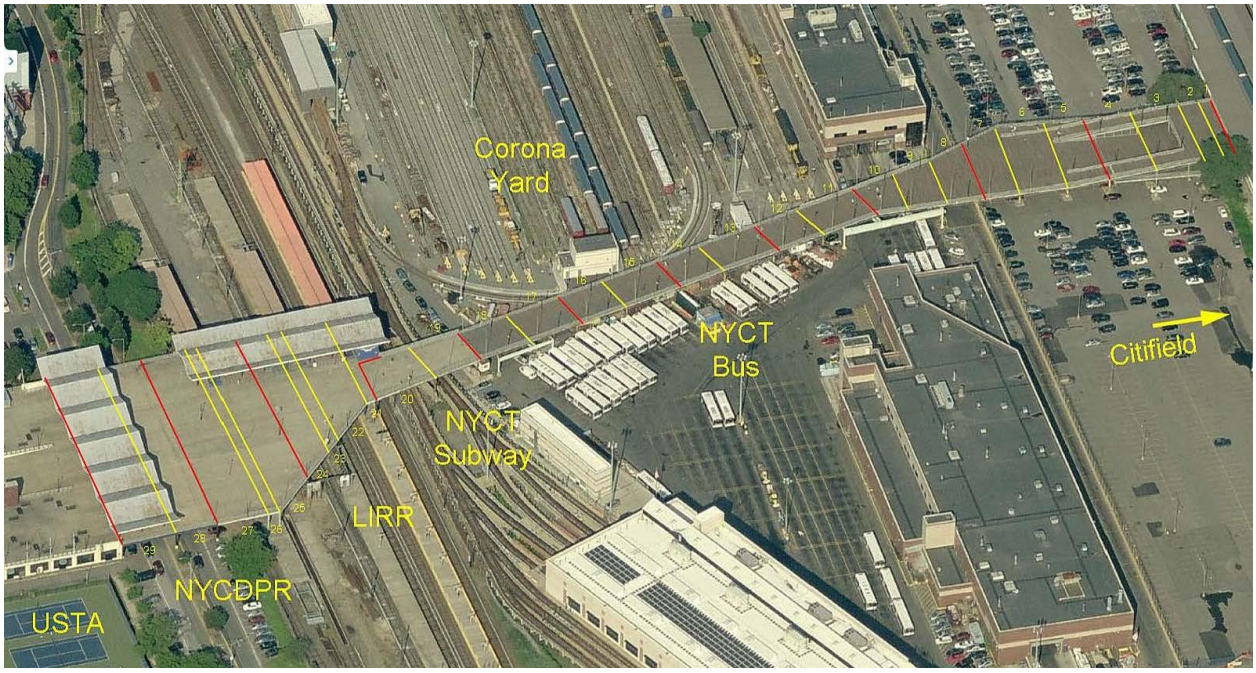
NYC DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF INFRASTRUCTURE

PROJECT ID:
HBPED700Q

DESIGN REPORT
FOR PRE-SCOPING SERVICES

BOOK 1 OF 2



PASSERELLE PEDESTRIAN BRIDGE
BOROUGH OF QUEENS

OCTOBER 2014

HAKS | WEIDLINGER ASSOCIATES® INC
Joint Venture

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1. Introduction

1.1 Executive Summary

Background

The Passerelle Bridge is the pedestrian gateway to Flushing Meadows Corona Park from the north and is a key connection to a number of facilities in and around the park. There are a number of planned projects which will have a significant impact on the pedestrian usage of the bridge.

The Passerelle pedestrian overpass was originally built for the 1939 World's Fair. It underwent major reconstruction for the 1964 World's Fair that involved the complete replacement of the superstructure. The structure is multi-span steel trestle frame with timber and concrete decking with a total length of approximately 1,100 feet and widths ranging from 40 feet at the main walkway to 230 feet over the LIRR area.

Scope of Work

The condition of the structure has severely deteriorated since its last reconstruction for the 1964 World's Fair. The intent of this Scoping Project is to: assess the structural condition of the Bridge; develop alternatives and make a recommendation for rehabilitation or replacement that will provide for a 75 year service life; and provide architectural concepts consistent with its role as a pedestrian corridor between Citifield; the NYCT # 7 Line; the LIRR and a gateway to Flushing Meadows-Corona Park and the National Tennis Center.

While the formal scope of work ends at the Passerelle Building at the south end of the Bridge, this Report includes an order-of-magnitude estimate to include the building roof and ramp to the Park which are an integral part of the gateway to the Park and will be included in the final design.

Jurisdictions

The Passerelle Pedestrian Bridge is currently owned and maintained by the New York City Department of Parks and Recreation (NYCDPR). Upon rehabilitation and reconstruction, maintenance of the Bridge will be transferred to Department of Transportation (NYCDOT). The structures, drainage, and street lighting will be maintained by NYCDOT. No private utilities will be installed on the bridge. It will be recommended to relocate the existing NYCT power and signal cables outside of the structure.

In-Depth Inspection

From August to October, 2013, the HAKS/WAI JV performed an In-depth Inspection of the Passerelle Pedestrian Bridge. Based on the inspection, approximately twenty two (22) structural steel members, (stringers, floorbeams, and columns) were found to be in a severely deteriorated condition. A number of flag conditions were noted and repairs are currently underway with completion expected in August 2014.

Load Rating Analyses

The ratings are low for stringers, floorbeams, and girders, except columns. Corrosion and section losses were generally significant for members in Spans 1-7 and Spans 19-29. On the other hand, members in Spans 7-18 and Spans 24-29 have minor corrosion and section loss.

Pedestrian/Vehicular Usage

The majority of pedestrians who utilize the bridge are destined for/originate from the NYC Transit subway, located just north of the bridge. Pedestrian volumes are relatively low during the majority of the year, with users travelling between the subway station and the expansive Flushing Meadows Corona Park during the seasonable periods. Higher volumes occur on the bridge when a baseball game (or other event) is held at Citi Field. As per the FEIS for the NTC, there is a proposed expansion (estimated construction of 2019) which will produce an estimated increase of 10,000 visitors to the US Open on a daily basis. In addition, the improvements include two new parking garages which will add approximately 400 parking spaces for visitors.

The estimated future peak hour pedestrian volume on the bridge is 13,500 which results in an acceptable level of service of “C” on the present structure. Thus the existing width of the bridge is adequate for future needs.

Maintenance vehicles are limited to the concrete deck section from spans 19 through 29. No vehicle is permitted on the timber deck section from spans 1 through 18 and this is enforced by a row of steel bollards.

Alternatives

Upon completion of the in-depth inspection and load ratings of the structure and following the strategy meetings with NYCDDC and NYCDPR, the HAKS/WAI JV prepared structural design alternatives to provide a 75 year service life and developed a few architectural concepts consistent with the bridge as a gateway to the Park.

The Alternatives studied are:

Alternative 1: Replacement of Bridge Deck in Kind and Rehabilitation of Existing Structure.

Alternative 2: Replacement of Existing Deck with a New Concrete Deck and Rehabilitation of Existing Structure.

Alternative 3: Replacement of the Existing Structure on the Existing Foundations.

During the course of study, in addition to the structural alternatives, the JV developed a range of architectural concepts including partial and fully covered walkways, plantings and various rail, barrier and fence treatments along the main bridge section. In the wider deck section with canopies alternatives to replace the canopies were sketched.

NYCDPR Guidelines

After review of alternative architectural concepts, NYCDPR provided the following guidelines for completion of the scoping study.

