to the increased overhead deterioration. Environmental exposure, and depending on ambient humidity levels, can cause moisture to condense onto the underside of the deck creating an environment conducive to active and progressive corrosion.

DESMAN recommends that NHPA continue to implement a periodic maintenance program to inspect all overhead and vertical surfaces (Spring and Fall) and to knock loose or remove all deteriorated concrete in a controlled fashion. Even if overhead and vertical concrete repairs were to be implemented on a yearly basis, it is likely that additional deterioration will occur.

Due to the various repair programs performed at the Garage, in conjunction with the age of the facility, DESMAN has observed varying stages of weathering that have had an impact on the multitude of repair mortars used at the facility **(*Photo #33*)**. Although the majority of the patches continue to remain durable, the patches have presented a patchwork of colors that, depending on the location, can have a negative impact on the facility's aesthetics. Depending on the extent of visibility, DESMAN recommends that select patches be re-addressed or a staining be considered that may improve the blending of colors.

This work is currently scheduled to be performed as part of NHPA Project No. 17-006, currently in design.

Photo #35

Photo #36

Photo #37

Curb Repair: Upon completion of the 2013 comprehensive capital project, certain concrete curb repair should be anticipated in the future. DESMAN recommends that the decks be monitored and NHPA budget accordingly. This work is currently scheduled to be performed as part of NHPA Project No. 17-006, currently in design.

Stair Repair: Upon completion of the 2013 comprehensive capital project, certain concrete stair repair should be anticipated in the future. DESMAN recommends that the decks be monitored and NHPA budget accordingly. This work is currently scheduled to be performed as part of NHPA Project No. 17-006, currently in design.

Exterior Parapet Wall/Façade Repair: On the eastern façade of the parking facility, south of George Street, certain architectural issues exist that have not been resolved regarding rebuilding portions of the exterior parapet walls to match the balance of the exposed parapet with its step-down ship-lap concrete finish **(*Photos #34 & #35*)**. Although similar conditions had been exposed on the eastern façade north of George Street, the construction of Gateway College on both the Macy's and Malley's sites (north and south of George Street respectively) has now blocked the facade. While it may not be necessary to make any asethetic changes as the prexisting construction is no longer visible, DESMAN will monitor the conditions to see if any limited repairs are recommended in the future.

Roof Level Light Poles: Recently, DESMAN observed significant deterioration occurring at the top of one of the "cobrahead" light poles on the Roof Level **(*Photo #36*)**; repairs are currently in progress as part of NHPA Project No. 18-030. DESMAN recommends that the other light poles be monitored and repaired as required, addressing cracking as it occurs.

Photo #38

WATERPROOFING WORK:

Cantilever Deck Membrane Repair: The waterproofing membrane installed on the cantilevered sections of the garage in 1989 has all been repaired and recoated as part of the (2013) comprehensive capital project **(*Photos #37 & #38*)**. DESMAN recommends that the membrane be monitored and repaired as required. This work is currently scheduled to be performed as part of NHPA Project No. 17-006, currently in design.

Traffic bearing membranes are approximately 85%-90% effective as moisture and chloride screens inhibiting future chloride-ion migration into the deck; an elastomeric membrane will also traverse cracks that may form and joints that may be tooled. However, upon completion of the membrane installation, Desman suggests developing a yearly service contract with a qualified waterproofing contractor to assure that damaged portions of the membrane are successfully repaired each spring and autumn. It is important that all damage to waterproofing membranes be repaired, as continued and progressive de-bonding of the membrane will result if left unattended

Photo #39

Photo #40

Although PNH continues to repair deteriorated concrete throughout the garage, PNH has observed leaking through the end of the ramp from Level 2 down to Level 1 **(*Photos #39 & #40*)**. Since this deck area consists of a slab with an intermediate waterproofing [(as well as various other areas of the garage (Levels 1, 2, 3 & 4)], no single origin can be designated as the source since the surface has miscellaneous cracking throughout and subsequently, penetrating moisture may travel through the intermediate layer to an alternate location.

DESMAN recommends that this ramp be monitored further, and all apparent cracking be routed and sealed, as well as deteriorated concrete be repaired along with replacement of the intermediate waterproofing as it becomes exposed. Should the leaking continue, DESMAN suggests that installation of waterproofing membrane may need to be programmed for installation throughout this area.

Photo #41

Photo #42

Photo #43

Photo #44

Prior to installation of the membrane in this area of Level 2, though, DESMAN strongly recommends that the moisture content within the deck be confirmed as an acceptable level for subsequent membrane installation. It is critical that the hydrostatic, capillary, and moisture vapor pressure (as well as other related parameters) all be verified to not exceed acceptable thresholds. The presence of intermediate membranes can be an impediment to minimizing the moisture levels, and they can be detrimental to membrane adhesion and contribute to premature failure.

Topically Applied Corrosion Inhibitor Application: A corrosion inhibitor was applied on all areas of the facility's supported concrete deck as part of the 2013 comprehensive capital repair project. 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 was done in conjunction with a program of crack and control/construction joint repair and in some cases combined with the application of an elastomeric traffic bearing waterproofing membrane in certain areas. Considering the duration of the warranty, re-application of the inhibitor is not anticipated until at least 2023; DESMAN recommends that corrosion levels be monitored accordingly.

Crack Repair/Control/Construction Joint/Cove Joint Repair: Although a miscellaneous amount of crack and joint repair was addressed as part of the (2013) repair program, additional repairs should be anticipated in the future due to sealant deterioration associated with normal wear and tear. Designated miscellaneous & minor work is currently scheduled to be performed as part of NHPA Project No. 17-006, currently in design.

Expansion Joint Repairs: Miscellaneous repairs were performed as part of the (2013) repair program **(*Photo #41*)**; however, more comprehensive repairs and/or replacement are recommended. Although new joints were installed on designated ramps that were not addressed as part of the comprehensive renovation program of (2000) **(*Photo #42 & #43*)**, the joint glands on the supported levels are all almost 20 years of age now, including the joint glands surrounding Elevator C **(*Photo #44*)**. DESMAN recommends that miscellaneous repairs continue to be performed as required, but a more comprehensive replacement program be planned for accordingly. This work is currently scheduled to be performed as part of NHPA Project No. 17-006, currently in design.

Photo #45

Water Infiltration – Basement Level: Water infiltration through the foundation wall directly adjoining the adjacent Gateway Community College site, and through the southern foundation wall down the center of Level B3 **(*Photo #45*)** has been addressed as part of the (2013) comprehensive capital project, utilizing chemical grout injection and negative-side waterproofing. Although water infiltration has been greatly reduced, DESMAN recommends that the basement continue to be monitored since water infiltration continues to occur. DESMAN will continue to carry costs associated with additional periodic negative-waterproofing which can be reasonably expected to be recommended over the next five years. This work is currently scheduled to be performed as part of NHPA Project No. 17-006, currently in design.

Photo #46

Elevator Machine Room Roofing: the existing roof systems of the elevator machine and fan rooms are exhibiting their age and wear-and-tear **(*Photo #46*)**. DESMAN recommends that the roofing systems be removed in their entirety and replaced with new systems.

Photo #47

ARCHITECTURAL REPAIR & IMPROVEMENT WORK:

Wall Tile Repair: Several areas of wall tile were observed to be damaged; the majority concentrated on the roof level where exposure to moisture, the effects of cyclical freeze-thaw, and possibly snow removal operations has caused damage. These miscellaneous tile repairs were addressed in the (2013) comprehensive capital project. DESMAN recommends that the condition of the tile be monitored and NHPA budget accordingly.

Photo #48

Door Repair: Various damaged doors were identified throughout the garage which require repair, typically associated with the basement levels of Levels B2 and B3 including various electrical and mechanical rooms. Some doors were seen to be sprung on their hinges or have inoperable hydraulic door closers needing repair or replacement. Door sweeps also need to be added to the upper level elevator vestibule doors, and these doors need to be adjusted to operate properly. DESMAN recommends that a comprehensive door and frame replacement program be scheduled accordingly (***Photo #47);*** since the basement, specifically, is exposed to such high levels of moisture, DESMAN recommends that an alternative heavy-duty, non-metal type system be considered, such as fiberglass reinforced polyester (FRP).

Photo #49

DESMAN will also continue to carry some costs associated with the periodic door repair which can be reasonably expected to occur over the next five years. 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.

Epoxy Flooring Repairs and Improvements: As part of the comprehensive restoration progroject of 2000, architectural improvements were implemented to various stair and elevator lobbies, including the installation of an epoxy flooring system within the street level lobby at Elevator 'B,' and as part of NHPA Project No. 15-004A, cast aluminum treads were installed as well. DESMAN recommends that the epoxy flooring system be monitred and repaired as required, as well as the anchors for the new treads be adjusted and/or replaced as required to keep the treads in-place and secured. **(*Photo #48)***

Photo #50

Miscellaneous Storefront Repair: DESMAN noted miscellaneous screws and seals missing from the storefront system of the George Street Lobby **(*Photo #49*)**. DESMAN recommends that PNH monitor the condition of this storefront system and repair the system on an as-needed basis, so that the envelope (and related patron comfort) of the lobby is maintained.

Photo #51

Photo #52

Photo #53

Replacement of Vehicle Wood Bumpers: the wood boards installed throughout the perimeter of the garage, acting as vehicle protection, are in various states of disrepair **(*Photos #50 & #51*)** or are lacking completely. In order to continue to provide appropriate vehicle protection, the wood boards should all be replaced.

Ventilation Shaft Bench Improvements: Due to loitering atop of the ventilation shafts which have become used as benches, as well as damage due to skateboarding, PNH has requested that DESMAN consider certain aesthetic improvements that would impede the loitering and protect the benches **(*Photo #52*)**. While various concepts were developed, the preferred option incorporates a wood skin over the benches with possible planter configurations, although a simpler concept, such as the steel rods used at nearby benches **(*Photo #53*)**, may be used at certain benches to minimize cost.

Concept 01: Wood Skin over Existing Concrete Bench w/ Integral Planter Options

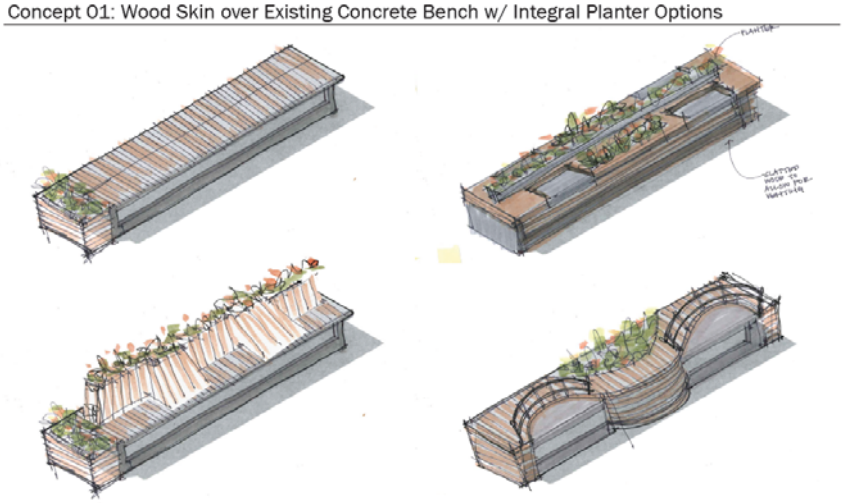


Photo #54

Garage Entrance (from Crown Street) Façade Enhancements:

The façade of the Temple Street Garage along Crown Street has become aged with varying colors of past repair mortars **(*Photo #54*)**. Although architecturally unique, the recent and ongoing development in the immediate area, including the construction of the adjacent Gateway Community College, continues to provide a challenge for the garage to stay current.

Recently, with NHPA's re-branding efforts fully underway, additional opportunities have developed that could assist in revitalizing the garage. Enhancements, such as the installation of linear, programmable LED accent lighting to wash the underside of the structure and accentuate the form with similar LED fixtures to up-light the ceiling of the entrance, could assist in transforming the garage (various concepts as follows) (installation of accent lighting along Temple Street is currently scheduled to be performed as part of NHPA Project No. 19-006, currently in design).

Pedestrian Entrance Enhancements (to Elevator A, from Crown Street):

Photo #55

The pedestrian entrance from Crown Street has proven to be a challenge **(*Photo #55*)**. The entrance consists of a substantial open area that has yet to be defined and made unique and welcoming. In conjunction with the resurfacing of the floor slab with a decorative stamped/stenciled concrete, linear, LED, exterior lighting strips may be installed along the structural ribs to up-light the ceiling surface, all providing an aesthetically enhanced pathway highlighting the route to the stair and elevators.

Additional enhancements could include installing an architectural screen element to divide the pedestrian space from the vehicular entrance, applying an accent material to the stairwell wall surface at the rear of the space to attract patrons into the space, incorporate bench seating at the rear of the space, coordinate graphics and the colors/themes of the glazing decals with the design of the space, as well as incorporating bike racks or a sculptural element to further activate the space (various concepts as follows).