- The bridge should be considered as a gateway to the park and as a functional transportation element over a destination or attraction. Designs on the narrow portion of the bridge need not incorporate benches, overlooks or similar amenities along the span.
- Elaborate on the need for way finding systems and propose preliminary schemes.
- A concrete walking surface is preferred over wood or other decking. Options for decorative, functional or otherwise significant embellishments (e.g. plaques, way finding, coloring, should be mentioned as possible under the full design project.
- Ease of maintenance is a high priority. Do not include plantings or other installations with heavy maintenance requirements along the narrow span of the structure. Low-maintenance plantings at the southern end and near the shade structures are appropriate.
- The southern area of the bridge, the rooftops of the Passerelle building and the entrance plaza to the park must be redesigned in concert with the bridge. The south end ramp must be made ADA accessible. Include a cost estimate for design and construction in the project budget.
- Lighting must be able to be maintained by DOT, i.e. use light standard and fixtures acceptable to DOT.
- Fence design with an overhang is inappropriate for a pedestrian bridge in a park. Include instead options for low railing and verify code requirements.
- Keep historic look of the southern shade structures. Include modest modernizing options like greenroofs and solar panels.
- Shade structures at the north end are not necessary.
- Landscape/Architectural design must relate to the park and reflect historic importance as entrance to World's Fairs.

South Bridge Approach Modification for ADA Accessibility

At the south end of the Bridge, the existing ramp adjacent to the Passerelle Building is 206 feet long, 60 feet wide, and has an 8% longitudinal slope. From the edge of the bridge deck for a distance of 164 feet, the ramp is supported on a steel frame structure and beyond that, the remaining length is on grade. The existing ramp does not meet ADA Design Standards. For purposes of estimating costs, the ADA Ramp construction is assumed to consist of a 8 foot wide, 230 feet long ramp at an 8% slope with 5 foot level landings every 30 feet. For flexibility and improved service, ADA ramps shall be added along both walls of the Passerelle Building.

Context Sensitive Design

This project offers a few opportunities for context sensitive design, which would include structural materials and /or design that blend or enhance the overall aesthetic appearance in the project area.

The questions posed in reviewing the current functions of the bridge are:

- How can the signage and the architecture work together?
- Is there a way of making routes to the park clearer?
- What role can fencing, lighting and graphics play in orientating visitors to the park?
- The bridge is largely empty outside of events, how can design help this situation?

For the fencing and railing strategy, an 8 feet high vertical fence with a bridge rail is recommended. With a well finished concrete, this has the greatest potential in design, experience, and maintenance. This streamlined works with the distinctive language of the canopies and the futurism style they represent. There are also possibilities to embed historical elements and wayfinding in the railings in the railings and the deck surface.

Included are some ideas of increasing the "high performance design" potential of the project by adding a sedum or "green" roof to the rehabilitated canopy structures at the Passerelle Plaza and considering combining a sedum roof with a PV installation and a potential for solar power. Three paving options are presented using an ashlar joint pattern, similar to that used in ashlar joint construction, that is imprinted onto the overlay of the future deck. The first option is a series of colored lines with Mets colors, orange and blue accents toward the north side, and US Open/Park green accents to the south (Figure 9-1). A series of commemorative bands (Figure 9-2) or commemorative plaques (Figure 9-3) could also connect to the history of the bridge.

Recommendation

Alternatives 1 and 2 both replace the existing deck, rehabilitate the Bridge structure with extensive repairs, and increase the service life to 75 years with scheduled maintenance every ten years. In both Alternatives the repair of steel members cannot be fully quantified until the removal of the existing bridge deck occurs. Due to water intrusion through the timber deck in Alternative 1, the steel members will continue to deteriorate more rapidly than Alternative 2. Alternative 1 does not provide the same level of service as Alternatives 2 and 3 as it cannot carry a service vehicle in Spans 1 through 18. Therefore, Alternative 1 is not recommended.

Alternative 2 will require significant modification to the existing framing system to install expansion joints for the concrete deck and may lead to added maintenance costs. It will provide the load capacity for a vehicle but will not meet seismic code.

Alternative 3 has a higher initial construction cost than Alternatives 1 and 2, but provides the required design load capacity, and conforms to most of the seismic design codes, while Alternative 1 only maintains the existing load carrying capacity and Alternative 2 improves the load capacity with the exception of seismic forces. Also, the architectural opportunities to enhance the bridge deck area as a gateway to the Park and sports facilities are greater with Alternatives 3, as well as Alternative 2, which contain a concrete deck. However, compared with Alternative 2, Alternative 3 can provide a stronger superstructure and may handle greater deck development.

Table 1-1: Comparison of Alternatives

Aspect	**Alternative 1:**	**Alternative 2:**	**Alternative 3:**
Estimated Construction Cost for Bridge, Exhibit 11.6, Table 1	$91.6 Million	$102.8 Million	$122.6 Million
Estimated Construction Duration for Bridge	24 Months	30 Months	36 Months
Estimated Life Cycle Cost (75 years) Future Value, Exhibit 11.6, Table 2	$593.6 Million	$413.9 Million	$292.1 Million
Estimated Construction Cost for ADA Ramp at South End of the Bridge	$1.5 Million	$1.5 Million	$1.5 Million
Estimated Construction Cost for Passerelle Maintenance Building and Ramp	$10.5 Million	$10.5 Million	$10.5 Million
Inspection and Preventative Maintenance Costs Prior to 2020 Rehabilitation, Table 7-7	$5.7 Million	$5.7 Million	$5.7 Million

The initial costs of bridge rehabilitation, summarized in the above table, for Alternative 1 and Alternative 2 are more than 65% of the total bridge replacement cost of Alternative 3, which is a NYSDOT Bridge Design Manual guideline for opting for replacement versus rehabilitation. Considering the life cycle cost analysis and extensive maintenance schedule for Alternatives 1 and 2, Alternative 3 is more cost effective than Alternatives 1 and 2 and is considered to be the most favorable alternative. The new bridge structure provided by Alternative 3 will improve the community environment and avoid disruption of pedestrian traffic and railroad traffic compared to the other two alternatives.

Recommended Alternative

- The scope of work for the recommended replacement alternative (Alternative 3) is as follows.
- Replace Existing Timber Deck and concrete deck with New Precast or Cast-In-Place Concrete Deck
- Replace Steel Stringers, Floorbeams, Girders, and Columns over Existing Foundations
- Retrofit Foundations as Necessary
- Install Improved Railing and Lighting, Subject to PDC Approval

- Deck Treatment, Subject to PDC Approval
- Replacement of Canopy Structures in Kind with Green or Solar Treatment for the Roofs
- Modify the South Ramp to the Park to Achieve ADA standards.
- Inspect and Rehabilitate the Roof and Structure of the Passerelle Building and Consider Adding Shade Structures on the Decks.

The estimated construction duration for Alternative 3 is 36 Months. The estimated construction cost of this replacement Alternative is $122.6 Million plus an estimated $12 Million to develop the south entrance to the Park at the Passerelle Building.

On September 29, 2014, the Project was presented to OMB for approval of funding to allow preliminary and final design to proceed. In terms of the Architectural features to be included in the final design, these will have to be advanced in coordination with NYCDPR for presentation and approval of PDC during the final design process.

Initial Construction Costs for all alternatives are calculated based on the current price history (2014) projected to the year 2022 with 4% inflation. OMB also requested to include the maintenance cost and the annual bridge inspection cost until the start of construction.

1.2 Engineering Agreement

On behalf of the New York City Department of Design and Construction (NYCDDC), HAKS and Weidlinger Associates, Inc., as a joint venture, provided preliminary engineering services for the Passerelle Pedestrian Bridge located in Flushing Meadows-Corona Park, Flushing, New York. The purpose was to collect information and perform the work necessary to determine the existing structural condition, so that a recommendation to rehabilitate and/or replace the Bridge and its components could be provided.

The original scope of work agreed upon in May 2013 included tasks that were required to enable the joint venture and its subconsultants to develop recommendations to rehabilitate or replace the Bridge. The studies included topographic survey and right of way (ROW) determination, existing deck core testing, hazardous material investigation, soil investigation, pedestrian count program, in-depth inspection, and structural evaluation. The project deliverables included schematic design alternatives, preliminary design drawings of the recommended alternative, and cost estimates to form the basis for the final design contract (not included in this contract) at the end of year 2014.

1.3 Project Location and History

The Passerelle Pedestrian Bridge is owned by the New York City Department of Parks & Recreation (NYCDPR). The pedestrian overpass was originally built for the 1939 World's Fair between Roosevelt Avenue and the Fair entrance and underwent major reconstruction for the 1964 World's Fair that involved the complete replacement of the superstructure. In 1964, NYCDPR also added more foundations and built a new building called the Passerelle Building (currently the NYCDPR maintenance building). The structure is multi-span steel trestle frame with timber and concrete decking with a total length of approximately 1,100 feet and widths ranging from 40 feet at the main walkway to 230 feet over the LIRR area. The condition of the structure has visibly deteriorated since its last reconstruction for the 1964 World's Fair.

The Bridge spans over (from north to south) the NY Mets Southfield parking lot managed by IMPARK; the New York City Transit (NYCT) Corona maintenance yard for subway trains and buses; LIRR Port Washington Line tracks and platforms that are part of the Mets-Willets Point station; and NYCDPR property that consists of a parking area, a park roadway (Perimeter Road), and a sidewalk (Figure 1-1 and 1-2).

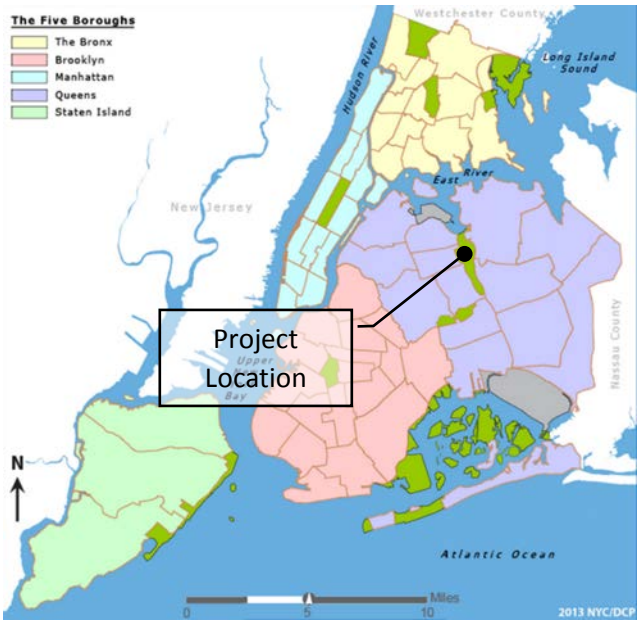


Figure 1-1: Location Plan

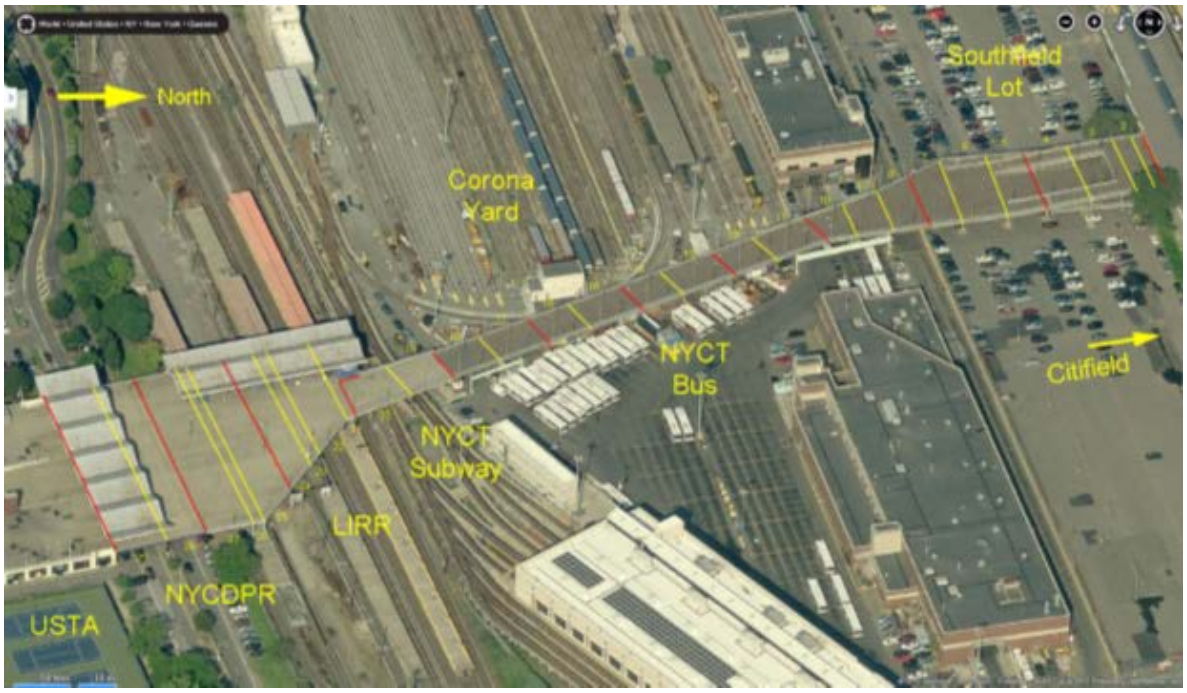


Figure 1—2: Site Overview

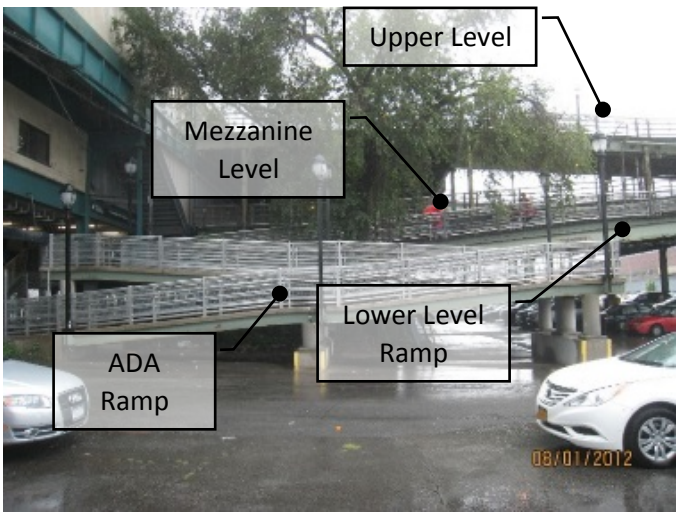


Figure 1—3: Bents 1 and 2 (Looking East)

Figure 1—4: Bents 1 and 2 (Under Bridge)

At the north end, the elevated NYCT No. 7 (Roosevelt Avenue) subway track structure runs perpendicular to the pedestrian bridge. The NYCT station is not part of the bridge. The Bridge has three levels from Spans 1 through 5; the upper, mezzanine, and lower levels (Figure 1-3). The upper and mezzanine levels are directly connected to the NYCT structure with an expansion joint separating these two structures, where both levels gates are closed most of the time and occasionally open for special events. The lower level is a ramp that leads directly into the mezzanine of the Bridge and to the sidewalk of Roosevelt Avenue and entrance to the station. In 2009, NYCT improved the station by adding a disability ramp adjacent to the lower level ramp of the Bridge.