Photo #56

<u>Elevator A Lobby (by Crown Street), Ground Level, Improvements</u>:

Although the stair/elevator lobby by Crown Street has been well-maintained **(*Photo #56*)**, DESMAN recommends that the lobby could be energized and refreshed to be made more current. Enhancements could include cleaning and refinishing the floor and walls, installing an accent material to the walls of the lobby to be coordinated with the exterior space design, relocating the trash receptacle and incorporating it into an architectural bench seating, as well as updating the signage and graphics to be more consistent with the updated signage visible from the street (various concepts as follows).

Photo #57

Elevator B Lobby (main lobby, George Street), Ground Level, Improvements:

Although the main stair/elevator lobby on George Street (associated with the Parking Office) provides an open and welcoming environment **(*Photo #57*)**, as well as being well-maintained, DESMAN recommends that the lobby could be energized and refreshed to be made more current. Minor enhancements could include installing a unique lighting scheme to separate the bump-out from the rest of the lobby space, such as pendant lights hung at random but balanced elevations, as well as placing a sculptural element/artwork in the glazed bump-out while incorporating stylish seating (various concepts as follows).




Photo #58

George Street (South) Stair/Elevator C, Ground Level, Enhancements:

Although the construction of Elevator C and the creation of the open area in 2002 succeeded in greatly improving the environment at this location **(*Photo #58)***, it has since become aged; the open nature of the space provides an opportunity for refreshing the space as well as coordinating it with the adjacent Gateway Community College. Minor enhancements could include installing thin linear LED accent lighting to up-light the ceiling, as well as activating the space with bike racks or a sculptural element (various concepts as follows).

Photo #59



Upon undertaking improvements to the area, replacement of the bollards should be considered **(*Photo #59)***, and possibly replaced with a system more aesthetically aligned with the other enhancements. The existing bollard mounts have aged and certain

Photo #60

bollards are extensively corroded; regardless, the bollards should be monitored and replaced as required to maintain the desired protection to the area.

ELECTRICAL WORK:

Emergency Lighting Testing & Repair: Because emergency lighting is a life safety issue, continued maintenance of emergency lighting should be carried as an operational cost by NHPA **(*Photo #60*)**. As conditions merit, specifically as the emergency lighting system components age or become obsolete and there is a need to replace the emergency lighting system and/or some of its component parts, this work would become a capital cost carried within projected repair and improvement costs.

Various damaged exit signs were replaced as part of the (2013) comprehensive capital project. Desman notes that certain other signs have been found to indicate battery trouble. DESMAN notes that varying factors can impact battery life, such as the cold weather (on warmer days, the battery condition may be observed as normal). Therefore, DESMAN recommends that the operation of this critical life safety equipment be reviewed periodically by NHPA maintenance staff to assure proper operation. This is not an item which would normally be carried as a capital budget item.

However, since long-term maintenance has become challenging, DESMAN recommends that PNH consider replacement in conjunction with the installation of an inverter to power certain designated lights, as well as replacing certain DC heads with LED floodlights which would normally be off but then powered by the inverter. This work is currently scheduled to be performed as part of NHPA Project No. 19-006, currently in design.

Miscellaneous Electrical Repair: Even though various electrical repairs were implemented in comprehensive (2013) capital project, DESMAN continues to carry miscellaneous costs associated with the periodic electrical repairs which can be reasonably expected to occur over the next five years. Additional miscellaneous electrical work includes the following:

1. Fire Alarm devices on the roof level appear to be demonstrating UV-related deterioration and reportedly have allowed water to enter the horn strobes. DESMAN recommends that these components, and other roof-level systems, be monitored for further deterioration and addressed accordingly.

2. Miscellaneous conduit feeding the roof level pole lights has been damaged. Water infiltration, as observed on Level B2 at column A-14/15, has also caused premature failure of certain conduits. Standing water, although addressed in most locations, has also caused deterioration in certain locations. DESMAN recommends that the conduit (on the roof level and throughout the remainder of the garage) be monitored for further damage and addressed accordingly.

3. Conduit, boxes and supports serving the stacked conduit on levels 2, 4 and 8 are continuing to corrode. While partial replacements have been performed, it appears that a more significant replacement scope will eventually be necessary.

As miscellaneous repair may be performed, DESMAN recommends that PNH be cognizant of new conduit passing through the floor slab; since the slab tends to be exposed to significant moisture, the metal conduit is then also exposed, thus corroding and deteriorating over time. To help extend the longevity of the conduit, DESMAN recommends that sleeves be used to protect the conduit from direct, sitting water, followed by a polyurethane cove joint as well.

This work was performed as part of NHPA Project No. 16-009, complete in 2019.

Photo #61

Lighting Maintenance: NHPA should implement a planned lighting maintenance schedule for the facility's lighting; whereby lamps and ballasts are replaced throughout the facility at the same time in lieu of the current practice of intermittent replacement on an as-needed basis ***(Photo #61).*** No doubt there is a need to periodically replace a limited number of lamps or individual ballasts due to premature failure, but programmed replacement is typically more cost effective.

Lighting Replacement with LED: There are 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. Based on these factors, LED lighting should be considered for use when the existing garage fixtures near the end of their useful life. While some LED retro-fit solutions are available, these raise concerns with UL Listing and they do not typically have the same efficiency levels as dedicated LED fixtures. LED garage fixtures can be more easily controlled via occupancy sensors, daylight sensors and dimming controls. Such control enhancements can significantly increase the energy savings realized by use of the fixtures but must be carefully evaluated during design to ensure that they are a proper fit for the facility. Most enhanced control strategies will either require the installation of separate control wiring or local controls on each fixture.

The Temple Street fixtures are in fair condition, and would benefit from replacement. However, DESMAN recommends that technology and related options continue to be monitored. To that end, DESMAN recommends that NHPA remain cognizant of the balance between ongoing maintenance costs, related to regular re-lamping and other associated expenses, and the potential savings from an improved technology, such as LED.

Due to the balance between ongoing maintenance costs, related to regular re-lamping and other associated expenses, and the potential savings from an improved technology, such as LED, DESMAN recommends that replacement be considered accordingly, as part of NHPA Project No. 19-006 now in design.

Photo #62

Photo #63

Emergency Intercom Station & Blue Light Repair: The operation of each individual intercom station was not specifically reviewed as part of the assessment of this facility. Testing of each station was not performed as it is understood that operation of this critical safety equipment is verified periodically by NHPA maintenance and operations staff or security **(*Photo #62*)**.

Originally, this emergency intercom system was installed as an independent system; DESMAN recommends that should significant repairs or upgrading be planned, though, that incorporation of the intercom system into a larger and more comprehensive security system be considered; additional security improvements are discussed later in this report.

Replacement of Micro-Lite Lighting Control System: The existing lighting & signage control system is no longer fully supported by the manufacturer. Given the age of the system and the lack of an easy supply of new parts, DESMAN recommends that the entire system be programmed for replacement (use of the Lighting Control & Design system on which the other garages has standardized would provide many advantages such as consistency and lifetime warranty and service). This work is currently scheduled to be performed as part of NHPA Project No. 19-006, currently in design.

Emergency Generator: The Temple Street Garage currently does not have an emergency generator, and therefore NHPA has questioned the feasibility and practicality of installing a generator. 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, currently being performed as part of NHPA Project No. 16-009, followed by subsequent installation, programmed as required.

Photo #64

Photo #65

Photo #66

Sidewalk Lighting Improvements: NHPA had expressed the desire to replace the pendant mounted cylinder lights that were serving the sidewalks **(*Photo #63*)**. This replacement would be for aesthetic, maintenance and energy savings considerations. New LED lights were installed in 2019 to decrease energy use and enhance illumination, as part of NHPA Project No. 16-009.

Surge Protection: Recent events in several of the facilities have raised concerns about surge protection for the electrical distribution system. 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. Currently the Temple Street Garage has a surge protection device on the main garage electrical service **(*Photo #64)***, but more comprehensive coverage could certainly be considered. This work is currently scheduled to be performed as part of NHPA Project No. 19-006, currently in design.

Decorative Lighting: Outdoor rated, linear, colored LED fixtures are available from a number of reliable manufacturers. These fixtures could be used for aesthetic appeal and/or level identification. Color changing effects can be included to provide season-appropriate lighting. This work is currently scheduled to be performed as part of NHPA Project No. 19-006, currently in design.

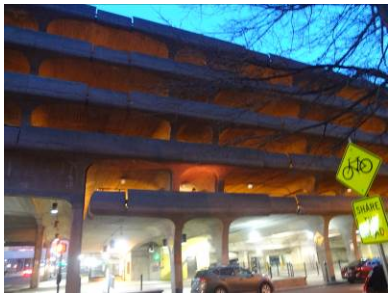


Photo #67

Photo #68

Photo #69

SECURITY ENHANCEMENTS:

NHPA has requested that DESMAN review the opportunities for enhancing security at the Temple Street Garage, including opportunities for video surveillance, access control and audio communication systems; improvements may include a control room and may be coordinated with other facilities.

Although an emergency intercom system currently exists at the Temple Street Garage **(*Photo #67*)**, the aged technology may not be appropriate or compatible for combining or incorporating it into a new security system, and thus may require full replacement.

DESMAN recommends that a study be performed first to review NHPA's needs and subsequently to provide appropriate recommendations; design and installation of the security system would follow and be programmed for implementation accordingly, as per the study in NHPA Project No. 15-002.

DESMAN understands that this work would be subject to funding, and so DESMAN recommends that NHPA program this work accordingly.

MECHANICAL/PLUMBING WORK:

Clean & Flush Drainage System: DESMAN continues to advise that it is important that accumulated sand be removed from the garage decks each spring as they hold a concentration of chloride (road salt) and moisture in direct contact with the concrete deck; causing an increase in the amount of deterioration which could take place.

Photo #70

Photo #71

Photo #72

Photo #73

Sand carried into the storm drains can clog drains and associated drain lines **(*Photo #68*)**. In combination with periodic garage wash down, it is imperative that the facility's drainage system be kept clean and operational. A sand/oil interceptor was recently installed as part of the (2013) comprehensive repair project which will require periodic cleaning as well. **(*Photo #69)***

The costs associated with the flushing of the facility's drainage system are included within our estimated repair and preventative maintenance costs only in coordination with other concrete repair work. The costs associated with cleaning and flushing down the deck surfaces otherwise is an operational cost and, therefore, is not included within projected repair and preventative maintenance costs.

Supplemental Drainage Installation: Miscellaneous ponding has been observed throughout the garage. The installation of supplemental drains was implemented as part of the (2013) comprehensive capital project; however, DESMAN recommends that conditions be monitored since additional drains may become appropriate.

DESMAN has been informed that ponding has been observed to occur on either side of various expansion joints, thus contributing to premature failure **(*Photo #70)***, as well as adjacent to the door to the elevator machine room (roof level). DESMAN recommends that this situation be monitored, but supplemental drains may be installed if needed to address the ponding should it continue to be a concern. This work is currently scheduled to be further reviewed and addressed as part of NHPA Project No. 17-006, currently in design.

Drainage System Repairs: DESMAN recommends that all damaged drainage components be repaired and/or replaced as required; the system should be monitored and NHPA budget accordingly **(*Photo #71*)**.

Photo #74

Photo #75

Photo #76

DESMAN noted a short section of piping that reduces in size, apparently contrary to current code. DESMAN recommends that this section of piping specifically be monitored for blockage and addressed as required if a concern.

Elevator Lobby Heating: Servicing and preventative maintenance should be performed on a regular basis. The costs associated with servicing the unit is an operational cost and, therefore, is not included within projected repair and preventative maintenance costs.

Pressurized Garage Wash-Down System: The installation of a pressurized garage wash-down system was performed as part of the current (2013) comprehensive capital project. **(*Photos #72 & #73*)**

NHPA's utilization of the high pressure wash-down system in this or other garages is an important consideration in reducing future concrete deck deterioration and the need for costly future repairs. It is highly recommended that the facility be washed down quarterly or as a minimum twice a year (Spring and Fall) to remove accumulated sand and debris and to flush accumulated road salt (chlorides) from the surface of the deck. The facility's wash-down system is designed to provide a sufficient volume of water at high pressure to assist in cleaning the concrete decks, thus greatly reducing the amount of structural deterioration likely to take place.

DESMAN recommends that the washdown system be monitored for damage and repaired as may be required on an as-needed basis.

Mitigation of Rev. Dr. Martin Luther King Jr. Boulevard Vehicle Exit Flooding: Storm water is unable to drain from this area of the facility during heavy rains due to the City's storm sewer system being overburdened. As a result, there is a problem with flooding at a low area near the collection booths at the Rev. Dr. Martin Luther King Jr. Boulevard exit. Flooding has resulted in damage to the revenue control equipment and prevents cars from exiting the garage during such events. While there is no ideal solution to this problem as long as the public storm system is incapable of handling the storm flow, a partial remedy has been provided and is in-place. A new sump pump near the collection booths discharges into the city sewer at a nearby location, as well as construction of a wooden barrier to serve as a protective dam. This work was performed as part of comprehensive

(2013) repair program. **(*Photos #74 & #75*)** Additionally, with the closure of the exit as part of the City's Downtown Crossing Phase 3 project, the ramp will be removed and walls installed, eliminating this flooding situation.