Underneath Spans 1 and 2, a fenced area is occupied by NYCT and used for storage, power operation, and electrical meter boxes for the station. Both Bents 1 and 2 are within the fenced area (Figure 1-4). Underneath Spans 3 through 7, the area is managed by IMPARK as a vehicular parking area. Underneath Spans 8 to 26, the area is the NYCT Corona maintenance yard for subway trains and buses and the LIRR Port Washington Line tracks and platforms (Figure 1-5 and 1-6).

Figure 1—5: East Fascia (Looking South)

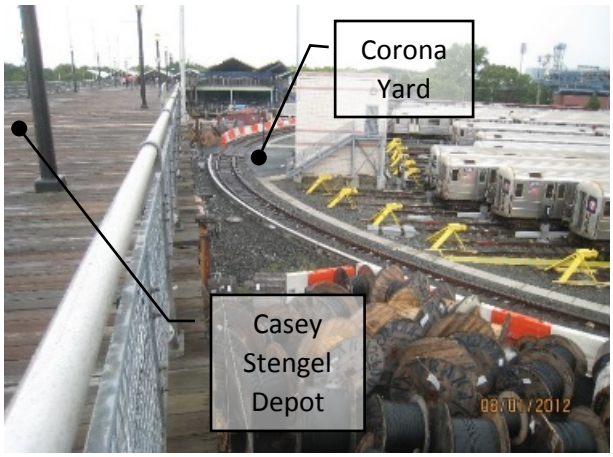


Figure 1—6: West Fascia (Looking South)

At the south end there is an approach ramp leading to the Bridge between an NYCDPR maintenance building (out of scope of this project). The roof of the building is a publicly accessed area with benches. Beyond this building is the David Dinkins Circle and the US Tennis Association's (USTA) complex. Underneath Spans 27 through 29, there exists a sidewalk, a park road, and a parking area owned by NYCDPR; this area is where there are two canopy structures located on top of the Bridge (Figure 1-7 and Figure 1-8).

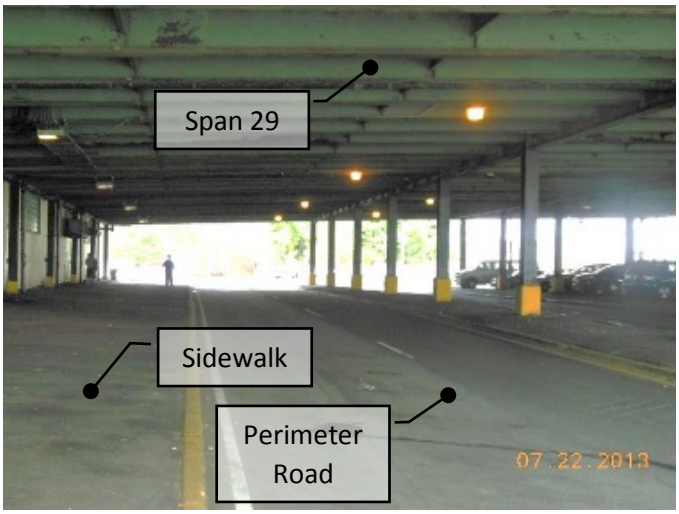


Figure 1—7: Span 29 Underdeck (Looking East)

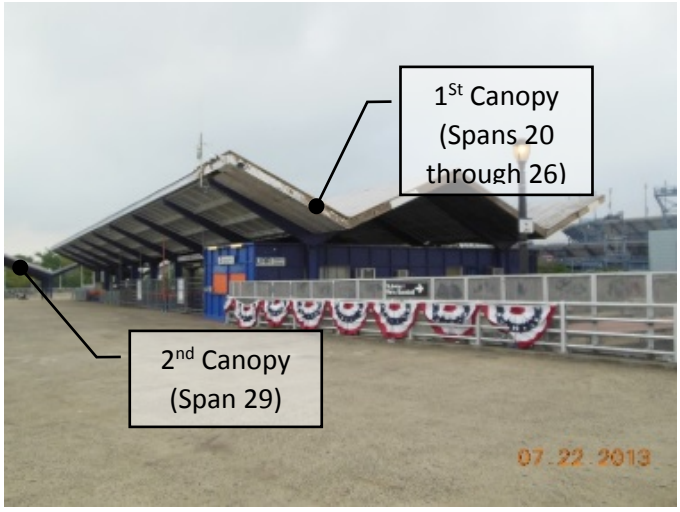


Figure 1—8: 1st Canopy at Spans 20 through 26 (Looking South)

The Bridge has a total of 29 spans that consist entirely of a steel superstructure framing (a combination of bolt and rivet connections) supported on a steel pier column substructure. From the north end of the bridge counting south, there are 18 spans (Spans 1-18) that have boardwalk timber decking. Spans 1 to 7 (over the Southfield parking lot) has steel girder-floorbeam-stringer framing systems which are framed into steel pier cap beams that are supported on multi-steel columns. In these spans, there are ramps on each side of the Bridge, creating multiple levels of framing. Spans 8 through 18 (over the NYCT Corona maintenance yard for subway trains and buses), has steel girder-floorbeam-stringer framing systems framed into steel pier cap beams that are supported on two-steel columns. The remaining 11 spans , Spans 19-29, have a concrete deck. These spans are all steel multi-stringer systems framed into steel pier cap beams supported on multi-steel columns. Steel columns are founded on footings with piles throughout the bridge.

Since the entire superstructure was replaced circa 1964, it is approximately 50 years old, with foundations in Spans 1 to 18 (constructed circa 1939) approximately 75 years old and foundations in Spans 19 to 29 (constructed circa 1964) approximately 50 years old. It should be noted that at two locations within the NYCT Corona maintenance yard (Spans 9-11 and Spans 17-18), three large span transfer girders were installed to allow a greater horizontal clearance for buses to pass underneath the Bridge. This construction is more recent and involved replacing original pier columns with newer, widely spaced columns to facilitate the larger open space, while maintaining

the existing superstructure framing. Figure 1-9 and Figure 1-10 show how the bridge is used during special events.

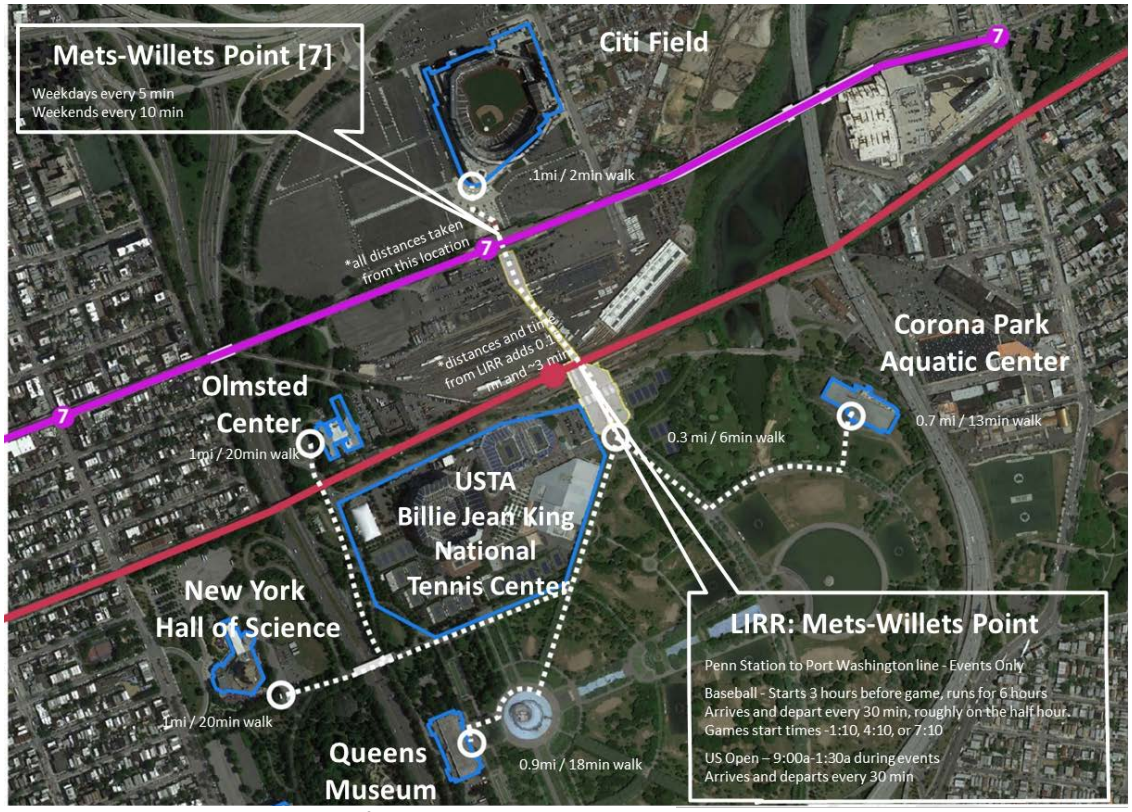


Figure 1—9: Key Adjacent Facilities / Pedestrian Routes

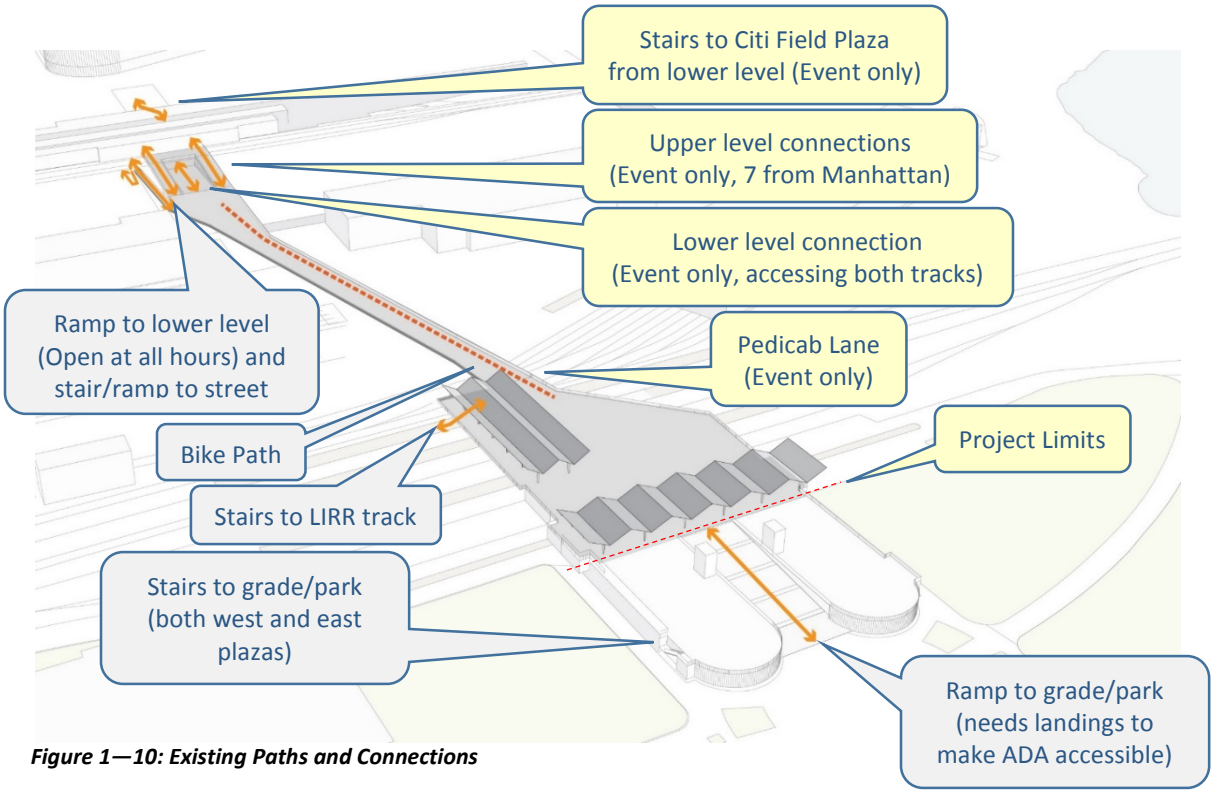


Figure 1—10: Existing Paths and Connections

1.4 Ownership and Maintenance Jurisdiction

The Bridge is currently owned and maintained by NYCDPR. Upon rehabilitation and reconstruction, maintenance of the Bridge will be transferred to NYCDOT. The structures, drainage, and street lighting will be maintained by NYCDOT. No private utilities will be installed on the bridge. It will be recommended to relocate the existing NYCT signal and power cables outside of the structure. Discussion and coordination with NYCT will be necessary during a future final design contract.

2. In-Depth Inspection

2.1 Background

From August to October, 2013, HAKS/WAI JV performed an in-depth inspection of the Bridge as part of the Pre-Scoping Services, Project ID. HBPED700Q. Based on the inspection, approximately twenty two (22) structural steel members (stringers, floorbeams, and columns) were found to be in a severely deteriorated condition. These members are not capable of supporting any load. To prevent the collapse of these members and to keep the public safe, several sections of the bridge deck above the deteriorated members were barricaded and closed for public use. The Passerelle Pedestrian Bridge is currently not included for rehabilitation in any capital programs. To restore the bridge structure to an acceptable level of service, these deteriorated steel members must be repaired or replaced as necessary. For further details of the inspection see attached Appendix A: In-Depth Inspection Report.

2.2 Bridge Deck

2.2.1 Timber Deck Section

The Timber Deck Section (Figure 2-1) of the Bridge runs from Span 1 to Span 18. The length of this section is 732ft and the width ranges from 40ft to 96.5ft. The total area is approximately 48,500 sf. The timber plank decking consists of 3” thick x 6” wide pressure treated lumber (original design) and pine lumber (replaced planks). The timber deck is generally deteriorating, exhibiting splitting, checking, cracking, and decaying. Screws and nails are missing throughout the deck. There is a general unevenness that is typical of boardwalk planking. At some locations, vertical differential between planks and metal joints up to an inch were noted and may pose a tripping hazard for pedestrians.