Photo #77

Mitigation of Flooding within Abandoned Corridor/Storage Room (Level B3): Water infiltrating the structure and trapped in an abandoned store room at the B3 Level near column lines C-21 was addressed (indirectly) due to the adjacent construction on Gateway project. Desman will continue to monitor this storage room, though, to see if the condition arises again.

Photo #78

Corrosion of Make-up Air Ductwork, Sprinkler and Storm Drainage Piping Located below George Street: Water, which is infiltrating failed or damaged expansion joints along both sides and across George Street where it passes through the garage above the basement level (Level B2 & B3), is resulting in premature corrosion damage to both the underlying ductwork, sprinkler and drainage piping. Limited repair along with prepping, priming and painting this piping to alleviate a situation with progressive deterioration **(*Photos #76, #77 & #78*)** is recommended. It should be noted that the other necessary repairs associated with the George Street pass-through as discussed previously are also required, but this work is the City's responsibility, not NHPA's. In order to accommodate the drains and address the leaking through the expansion joints in the meantime, the existing copper trough, below the George Street expansion joints, was repaired and modified accordingly **(*Photos #79 & #80*)** , as part of the (2013) comprehensive capital project.

Photo #79

Photo #80

Photo #81

Basement Ventilation & CO System Repairs: The existing carbon monoxide detection system and related fan controls have been difficult to maintain, and various sections of ductwork have corroded beyond repair. Replacement sensors are difficult to obtain and the CO system is generally nearing the end of its expected life. While the existing sensor locations and conduit could remain, the existing wiring would need to be coordinated with any proposed new sensors for compatibility. The exhaust fans are in various states of disrepair, subsequently needing repair and/or replacement. DESMAN recommends that replacement of the system headend and all existing sensors be considered This work is currently scheduled to be performed as part of NHPA Project No. 18-009, currently in construction.

Sump Pump PVC Discharge Piping: The piping is reportedly leaking at the joints. DESMAN recommends repiping the pumps or remaking pipe joints as required to eliminate the leaking. The costs associated with repairing the piping is an operational cost and, therefore, is not included within projected repair and preventative maintenance costs.

Fire Protection System Maintenance: 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.

Mechanical Preventative Maintenance: 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 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:

- Basement Parking Level Ventilation Equipment (inclusive of Roof Level Exhaust Fans & Basement Level Make-up Air Fans and Carbon Monoxide Detection System, as well as street level air intakes.
- Collection Booth Systems inclusive of Ventilation Systems including Duct Heaters, Air Conditioners, and Cabinet Unit Heaters
- Elevator Machine Room HVAC Equipment.
- NHPA Office HVAC Systems including but not limited to air handling units, electric heating elements (heat pump, dehumidification system, cabinet unit heaters, HVAC controls including but not limited to thermostats, humidistats and control dampers and toilet exhaust fans
- Facility Washdown System and Washdown Room Heater
- Sump Pumps at Basement B3 Level, Elevator Pits and Rev. Dr. Martin Luther king Boulevard

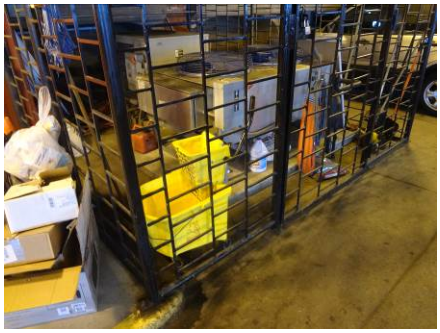


Photo #82

Photo #83

Photo #84

Installation of a Sink for Cleaning: The maintenance mop and bucket for cleaning is stored within the fenced space on Level 3 **(*Photo #82*)**. Whenever NHPA performs its cleaning, staff needs to bring the bucket down to the office in order to clean and fill the bucket, to then bring it back out to the garage. Therefore, NHPA has requested that a sink be installed so that it is closer to where the mop may be needed. However, prior to the sink being installed, DESMAN recommends that proper winterizing and pipe insulation requirements be reviewed to confirm appropriateness.

SIGNAGE IMPROVEMENTS:

Miscellaneous Signage Repair: This garage has a multitude of traffic and pedestrian way-finding signage installed throughout the facility. Over time, depending on environmental exposure, vandalism and abuse, and normal wear, some of this signage needs to be repaired or replaced **(*Photos #83 & #84*)**. Depending on the type and location of this signage should dictate when it should be repaired; some

signage, particularly some of the illuminated signage with changeable computer controlled messages are critical to garage operation and traffic control and should be replaced immediately after the damage is identified. Some of this work was implemented as part of the (2013) comprehensive capital project although continued repairs should be monitored and address as required.

In conjunction with NHPA's re-branding program, the exterior identification signage was replaced **(*Photos #85 & #86*)**. Interior and/or pedestrian signage which incorporates NHPA's logo should also be programmed for replacement. The signage can be updated with new sign box materials and new graphic faces to be more in keeping with NHPA's new logo and graphic standards.

Photo #85

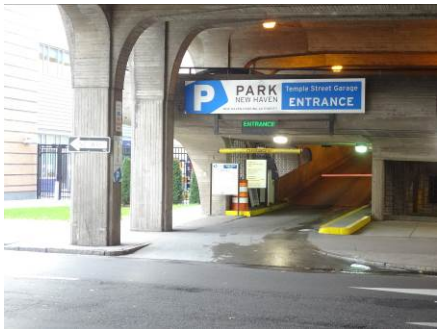


Photo #86

With new development occurring within downtown New Haven, conditions can sometimes change where additional signage may be required to address changes in patron usage, or because of new building construction in close proximity to a facility; all of which may dictate the need for additional signage or updating of the older previously installed signage.

The maximum height for clearance for entering the garage is posted as 6'-0". However, patrons with vehicles taller than this clearance have continually been a concern for NHPA. When NHPA programs the signage improvements and considers installation of new clearance bar systems, additional enhancements could be considered. Such enhancements could involve a laser sensor connected to some form of audible & visual alarm; the alarm could be a blinking light with a sign that immediately informs the patron that his vehicle exceeds the maximum height.

Photo #87

At that time, though, DESMAN recommends that NHPA consider the practicality of the alarm system since location may be a concern in order to avoid forcing the patron to back out into incoming traffic; if the alarm system is to be placed independently, closer to the sidewalk edge at the street, a pole with a foundation may be needed. DESMAN recommends that NHPA review all options accordingly.

Photo #88

Photo #89

Photo #90

Photo #91

PAINTING:

Parking Stall & Lane Striping: The parking facility was re-striped in 2013. As with any parking facility, periodic re-striping will be required, the cost of this periodic re-striping has been included within our projected repair costs for this facility.

Railings and Miscellaneous Metalwork: This item of work includes painting of facility handrails as well as other ferrous materials **(*Photos #87, #88 & #89*)**, such as the guardrail in front of the roof level elevator vestibules. Painting offers corrosion protection and is an aesthetic enhancement as well. Normal wear and tear due to continued use of the facility stairs necessitates periodic repainting of stair hand railings.

REVENUE CONTROL EQUIPMENT REPLACEMENT:

The existing revenue control and parking access equipment was replaced in 2013. However, due to new and improved technology, DESMAN recommends that PNH review the current system for potential enhancements and/or replacement, and plan accordingly. **(*Photos #90 & #91*)**

ELEVATOR IMPROVEMENTS:

In 2000, elevator repairs were performed which included the replacement of elevator cabs and doors in the four pre-existing elevators and the installation of a new hydraulic elevator at the southeast corner of George Street and Temple Street. In conjunction with a maintenance service contract currently in place, related HVAC improvements to the elevator machine room were implemented in FY 2014. However, due to age and wear-and-tear, modernization of the elevators is now recommended as programmed accordingly in FY 2022.

In the meantime, due to the age of the equipment and various improvements over time, certain equipment has become obsolete and thus cannot be repaired, subsequently requiring full replacement. In 2018, one governor had to be replaced on an emergency-basis; the replacement of the other (3) safety governors were replaced as part of Project No. 19-012.

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

Photo #92

DESMAN did observe miscellaneous corrosion at various framing **(*Photo #92*)**; DESMAN recommends that PNH monitor these conditions as required.

MISCELLANEOUS CONSIDERATIONS:

As part of the construction of the adjacent Gateway Community College property, one of the abandoned elevators within the eastern corridor was permanently filled, leaving the second one still open **(*Photo #93*)**. Since various improvements to the George Street area above are still in progress, water infiltration coming from the adjacent property may or may not continue to be a concern. DESMAN recommends that this abandoned elevator be monitored and if appropriate, formally filled.

Photo #93

Replacement of Metal Stair: the existing metal stair, leading from the valet parking area (on street level) to the rear corridor on Level B3, is corroded beyond repair **(*Photos #94 & #95*)**. DESMAN recommends that this metal stair be removed and replaced with a new hot-dipped galvanized metal stair system, fully compliant with current Code. However, either prior to or in conjunction with the replacement work, DESMAN recommends that the continued water intrusion into this corridor be addressed so as to avoid further corrosion to the stair system. This work is currently scheduled to be performed as part of NHPA Project No. 20-006, currently in design.

Photo #94

Photo #95

Photo #96

Garage Cleaning: 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. Although it is DESMAN's opinion that facility cleaning is in reality an operating expense which should be performed on an as-needed basis, DESMAN recommends that a comprehensive cleaning and degreasing of the entire facility (interior and exterior surfaces, as well as sidewalk areas) be programmed.

Ice-Melt and Snow Removal: 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 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 in-house, 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 **(*Photos# 96, 97 & 98*)**. For that purpose, **DESMAN** has included a sample "Seasonal Washdown Checklist" that can be used to track each scheduled washdown.

Photo #97

Photo #98

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.

This work is currently being performed as part of NHPA Project No. 16-007.

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 Temple Street Parking Garage. The repairs required have been prioritized into three courses of action:

- Prioritized Repairs (FY 2021)
- Early Repairs (FY 2022)
- Programmed Repairs (FY 2023)
- Long-Term Repairs (FY 2024 - 2025)

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)	$6,668,550.00
Programmed Repairs (FY 2023)	$1,162,900.00
Long-Term Repairs (FY 2024 – 2025)	$2,235,900.00
TOTAL ESTIMATED COST	**$10,067,350.00**

A detailed cost estimate is provided in the table on the following pages which is entitled “Projected 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.

Temple Street Parking Garage
Projected Five Year Construction Cost

(FY 2020)