Figure 2—1: Typical Timber Decking

A safety flag was issued regarding the timber deck located between floor beams FB11 and FB11A in Span 12. The planks are cracked and soft. For further details see the Inspection Report in Appendix A.

NYCDPR continuously performs maintenance work on the timber deck to provide safe conditions for the public.

2.2.2 Concrete Deck Section

2.2.2.1 Inspection

The Concrete Deck Section (Figure 2-2) of the Bridge runs from Span 19 to Span 29. The length of this section is 390ft and the width ranges from 40ft to 230ft. The total area is approximately 57,500 sf. The concrete deck is a 5.5inch thick slab and is in fair-to-good condition. There are some defects noted, such as cracking and patches along the expansion joints. These defects are estimated to cover approximately 2% of the total area. The expansion joints are 3/4" wide joints filled with pourable sealer that allows water to infiltrate below. The constant water leakage and wetness of these joints has resulted in corrosion and section loss of the longitudinal stringers and transverse floorbeams located directly below.

Figure 2—2: Typical Concrete Decking

2.2.2.2 Concrete Coring

In addition to the in-depth structure inspection, core samples from the deck were taken for laboratory testing to support the deck evaluation. Eight (8) core samples were taken from various locations throughout the concrete deck. Two (2) samples were subject to compressive tests, two (2) samples were subject to petrographic analysis, two (2) samples were subject to chloride content analysis, and the remaining two (2) samples were taken for freeze-thaw testing.

Compressive strength tests were performed in conformance with ASTM C39. Results show that the compressive strength ranges from 3,293 psi (Core #8) to 4,185 psi (Core #6). The criteria for compressive strength testing states that compressive strength should be greater than 3,500 psi. These results show that the overall condition of the concrete is fair.

A visual petrographic analysis of the full length of the core samples was performed. Results from the petrographic analysis show that the overall condition of the concrete is fair (Core #1) to fair-to-good (Core #7). The concrete in both cores has a poor durability. The concrete contained an air void system that is not consistent with current technology for resistance to freeze-thaw deterioration. Continuing deterioration is expected to occur if the concrete is exposed to freezing conditions when saturated.

Freeze-thaw tests were conducted in accordance with ASTM C666/C 666M–03(2008), "Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing, Procedure A – Freezing and Thawing in Water." Results from the freeze-thaw test show no deterioration (0.00% mass change, Core #4) in one location, but significant deterioration (-10.95% mass change, Core #2) in another.

Chloride content analysis was performed using the NYSDOT Materials Method. Results from the chloride content analysis show that the water-soluble chloride ranges from 0.039%, 1.26 lbs/cy (Core #5) to 0.099%, 3.20 lbs/cy (Core #3). From these results the overall condition of the concrete is fair-to-poor.

The core locations and test results are described in Appendix E.

The results are summarized in Table 2-1 below.

Table 2-1: Concrete Core Test Results

Test	Core No.								Acceptable According to NYSDOT Criteria?
	1	2	3	4	5	6	7	8	
Compressive Strength (psi)	-	-	-	-	-	4,185	-	3,293	No
Petrographic Analysis	Fair	-	-	-	-	-	Fair to Good	-	NA
Freeze – Thaw (%)	-	-10.95	-	0.00	-	-	-	-	No
Chloride Content (%)	-	-	0.099	-	0.039	-	-	-	No

2.3 Superstructure and Substructure

2.3.1 Timber Deck Section

2.3.1.1 Stringers

There are approximately five-hundred thirty-five (535) stringers in the Timber Deck Section, totaling approximately 230,000 pounds. These wide flange rolled members vary in size: W10X21, W10X25, W16X36, and W24X76. In general, the stringers are in a fair-to-poor condition and exhibit heavy corrosion and section loss within Spans 8 through 18. Some stringers in these spans are severely deteriorated. Fifteen (15) stringers were flagged due to reduced load capacity: four (4) Red Flags and eleven (11) Yellow Flags, seen in Table 2-2 below. For further details see the Flag Report in Appendix B.

Table 2-2: Flagged Stringers in Timber Deck Section

Structural Flag	Location		Structural Flag	Location
Yellow	Span 11 - S6B*		Yellow	Span 17 - S6B*
Yellow	Span 12 - S6B*		Yellow	Span 17 - S7B
Yellow	Span 13 - S7C		Red	Span 18 S3C*
Yellow	Span 15 - S7C*		Yellow	Span 18 - S4A*
Yellow	Span 16 - S5A		Red	Span 18 - S5C* and S6C*
Yellow	Span 16 - S6A		Red	Span 18 - S7B*
Yellow	Span 16 S5B and S6B		Red	Span 18 - S7C*
Yellow	Span 17 - S6A* and S7A*			

** These structural flags have been repaired in an emergency repair contract, HBPED700E*

Figure 2—3: Span 18 Stringer S3C

Figure 2—4: Span 18 Stringer S7C

2.3.1.2 Floorbeams

There are approximately one-hundred twenty (120) floorbeams in the Timber Deck Section, totaling approximately 290,000 pounds. These wide flange rolled members vary in depth from 10 inches to 36 inches, and vary in weight from 21 pounds per foot to 300 pounds per foot. In general, the floorbeams are in a fair-to-good condition, with the exception of Spans 7 to 17 where the members exhibit heavy corrosion and section loss throughout. In the Timber Deck Section, two (2) floorbeams were flagged due to reduced load capacity: Two Yellow Flags, seen in Table 2-3 below. For further details see the Flag Report in Appendix B.

Table 2-3: Flagged Floorbeams in Timber Deck Section

Structural Flag	Location
Yellow	FB17B*
Yellow	FB7A(3)

** These structural flags have been repaired in an emergency repair contract, HBPED700E*

Figure 2—5: FB17B (Looking South)

Figure 2—6: FB7A(3)

2.3.1.3 Girders

There are approximately eighty (80) girders in the Timber Deck Section, totaling approximately 425,000 pounds. These wide flange rolled members vary in depth from 24 inches to 36 inches, and vary in weight from 76 pounds per foot to 230 pounds per foot. In general, the girders are in a good condition. No girders in the Timber Deck Section were flagged due to corrosion and reduced load capacity, however, the majority of these members exhibit paint deterioration resulting from mild corrosion.

2.3.1.4 Columns

There are approximately forty-five (45) columns in the Timber Deck Section. All columns have a depth of 14 inches, but vary in weight from 38 pounds per foot to 119 pounds per foot. In general, the steel columns are in a good condition. Some defects such as minor section loss at flanges near the bottom base plate, missing bolt nuts, and paint deterioration were noted. No columns in the Timber Deck Section were flagged due to corrosion and reduced load capacity.

2.3.2 Concrete Deck Section

2.3.2.1 Stringers

There are approximately two-hundred seventy (270) stringers in the Concrete Deck Section, totaling approximately 885,000 pounds. These wide flange and channel rolled members vary in depth from 12 inches to 33 inches, and vary in weight from 25 pounds per foot to 160 pounds per foot. In general, the stringers in the Concrete Deck Section are in a good condition with the exception of S18, S23 and S25 in Spans 24, 25, and 16, respectively. These members exhibit severe corrosion and section loss due to water leakage from the longitudinal expansion joint above. In the Concrete Deck Section, four (4) stringers were flagged due to their as-inspected condition: three (3) Red Flags for advanced corrosion and one (1) Yellow Flag for impact damage and distortion, seen in Table 2-4 below. For further details see the Flag Report in Appendix B.

Table 2-4: Flagged Stringers in Concrete Deck Section

Structural Flag	Location
Red	Span 24 - S18*
Red	Span 25 - S23*
Red	Span 26 - S25*
Yellow	Span 28 - S18

** These structural flags have been repaired in an emergency repair contract, HBPED700E*

Figure 2—7: S25

Figure 2—8: S18

2.3.2.2 Floorbeams

There are approximately seventy (70) floorbeams in the Concrete Deck Section, totaling approximately 315,000 pounds. These wife flange rolled members vary in depth from 30 inches to 36 inches, and vary in weight from 116 pounds per foot to 194 pounds per foot. Generally, the floorbeams in the Concrete Deck Section are in a good condition with the exception of the floorbeams at Bents 24 and 27 under the transverse expansion joints. These floorbeams exhibit significant corrosion with through holes at a few locations. No floorbeams in the Concrete Deck Section were flagged due to corrosion or reduced load capacity.

2.3.2.3 Girders

There are six (6) girders in the Concrete Deck Section, located only among the east fascia, totaling approximately 45,000 pounds. These rolled members vary in size: W33X130 and W33X152. The girders in the Concrete Deck Section are in a good condition. No girders in the Concrete Deck Section were flagged due to corrosion or reduced load capacity.

2.3.2.4 Columns

There are approximately eighty (80) columns in the Concrete Deck Section. All columns have a depth of 14 inches, but vary in weight from 61 pounds per foot to 95 pounds per foot. In general, the majority of the columns are in a good conditions. Typical defects include minor section loss at column flanges, cracked or spalled concrete encasement at lower part of the columns, and paint deterioration. In the Concrete Deck Section three (3) columns were flagged due to corrosion and reduced load capacity; see Table 2-5 below.

Table 2-5: Flagged Columns in Concrete Deck Section

Structural Flag	Location
Red	Column Line G at Bent 23*
Red	Column Line G at Bent 24*
Red	Column Line F at Bent 24*

** These structural flags have been repaired in an emergency repair contract, HBPED700E*

Figure 2—9: Column G23 Upper Section

Figure 2—10: Column G23 Lower Section

2.4 Foundations

2.4.1 Background

The Overpass was originally constructed circa 1937 for the 1939 New York World's Fair. The original overpass was supported on 15 ton creosote treated timber piles. Circa 1961, the Bridge underwent a major reconstruction in preparation for the 1964 New York World's Fair. At this time, the eastern end of the Bridge was entirely rebuilt to make a larger and wider bridge, with a ramped entrance that includes the Passerelle Building. New 20 ton capacity creosote treated timber piles were driven to support the new section of the Bridge. At the same time, the 1937 superstructure along the western half of the Bridge was completely removed and replaced, with only the foundation pile caps from the 1937 construction left in place. Piles with batters of approximately 1 horizontal to 5 vertical exist at many of the pile caps to resist lateral loads.

Select pile groups at the western half of the Bridge (Bents 1 to 18) were load tested to confirm capacity. Some pile caps were reconstructed after damaged portions of the supporting piles were cut down. It appears that the damage was splintered tops that may have been the result of the original pile installation.

Currently, the Bridge has a timber deck over the western half and a concrete deck over the eastern half of the Bridge. It is understand that the original 1937 timber deck was replaced at the time of the 1961 reconstruction, however, neither portion of the deck has been replaced since 1964.

2.4.2 Pile Condition

Subsurface conditions along the alignment of the Bridge include approximately 20 feet of fill including a significant amount of ash underlain by about 5 to 10 feet of organic deposits. Approximately 50 to 60 feet of varved silts underlie the organic deposits with the lower 5 to 10

feet of the silt layer containing some organic material. The entire site is underlain by medium dense sand at a depth of about 80 feet becoming more clayey with depth. Bedrock was not encountered in any of the test borings.

All piles bear in the sand layer at depths of about 90 feet to 100 feet below existing grade. No drive records, records of load tests, or details on the hammers used to drive the piles are available. For most locations, the pile cut offs are about 2 to 3 feet below grade. Timber piles, with or without creosote, are susceptible to rot when above the permanent groundwater level. Groundwater was encountered at depths of about 7 to 10 feet below grade.

2.4.3 Test Pits Conducted for this Study

In order to assess the current condition of the timber piles, two (2) test pits were excavated to expose representative piles from each phase of installation to assess potential for rotting. All of the exposed piles were about 12 inches in diameter at the butt. Inspection found sound condition of all exposed piles at the butt. A core sample of one (1) pile was taken using a 1/8 inch increment bore tool to a depth of about 8 inches. No rot or other discontinuities were identified in the core sample.

2.4.4 Pile Installation and Capacity

The piles currently supporting the western half of the bridge (Bents 1 to 18), installed circa 1937, have an allowable design capacity of 15 tons while the piles supporting the eastern half of the Bridge (Bents 19 to 29), installed in 1961, have an allowable design capacity of 20 tons. Normally, the capacity is considered to be an axial capacity and in some cases, a reduction is required in assessing the vertical capacity of battered piles. However, given the relatively slight batter, it is believed reasonable that the driven axial capacity be considered a vertical capacity.

Normally, individual pile load tests to confirm capacity require a factor of safety of 2.0, while pile load tests on groups of piles are based on a factor of safety of 1.5. No documentation exists related to individual pile load tests conducted at the time of installation, although it is assumed that these were completed. Group load tests conducted in about 1961 on the original 1937 piles confirmed a vertical capacity of 15 tons per pile.

2.4.5 Seismic Design Classification

Based on the available test borings, the site should be classified as a Site Class “E”, Soft Soil Profile. Based on the blow counts reported for the silty soils, which are within 60 feet of the groundwater level, it is believed that the soils below the site could be susceptible to liquefaction. It is believed that the liquefaction could cause some loss of strength for the foundations bearing in this material as well as some seismically induced settlement. However, it is not believed that catastrophic failure or collapse of the strata itself is likely, avoiding being classified as a Site Class “F”.

2.4.6 Assessment of Current Pile Condition and Capacity

Based on the observed conditions of representative piles, and in lieu of further load tests that might confirm some additional capacity, it is recommended to assume that the allowable vertical compressive load is 15 tons for pile Bents 1 to 18 and 20 tons for the remainder of the piles (Bents 19 to 29). Due to lack of a positive connection between the pile cap and the piles (typical of timber piles), no uplift capacity should be assumed for any of the piles.

2.5 Miscellaneous Bridge Components

2.5.1 Railing

The current 3” - 2 1/2” high four-rail steel bridge railing will be replaced with a new railing that meets the requirements of NYSDOT Bridge Railing for Pedestrian Bridges.

2.5.2 Fence

Currently there is no fence on the Bridge from Spans 1 to 18. The existing 5 feet fencing on each side of the Bridge from Spans 19 to 27 (over MTA’s LIRR and NYCT tracks) is below the NYCDOT minimum height of 8 feet. An 8 feet high pedestrian fencing will be installed on both fascia in accordance with NYCDOT standard details.

2.5.3 Drainage

Currently there are no scuppers in the Timber Deck Spans 1 through 18. In Spans 27 and 28 there are troughs/trench drains with down-spouts. A new drainage system will be developed during the final design.