DESMAN Design Management

		Work Description	Prioritized Repairs (FY 2021)	Early Repairs (FY 2022)	Programmed Repairs (FY 2023)	Long-Term Repairs (FY 2024-2025)
A.		**Concrete Work:**				
	1	Miscellaneous Partial Depth Concrete Deck Repair	$ -	$ -	$ 2,000.00	$ 2,000.00
	2	Miscellaneous Roof Overlay Repair	$ -	$ -	$ 5,000.00	$ 5,000.00
	3	Miscellaneous Lower Level Overlay Repair	$ -	$ -	$ 1,000.00	$ 1,000.00
	4	Concrete Scaling Repair/Application of Healer/Sealer	$ -	$ -		$ 47,000.00
	5	Miscellaneous Overhead Concrete Repair (incl. misc. replacement for color improvements)	$ -	$ -	$ 20,000.00	$ 21,000.00
	6	Miscellaneous Vertical Concrete Repair (incl. misc. replacement for color improvements)	$ -	$ -	$ 3,000.00	$ 3,000.00
	7	Miscellaneous Curb Repair	$ -	$ -	$ 1,000.00	$ 1,000.00
	8	Miscellaneous Exterior Sidewalk and Bench Repair	$ -	$ -	$ 1,000.00	$ 1,000.00
	9	Miscellaneous Stair Repair	$ -	$ -	$ 1,000.00	$ 1,000.00
	10	Roof Level Wear Course Installation/Partial-Depth Repair	$ -	$ -	$ 277,000.00	$ 146,000.00
	11	Partial-Depth Concrete Repair, Ground Level	$ -	$ -	$ -	$ -
	12	"Cobra-Head" Light Standard Repair	$ -		$ 134,000.00	$ 140,000.00
B.		**Waterproofing Work:**				
	1	Traffic Bearing Membrane Installation and Repair	$ -			
		a. Miscellaneous Traffic Bearing Membrane Repair	$ -	$ -	$ -	$ -
		b. Membrane Installation on Ramp from Level 2 to Level 1	$ -	$ -		
	2	Programed Expansion Joint Replacement	$ -	$ -	$ -	$ -
	3	Crack Repair	$ -	$ -	$ -	$ -
		a. Roof Deck	$ -	$ -	$ 1,000.00	$ 1,000.00
		b. Lower Levels	$ -	$ -	$ 1,000.00	$ 1,000.00
	4	Control/Construction Joint Repair	$ -	$ -	$ -	$ -
		a. Roof Deck	$ -	$ -	$ 1,000.00	$ 1,000.00
		b. Lower Levels	$ -	$ -	$ 1,000.00	$ 1,000.00
	5	Cove Joint Repair	$ -	$ -	$ -	$ -
		a. Roof Deck	$ -	$ -	$ 1,000.00	$ 1,000.00
		b. Lower Levels	$ -	$ -	$ 1,000.00	$ 1,000.00
	6	Basement Waterproofing	$ -	$ -	$ -	$ -
		a. Chemical Grout Injection	$ -	$ 16,000.00	$ 17,000.00	$ 35,000.00
		b. Interior (Negative Side) Waterproofing	$ -	$ 32,000.00	$ 34,000.00	$ 70,000.00
	7	EMR Roof Replacement	$ -	$ -	$ -	$ -
C.		**Architectural Improvements and Repairs:**				
	1	Facility Cleaning (Interior and Exterior)	$ -	$ -	$ -	$ -
	2	Garage Entrance (from Crown Street) Façade Enhancements	$ -	$ -	$ -	$ 140,000.00
	3	Pedestrian Entrance Enhancements (to Elevator A, from Crown Street)	$ -	$ -	$ -	$ 210,000.00
	4	Elevator A Lobby (by Crown Street), Ground Level, Improvements	$ -	$ -	$ -	$ 70,000.00
	5	Elevator B Lobby (main lobby, George Street), Ground Level, Improvements	$ -	$ -	$ -	$ 70,000.00
	6	George Street (South) Stair/Elevator, Ground Level, Enhancements	$ -	$ -	$ -	$ 140,000.00
	7	Door Replacement and Repairs (with heavy-duty FRP doors)	$ -	$ 634,000.00	$ -	$ -
	10	Replacement of Wood Bumper Guards	$ -	$ 200,000.00	$ -	$ -
	11	Sidewalk Bench Enhancements	$ -	$ -	$ -	$ 70,000.00
	12	Replacement of Metal Stair System	$ -	$ -	$ -	$ -
E.		**Mechanical and Electrical Work:**				
	1	Clean Floor Drains (w/ Construction)	$ -	$ -	$ 13,000.00	$ 13,000.00
	2	Installation of Supplemental Drains by Expansion Joints	$ -	$ -	$ -	$ -
	3	Installation of Supplemental Piping	$ -	$ -	$ -	$ -
	4	Cleaning of Sand/Oil Separator	$ -	$ -	$ 3,000.00	$ 3,000.00
	5	Ventilation System/CO Monitoring System Repairs	$ -	$ -		
	6	Miscellaneous Electrical Repairs	$ -	$ -	$ 14,000.00	$ -
	7	Replacement/Installation of New LED Light Fixtures	$ -	$ -	$ -	$ -
	8	Emergency Lighting Replacement/Improvements	$ -	$ -	$ -	$ -
	9	Accent Lighting Study	$ -	$ -		
	10	Installation of Decorative Lighting	$ -	$ -	$ -	$ -
	11	Installation of Emergency Generator (Allowance)	$ -	$ -	$ 200,000.00	
	12	Surge Protection	$ -	$ -	$ -	$ -
	13	Lighting/Signage Control System Programming & Adjustments with Related Training	$ -	$ -	$ -	$ -
	14	Installation of Maintenance Sink (Level 3)	$ -	$ 13,000.00	$ -	$ -
	15	Miscellaneous Repairs to Fire Standpipe System/FD Connections	$ -	$ -	$ -	$ -
F.		**Security Improvements**				
		Installation of Security System (i.e. Cameras and other components)	$ -	$ -	$ -	$ -
G.		**Signage Improvements**				
	1	Update Interior Signage (New Garage Identification w/ New Logo)	$ -	$ 127,000.00	$ -	$ -
	2	Repairs/Replacement of Signage	$ -	$ 381,000.00	$ -	$ -
	3	Clearance Bar Sensor Assembly Installation (3 Entrances)	$ -	$ 64,000.00	$ -	$ -
H.		**Revenue Control Equipment Renewal & Replacement**				
	1	Study for the Replacement of the Revenue Control Equipment	$ -	$ -	$ 10,000.00	$ -
	2	Replacement of the Revenue Control Equipment	$ -	$ -	$ -	$ 301,000.00
I.		**Painting:**				
	1	Parking Stall & Lane Striping	$ -	$ -	$ 40,000.00	$ 42,000.00
	2	Painting of Piping	$ -	$ 96,000.00	$ -	$ -
	3	Painting of Railings	$ -	$ 64,000.00	$ -	$ -
	4	Painting of Column Level Designation Bands	$ -	$ 127,000.00	$ -	$ -
J.		**Elevator Upgrades and Improvements:**				
	1	Maintenance Audit (Bi-Ennial)	$ -	$ 4,000.00	$ -	$ 4,000.00
	2	Replacement of Safety Governors - Allowance	$ -	$ -	$ -	$ -
	3	Modernization of (5) Elevators	$ -	$ 2,841,000.00	$ -	$ -
K.		**File Management**				
	1	Preparation of Record Drawings	$ -	$ -	$ 20,000.00	$ -
	2	Scanning of Original Drawings	$ -	$ -	$ -	$ -
		Sub-Total	**$0.00**	**$4,599,000.00**	**$802,000.00**	**$1,542,000.00**
		20% Contingencies (Unless Depicted Otherwise)	$0.00	$919,800.00	$160,400.00	$308,400.00
		25% Engr. & Construction Management, incl. Program Management (Unless Depicted Othe	$0.00	$1,149,750.00	$200,500.00	$385,500.00
		Total Phased Construction Costs with contingencies:	**$0.00**	**$6,668,550.00**	**$1,162,900.00**	**$2,235,900.00**
		TOTAL Construction Cost with Contingencies:				**$10,067,350.00**

Note 1: Costs Presented do not Include Typical Operational & Maintenance Costs Except as Noted
Note 2: Costs Presented do not include Work related to George Street, which is the responsibility of the City of New Haven
Note 3: Costs include a 15% allowance for General & Special Conditions.
Note 4: Future costs incorporate a cumulative 5% inflation for all costs, to be adjusted annually

6. DETERIORATION MECHANISMS

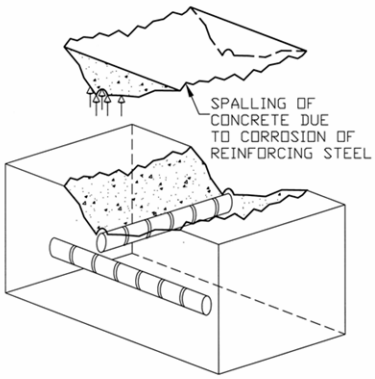


Fig. A

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.

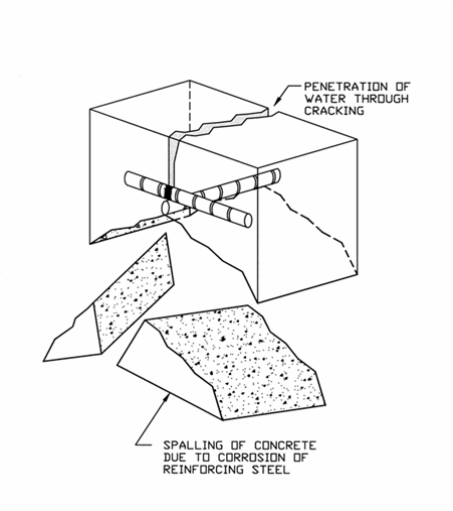


Fig. B

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 freeze-thaw 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.

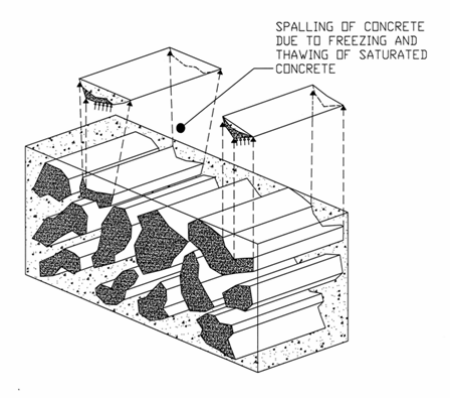


Fig. C

FREEZE-THAW DAMAGE:

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

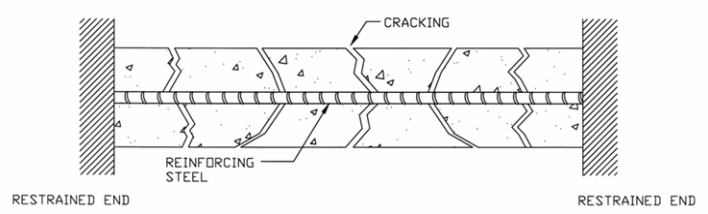
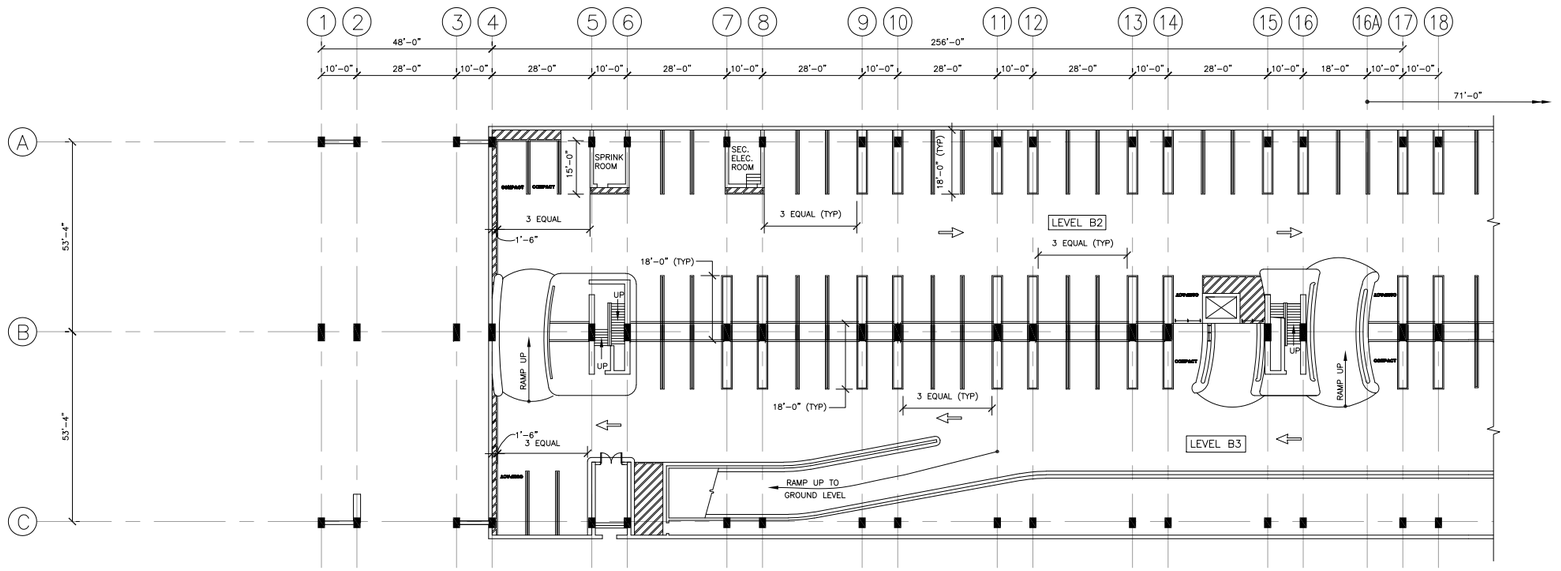


Fig. D

CHEMICAL ATTACK:

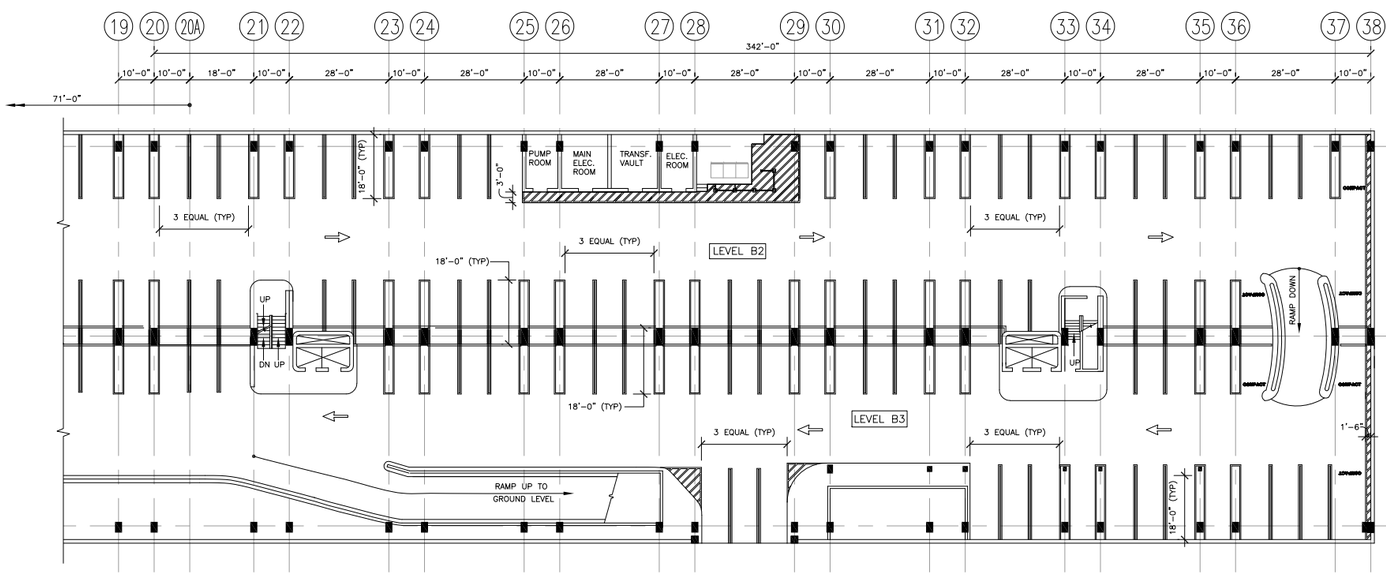
Chemical attack is a fifth major deterioration mechanism affecting the performance of reinforced concrete. The effect of de-icing chemical/chlorides upon reinforcing steel and scaling is one example of chemically influenced deterioration. Severe exposure to other chemicals, notably sulfates and acids, 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.

7. APPENDIX A – SCHEMATIC FLOOR PLANS



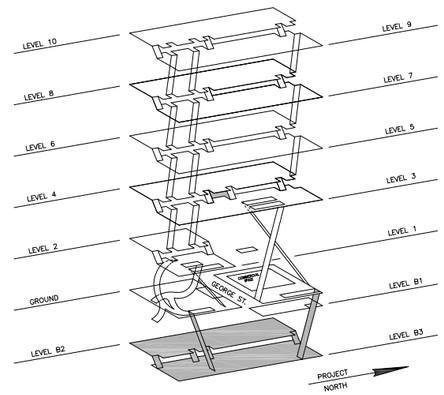
LEVELS B2 & B3 STRIPING PLANS (SOUTH END)

SCALE: N.T.S.



LEVELS B2 & B3 STRIPING PLANS (NORTH END)

SCALE: N.T.S.



ISOMETRIC KEY PLAN

DESMAN Design Management

CONNECTICUT

CONDITION APPRAISAL, YEAR 2020
NHPA PROJECT #20-001

NEW HAVEN

NO.	DATE	BY
REVISIONS		

DRAWING TITLE

B2 AND B3 LEVEL STRIPING PLANS

DRAWING NO.

ST-1.1

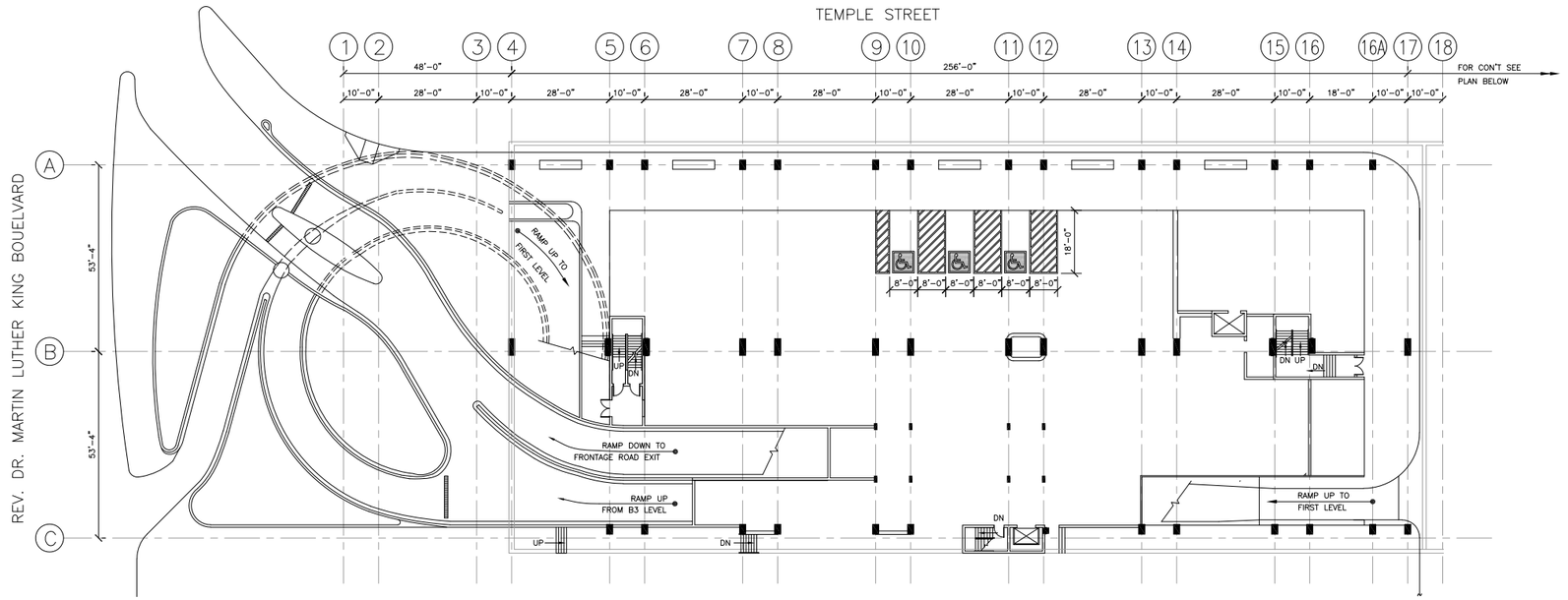
SCALE: NTS

DATE: APRIL 2020

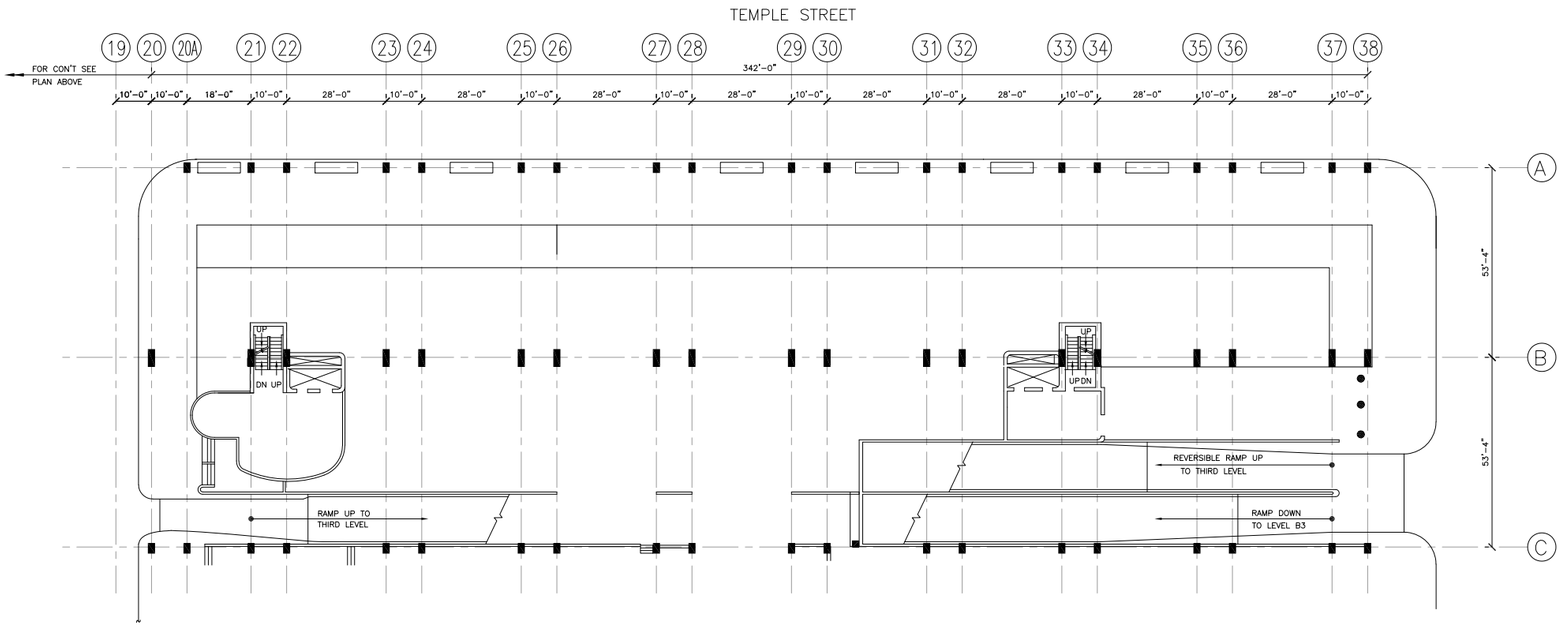
PROJECT NO. 20-19171.00-2

NHPA NO. 20-001

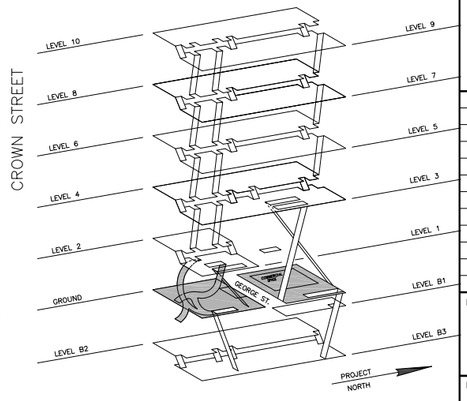
DESIGN	DRAWN	CH'KD.
KDS	KDS	KDS



GROUND LEVEL STRIPING PLAN (SOUTH END)
SCALE: N.T.S.



GROUND LEVEL STRIPING PLAN (NORTH END)
SCALE: N.T.S.



ISOMETRIC KEY PLAN

DESMAN
Design Management

CONDITION APPRAISAL, YEAR 2020
NHPA PROJECT #20-001

NEW HAVEN
CONNECTICUT

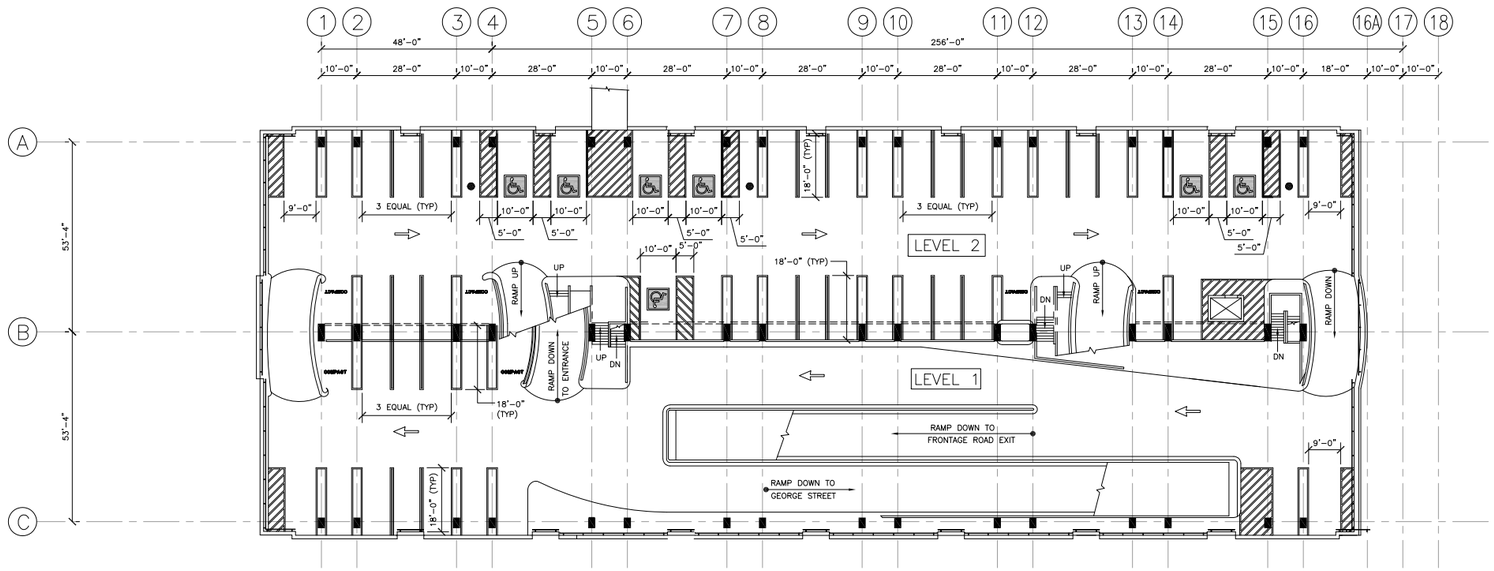
NO.	DATE	BY
REVISIONS		

DRAWING TITLE
GROUND LEVEL STRIPING PLAN

DRAWING NO.
ST-1.2

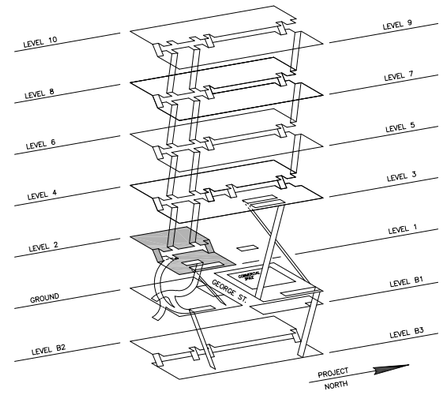
SCALE: NTS
DATE: APRIL 2020
PROJECT NO. 20-19171.00-2
NHPA NO. 20-001

DESIGN	DRAWN	CH'KD.
KDS	KDS	KDS



LEVELS 1 & 2 STRIPING PLANS (SOUTH END)

SCALE: N.T.S.



ISOMETRIC KEY PLAN

DESMAN
Design Management

CONDITION APPRAISAL, YEAR 2020
NHPA PROJECT #20-001

NEW HAVEN CONNECTICUT

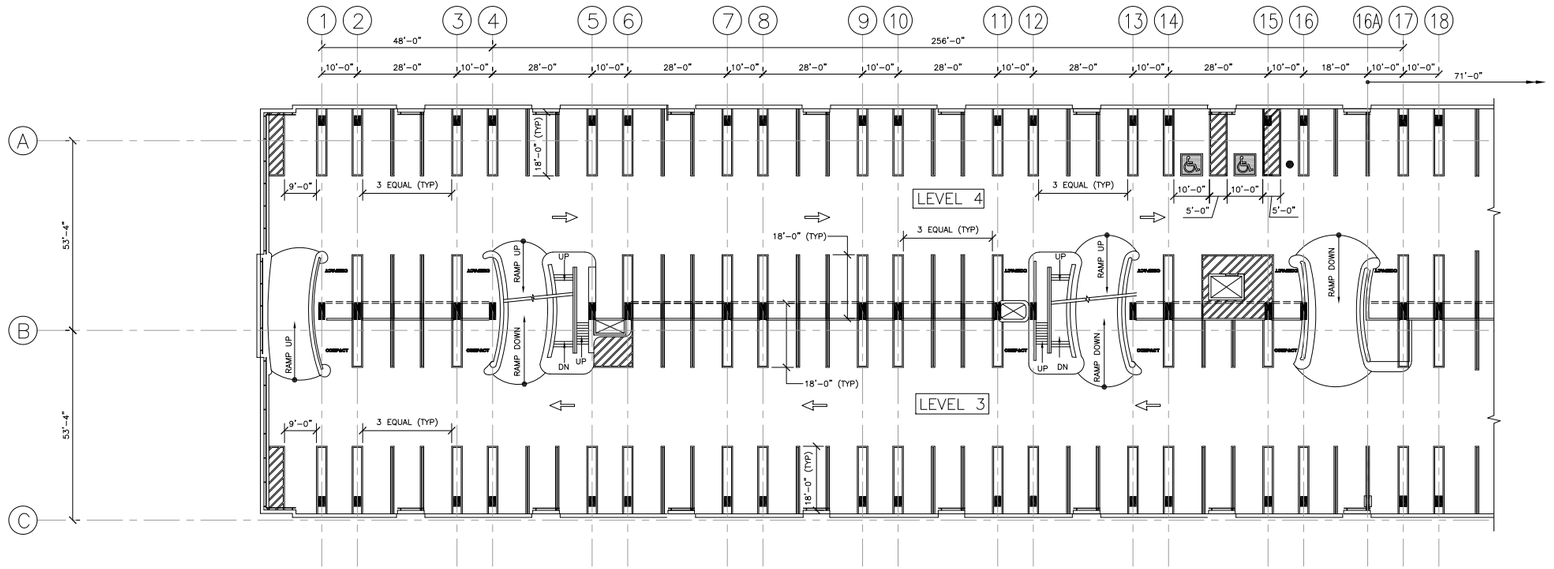
NO.	DATE	BY
REVISIONS		

DRAWING TITLE
FIRST AND SECOND LEVEL STRIPING PLANS

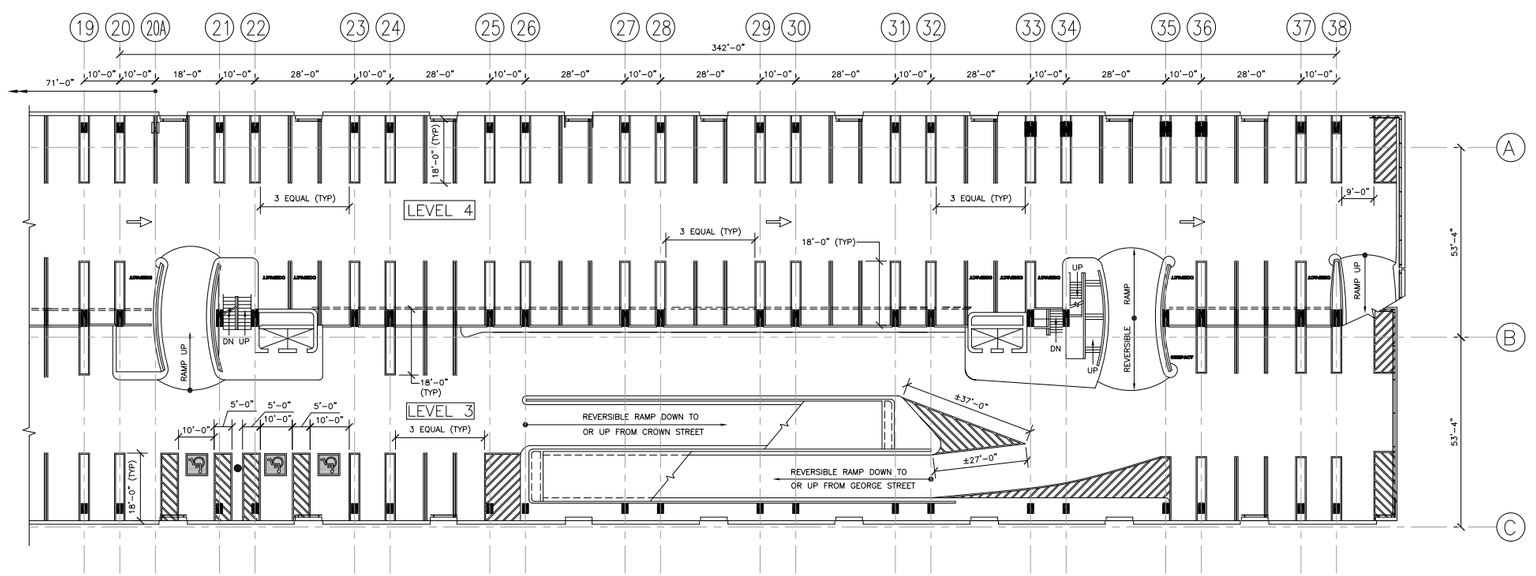
DRAWING NO.
ST-1.3

SCALE: NTS
DATE: APRIL 2020
PROJECT NO. 20-19171.00-2
NHPA NO. 20-001

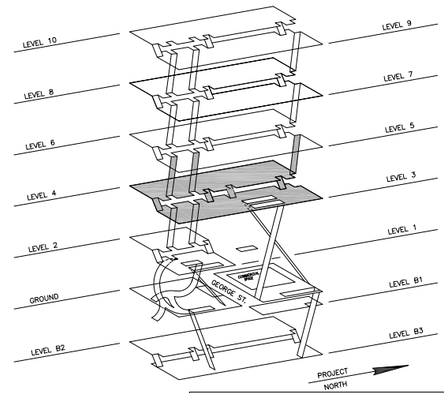
DESIGN	DRAWN	CH'KD.
KDS	KDS	KDS



LEVELS 3 & 4 STRIPING PLANS (SOUTH END)
SCALE: N.T.S.



LEVELS 3 & 4 STRIPING PLANS (NORTH END)
SCALE: N.T.S.



ISOMETRIC KEY PLAN

DESMAN
Design Management

CONDITION APPRAISAL, YEAR 2020
NHPA PROJECT #20-001

NEW HAVEN CONNECTICUT

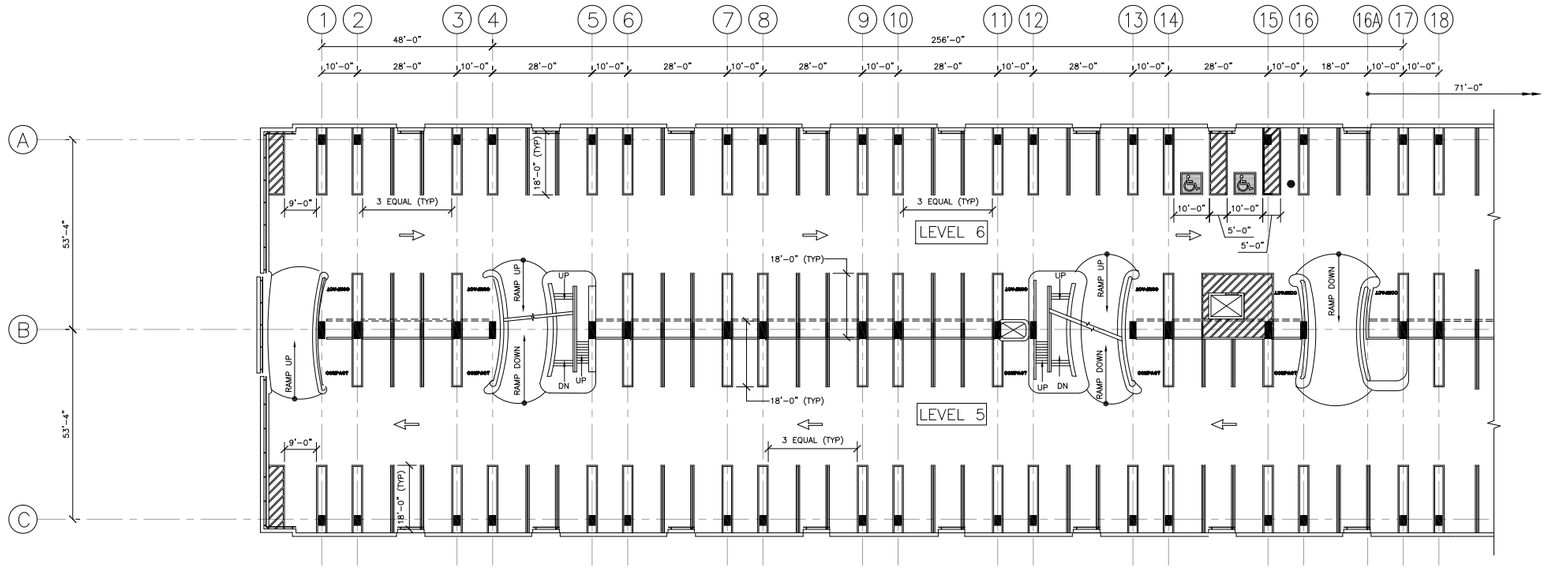
NO.	DATE	BY
REVISIONS		

DRAWING TITLE
THIRD AND FOURTH LEVEL STRIPING PLANS

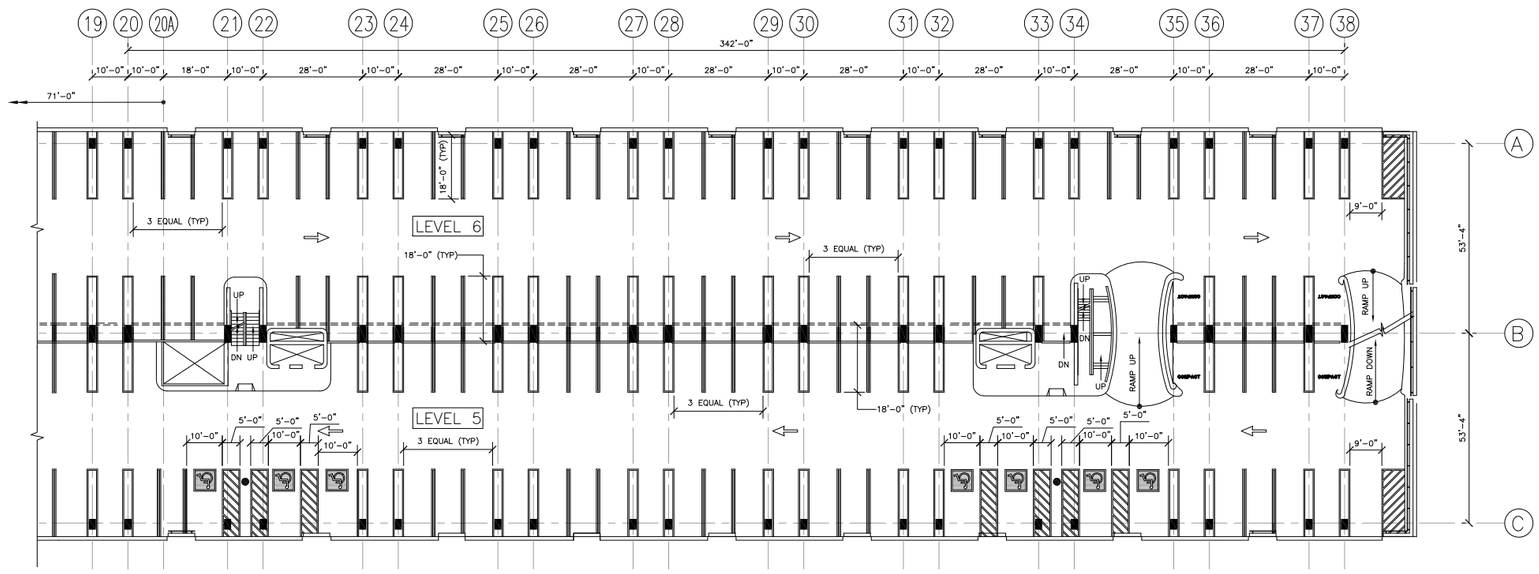
DRAWING NO.
ST-1.4

SCALE:	NTS
DATE:	APRIL 2020
PROJECT NO.	20-19171.00-2
NHPA NO.	20-001

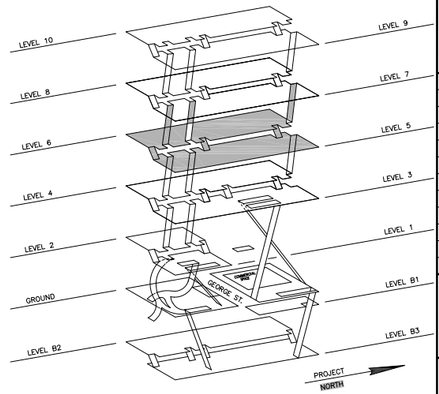
DESIGN	DRAWN	CH'KD.
KDS	KDS	KDS



LEVELS 5 & 6 STRIPING PLANS (SOUTH END)
SCALE: N.T.S.



LEVELS 5 & 6 STRIPING PLANS (NORTH END)
SCALE: N.T.S.



ISOMETRIC KEY PLAN

DESMAN Design Management

CONDITION APPRAISAL, YEAR 2020
NHPA PROJECT #20-001

NEW HAVEN

CONNECTICUT

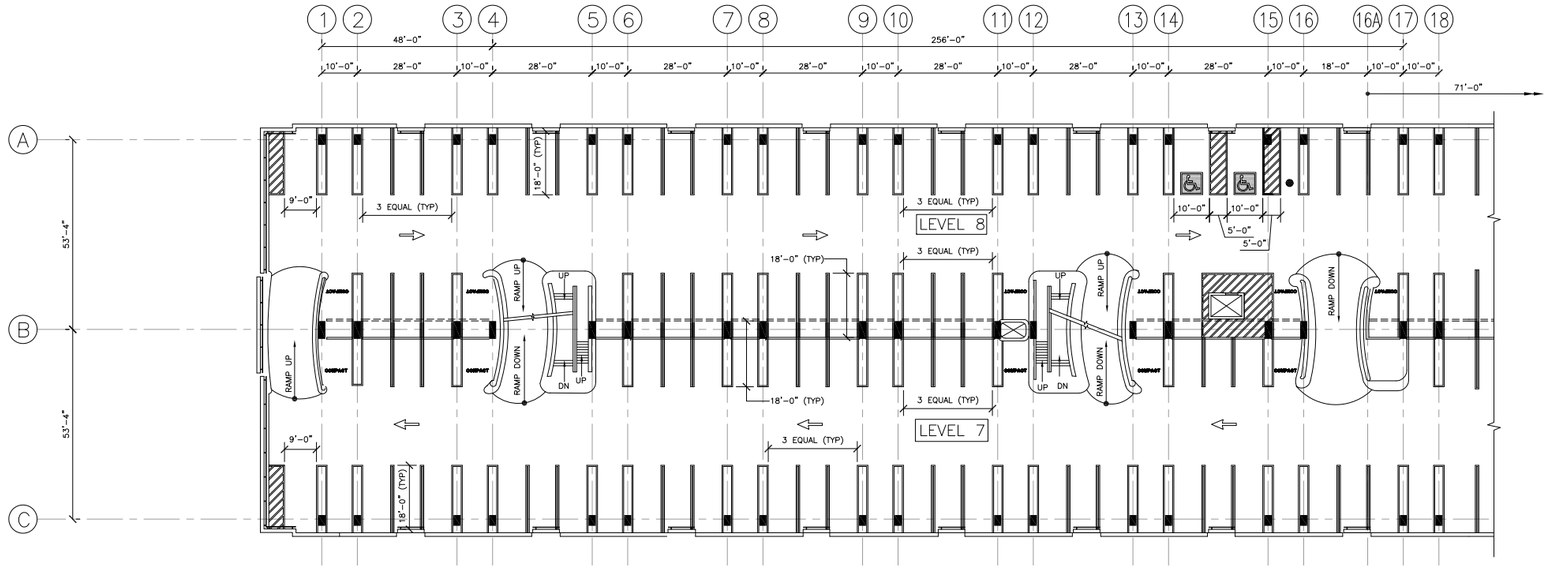
NO.	DATE	BY
REVISIONS		

DRAWING TITLE
FIFTH AND SIXTH LEVEL STRIPING PLANS

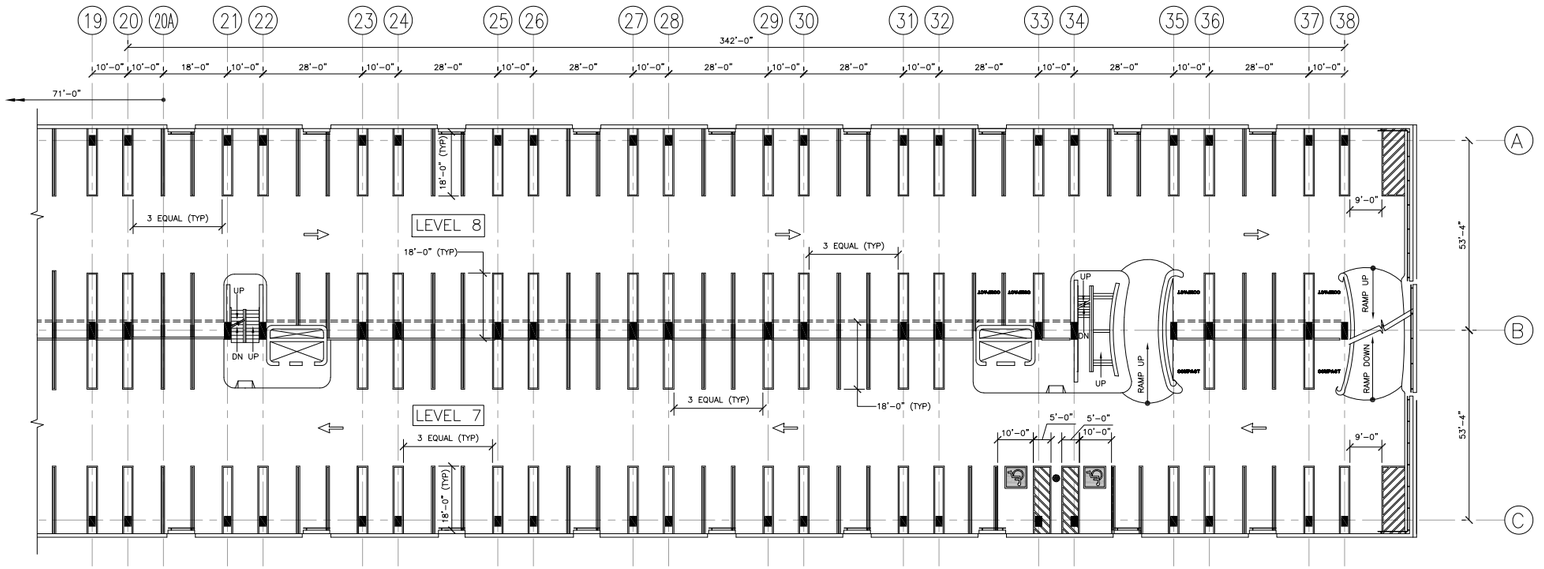
DRAWING NO.
ST-1.5

SCALE: NTS
DATE: APRIL 2020
PROJECT NO. 20-19171.00-2
NHPA NO. 20-001

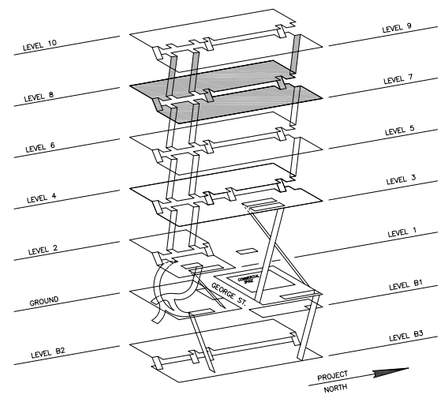
DESIGN	DRAWN	CH'KD.
KDS	KDS	KDS



LEVELS 7 & 8 STRIPING PLANS (SOUTH END)
SCALE: N.T.S.



LEVELS 7 & 8 STRIPING PLANS (NORTH END)
SCALE: N.T.S.



ISOMETRIC KEY PLAN

DESMAN Design Management

CONDITION APPRAISAL, YEAR 2020
NHPA PROJECT #20-001

NEW HAVEN CONNECTICUT

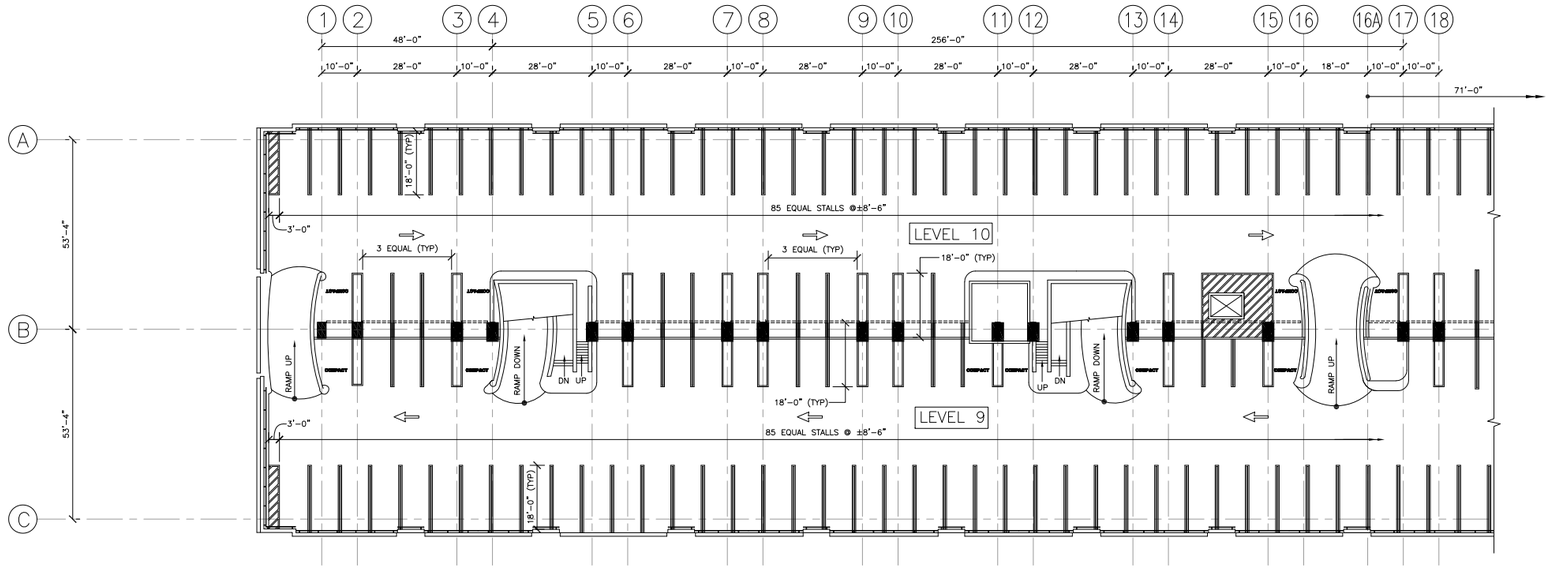
NO.	DATE	BY
REVISIONS		

DRAWING TITLE
SEVENTH AND EIGHTH LEVEL STRIPING PLANS

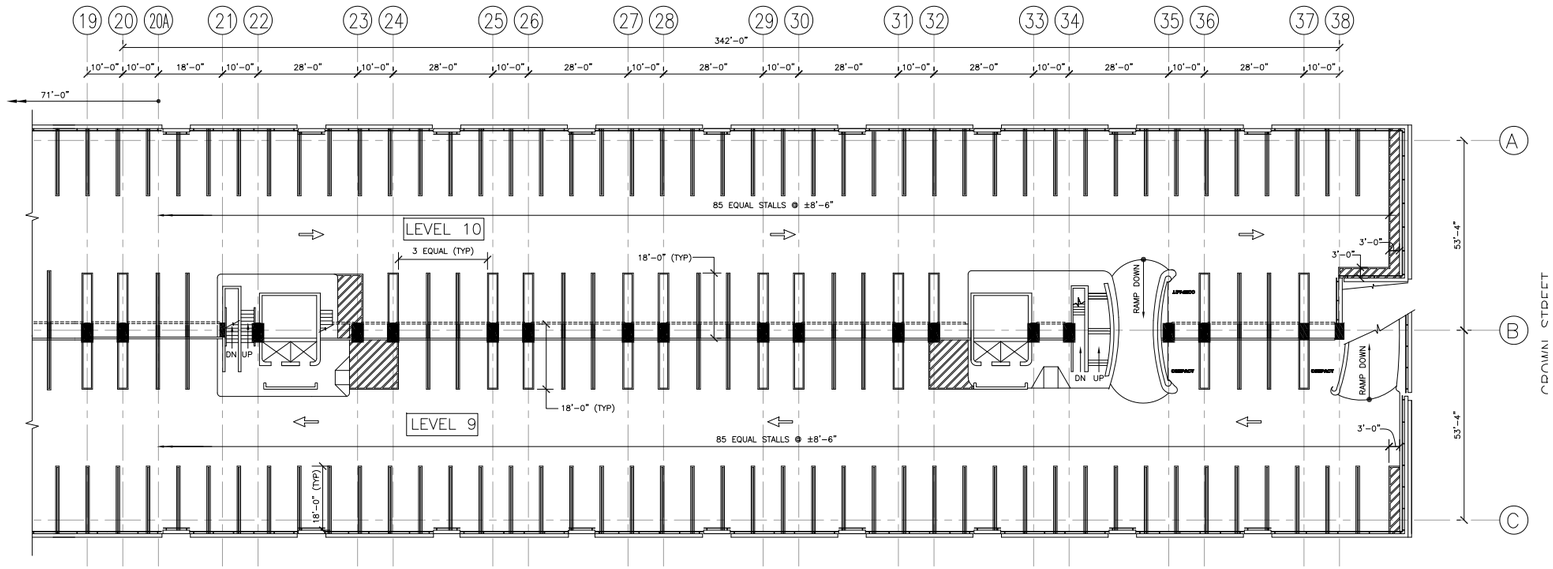
DRAWING NO.
ST-1.6

SCALE: NTS
DATE: APRIL 2020
PROJECT NO. 20-19171.00-2
NHPA NO. 20-001

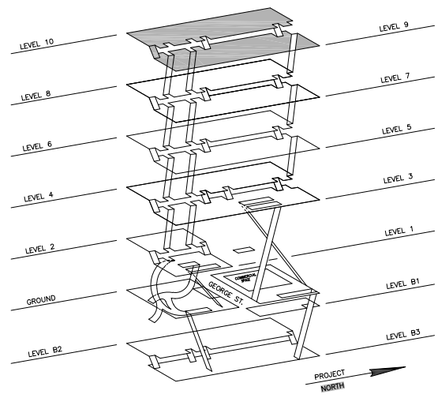
DESIGN	DRAWN	CH'KD.
KDS	KDS	KDS



LEVELS 9 & 10 (ROOF) STRIPING PLANS (SOUTH END)
SCALE: N.T.S.



LEVELS 9 & 10 (ROOF) STRIPING PLANS (NORTH END)
SCALE: N.T.S.



ISOMETRIC KEY PLAN

DESMAN
Design Management

CONDITION APPRAISAL, YEAR 2020
NHPA PROJECT #20-001

NEW HAVEN
CONNECTICUT

NO.	DATE	BY
REVISIONS		

DRAWING TITLE
NINTH AND TENTH LEVEL STRIPING PLANS

DRAWING NO.
ST-1.7

SCALE:	NTS
DATE:	APRIL 2020
PROJECT NO.	20-19171.00-2
NHPA NO.	20-001

DESIGN	DRAWN	CH'KD.
KDS	KDS	KDS

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

MAINTENANCE SCHEDULE

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

MAINTENANCE SCHEDULE

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

MAINTENANCE SCHEDULE

F. Painting:	Daily	Weekly	Monthly	4 Month Interval	6 Month Interval	Yearly	Other
1. 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	M	
e. Signs			R	M			
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**
1. Check for Proper Operation	R	M					
2. Parking/Revenue Control Equip - Preventive Maintenance							Note 3
H. Plumbing/Drainage Systems:	**Daily**	**Weekly**	**Monthly**	**4 Month Interval**	**6 Month Interval**	**Yearly**	**Other**
1. Check for Proper Operation:							
a. Sanitary Facilities	R	M					
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

MAINTENANCE SCHEDULE

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	M			
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	M					
c. Stairs (interior & exterior)	R	M					
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	M				
b. Clean				R	M		
c. Legibility			R	M			
d. Illuminated Signs or Changeable Information Signs	R	M					

MAINTENANCE SCHEDULE

L. Snow & Ice Removal:	Daily	Weekly	Monthly	4 Month Interval	6 Month Interval	Yearly	Other
1. 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**
1. Check Structure for:							
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 Engineer's Recommendation						
O. Repair and/or Replace Protective Concrete Coatings	As per Engineer's Recommendation						

Frequency	
R=Recommended M=Minimum	R*=Spring & Fall M*=Spring

Notes for Maintenance Checklist:

1. 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.

3. 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

DESMAN Design Management

A. Cleaning:

1. Sweeping - Localized ☐
2. Empty Trash Cans ☐
3. Restrooms:
   - 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 Normal Operation ☐
2. Check Elevator Indicator Lights:
   - a. Interior ☐
   - b. Exterior ☐

D. Landscaping:

1. Remove Trash ☐
2. 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 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) ☐

Supervisor:	
Date:	

MAINTENANCE CHECKLISTS
WEEKLY CHECKLIST

DESMAN Design Management

A. Cleaning:

1. Sweeping - All Areas *(including curbs)* ☐
2. Expansion Joints ☐
3. Restrooms:
   a. Walls ☐
4. Cashier's Booths:
   a. Walls ☐
   b. Windows ☐
5. Elevators:
   a. Doors ☐
   b. Windows *(if glass back elevator)* :
      - Interior Elevator Glass ☐
6. Stairs:
   a. Floors ☐
   b. Handrails ☐
7. Offices (Management/Security):
   a. Windows:
      - Interior Surfaces ☐
8. Wash Down Revenue Control Equipment ☐

B. Electrical System:

1. Check Lighting Fixtures ☐
2. Relamp Fixtures ☐

C. Elevator Operation:

1. Check Audible Tones *(ADA level annuciators)* ☐

D. Heating, Ventilation & Air Conditioning:

1. Check for Proper Operation:
   a. Heating Equipment ☐
   b. Ventilation Equipment ☐
   c. A/C Equipment ☐

E. Landscaping:

1. Mow Lawns ☐

F. Safety Checks:

1. Emergency Exit Signs ☐
2. Emergency Lights ☐

G. Security System:

1. Check for Proper Operation
   a. Elevator Communication Equipment (Telephone) ☐

H. Pedestrian & Vehicular Signage:

1. Check Signs:
   a. Proper Placement/Positioning ☐

Supervisor:	
Date:	

MAINTENANCE CHECKLISTS
MONTHLY CHECKLIST

DESMAN Design Management

A. Cleaning:

1. Stairs:
   a. Windows:
      - Interior Window Surfaces ☐
2. Offices (Management/Security):
   b. Windows:
      - Exterior Surfaces ☐

B. Doors & Door Hardware:

1. Lubricate Mechanized Doors:
   a. Pedestrian Doors ☐
   b. Rolling Grill Doors ☐

C. Electrical System:

1. Replace Fixture Ballasts ☐

D. Landscaping:

1. Weed Landscaping ☐

E. Painting:

1. Check for Appearance:
   a. Curbs ☐
   b. Signs ☐
   c. Touch-up Painting ☐

F. Plumbing/Drainage Systems:

1. Check for Proper Operation:
   a. Potable Water System ☐

G. Roofing & Waterproofing:

1. Check for Leaks:
   a. Roofing ☐
   b. Joint/Crack Sealants ☐
   c. Expansion Joints ☐
   d. Windows, Doors & Walls ☐
   e. Parking Deck Waterproofing Membrane ☐

H. Safety Checks:

1. Handrails & Guardrails ☐

I. Pedestrian & Vehicular Signage:

1. Check Signs:
   a. Legibility ☐

J. Structural System:

1. Check Structure for:
   a. Soffit (overhead) Deterioration ☐
   b. Wall & Column Deterioration ☐

Supervisor:	
Date:	

MAINTENANCE CHECKLISTS
QUARTERLY CHECKLIST

DESMAN Design Management

A. Electrical System:

1. Inspect - Specialized Electrical Equipment:
   - a. Time Clocks ☐
   - b. Photo Cells ☐
   - c. Lighting Control Equipment ☐
2. Fire Alarm System ☐

B. Painting:

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. Pedestrian & Vehicular Signage:

1. Check Signs:
   - a. Clean ☐

D. Structural System:

1. Check 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 ☐

Supervisor:	
Date:	

MAINTENANCE CHECKLISTS
6 MONTH & YEARLY CHECKLIST

DESMAN Design Management

	6 Month Interval	Yearly Interval
A. Cleaning:		
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)*		☐
3. Wash Down Parking Decks	☐	
B. Electrical System:		
1. Electrical Distribution Panels	☐	
2. Surface Mounted Conduit	☐	
3. Sprinkler System Compressor	☐	
C. Elevator Operation:		
1. Elevator Service - Preventive Maintenance	☐	
D. Heating, Ventilation & Air Conditioning:		
1. Check Filters		☐
2. HVAC Service - Preventive Maintenance		☐
E. Landscaping:		
1. Prune Trees		☐
2. Trim Shrubs	☐	
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/Drainage Systems:		
1. Check for Proper Operation:		
a. Floor Drains/Storm Risers	☐	
b. Fire Suppression Systems:		
- Sprinkler System		☐
- Dry Fire Standpipe System		☐
2. Drain Down Systems for Winter		☐
H. Roofing & Waterproofing:		
1. Check for Deterioration:		
a. Roofing	☐	
b. Joint/Crack Sealants	☐	
c. Expansion Joints	☐	
d. Windows, Doors & Walls	☐	
e. Parking Deck Waterproofing Membrane	☐	
I. Structural System:		
1. Check Structure for:		
a. Unusual and/or Unequal Settlement	☐	

Supervisor:	
Date:	

SEASONAL WASHDOWN CHECKLIST:

DESMAN
Design Management

FACILITY: TEMPLE STREET PARKING GARAGE

SEASON/YEAR: _____

10TH LEVEL:	_____	DATE:_____	SUPERVISOR: _____
9TH LEVEL:	_____	DATE:_____	SUPERVISOR: _____
8TH LEVEL:	_____	DATE:_____	SUPERVISOR: _____
7TH LEVEL:	_____	DATE:_____	SUPERVISOR: _____
6TH LEVEL:	_____	DATE:_____	SUPERVISOR: _____
5TH LEVEL:	_____	DATE:_____	SUPERVISOR: _____
4TH LEVEL:	_____	DATE:_____	SUPERVISOR: _____
3RD LEVEL:	_____	DATE:_____	SUPERVISOR: _____
2ND LEVEL:	_____	DATE:_____	SUPERVISOR: _____
1ST LEVEL:	_____	DATE:_____	SUPERVISOR: _____
STREET LEVEL:	_____	DATE:_____	SUPERVISOR: _____
B2 LEVEL:	_____	DATE:_____	SUPERVISOR: _____
B3 LEVEL:	_____	DATE:_____	SUPERVISOR: _____

CROWN ST STAIR:	_____	DATE:_____	SUPERVISOR: _____
GEORGE NORTH STAIR:	_____	DATE:_____	SUPERVISOR: _____
GEORGE SOUTH STAIR:	_____	DATE:_____	SUPERVISOR: _____
MLK BLVD. STAIR:	_____	DATE:_____	SUPERVISOR: _____