2.6 Canopy Structure

The canopy structure in the Concrete Deck Section consists of a roof structure on steel V-shaped beams supported on steel columns anchored into the Bridge superstructure framing. There are two canopy structures, one located between Spans 20 to 27 and the other located at Span 29. The tapered steel beams and columns were observed to be in good condition with minor surface rust. The roof structures were undergoing reconstruction at the time of the in-depth inspection. Approximately 90% of the roof was replaced; new sidings and gutter sleeves were also observed. In general, the roof structures are in a good condition with the exception of a few locations where the steel roof battens are disconnected due to corrosion resulting from past water leakage from the roof gutter. In addition, there was a section of the roof that was missing between Spans 21 to 22, above the entrance to the LIRR track No. 1 and No. 2 train platforms (Figure 2-11).

Figure 2—11: Canopy at Spans 20 to 27, note missing section

Figure 2—12: Canopy at Span 23-26

2.7 Utilities

2.7.1 New York City Transit Utilities

The Bridge supports NYCT power and signal cables.

2.7.2 Long Island Rail Road Utilities

The Bridge supports underdeck lighting fixtures and electrical power cables for LIRR mounted along the underside of framing.

2.7.3 New York City Department of Parks and Recreation Utilities

The Bridge supports underdeck lighting fixtures over the park's sidewalk and roadways in Spans 28 and 29.

2.7.4 Other Private Utilities

The Bridge does not support private utilities. Underground Con Ed ducts are located on the NYCDPR Perimeter Road.

2.8 Hazardous Materials

2.8.1 Paint Assessment

A total of six (6) paint chip sample were collected from select painted structural components at the Site for subsequent laboratory analysis. Out of the six (6) paint chip samples analyzed for lead content, all six (6) were identified as lead-containing, as identified by OSHA.

Table 2-6: Lead Paint Assessment

Sample ID	Location	Component Name	Substrate Material	Color	Lead Concentration (% by weight)
01	Span #18	Steel Beam #57C	Metal	Green/Red	11.13
02	Span #18	Steel Beam #57B	Metal	Green/Red	17.83
03	Span #17	Steel Beam #56B	Metal	Green/Red	12.47
04	Span #15	Steel Beam #57C	Metal	Green/Red	6.17
05	Span #12	Steel Beam #56B	Metal	Green/Red	21.33
06	Span #11	Steel Beam #56B	Metal	Green/Red	9.48
01	Span #23	Steel Beam S18	Metal	Green/Red	24.47
02	Span #23	Column 23G	Metal	Green/Red	8.73
03	Span #25	Column 25G	Metal	Green/Red	21.10

Note: The Reporting Limit (RL) of this method is 0.01%.
The Detection Limit as reported is the Reporting Limit.

2.8.2 Asbestos

Based on the record drawings, it is probable that parts of the Concrete Deck Section contain asbestos. We recommend that a further study be conducted in the final design phase.

2.8.3 Soil Contamination

Weston Solutions of New York, Inc. prepared a Phase I Corridor Assessment Report (CAR) for NYCDDC to reasonably determine the potential for environmental concern and possible

contamination posed by properties within or adjacent to the Corridor. Construction activities will be performed along the Corridor. The Corridor (also known as the Passerelle Pedestrian Bridge), is primarily surrounded by park property, stadium property, and train station and subway car repair facility property.

Weston conducted a site visit and reconnaissance of the Project Corridor to document current usage and conditions, reviewed Sanborn Fire Insurance Maps to document historical usage, and reviewed regulatory agency databases to identify sites with reported environmental conditions that could impact the scope during construction of the project. The report identified five (5) "High" risk sites and one (1) "Moderate" risk site with respect to project corridor.

Table 2-7: Risk Assessment

Site	Location Information
High Risk Sites	
Konica Photo Imaging at Citi Field	123-01 Roosevelt Avenue, (Map ID A1)
Subway Car Repair Facility/Subway Tracks	Block 2018 Lot 1000, (No Map ID)
Former Skylights Auto Sales Facility/Auto Repair Facility	12050 Unknown Road, (No Map ID);
LIRR Mets-Willets Point train station	Perimeter Road, (No Map ID)
MTA Mets-Willets Point train station (7 Train Line)	Roosevelt Avenue, (No Map ID)
Moderate Risk Site	
Flushing Meadows Park	123-30 Roosevelt Avenue, (Map ID A4)

Recommendation:

Following the standard NYCDDC investigation report, a Phase II Subsurface Corridor Investigation (SCI) is proposed by Weston. The SCI will consist of two (2) soil borings per "High" risk site and one (1) soil boring per "Moderate" risk site to determine if the Corridor has been impacted. However, since the "High" and "Moderate" risk sites are predominately in close proximity to each other, the number of soil borings may be reduced by placing borings in representative locations along the Corridor. A total of eleven (11) soil borings are recommended in Table 2 based on DDC protocols. However, it should be noted that the MTA 7 Train line and LIRR Mets-Willets Point train stations as well as the subway car repair facility/subway tracks are present at grade level, for which access to the proposed soil boring locations may not be gained due to the close proximity of numerous train tracks. The final Phase I Corridor Assessment Report is Included in Appendix G.

During the Phase II SCI site assessment activities, photoionization detector (PID) screening will be instituted and soil logging will be conducted by a qualified geologist. The on-site field geologist will make a sampling determination based on the results of field screening including PID readings, visual and odor observations, and at the discretion of the DDC.

3. Structural Analysis

3.1 Introduction

Load ratings were initially rated using the Allowable Stress Method (ASD). If the member did not meet the minimum required inventory rating for either pedestrian load or vehicle load H10, then it was re-rated using the Load Factor Method (LFD), in accordance with the guidelines of Appendix C of NYCDOT's Procedure for Bridge Reconstruction Project Report (BRPR). The as-built and as-inspected ratings were calculated according to the latest provisions of AASHTO Manual for Bridge Evaluation, 2nd Edition (2011), AASHTO Standard Specification for Highway Bridge, 17th Edition (2002), and LRFD Guide Specifications for the Design of Pedestrian Bridges (2009).

The following loads were applied to the structure, including the canopies at the south end:

- Steel self-weight;
- Concrete 150 pcf and wet timber plank 50 psf;
- 10 psf superimposed dead load;
- 100 psf floor live load;
- Vehicle load H10; (Single Truck, 8 kips wheel load)
- Self-weight and snow load on the canopies (Based on the latest ASCE 7-10 Minimum Design Loads for Buildings and Other Structures)
- Snow load, Pg = 25 psf for NYC region

The material properties were defined for the structure:

- Structural steel: Fy =33,000 psi (Year of construction between 1936 to 1963)
- Concrete: f'c = 2,500 psi
- For the transfer girder framing system, Structural steel: Fy =50,000 psi (assumed to be constructed after 2000)

Assumption made in the calculations:

- All superstructures framings are non-composite sections;

The superimposed dead load and pedestrian load are distributed based on the tributary area from the framing plan. Forces due to the vehicular live load (H10 maintenance truck) were computed based on a moving load to produce maximum results, typically at the mid-spans for moments. Since most of the structural members were simply supported spans, the maximum moving load results were compared to the pedestrian load results to find which load governs.

Original Design Criteria / References

- Bridge built from plans dated in 1961;
- No reference to design code used;
- Live Load = 100 psf, as shown on plans.

3.2 Summary of Findings

As-Built Load Rating Findings (Timber Deck Section):

The longitudinal stringers were not designed to carry a maintenance vehicle's concentrated wheel load of 8 kips. In contrast to the current design requirements, these timber deck spans were only designed for a pedestrian live load of 100psf with no vehicular loading requirement. When analyzed for only the uniform pedestrian live load, the stringers are found to rate well, however, the floorbeams and girders do not rate well. The lowest load rating found for a floorbeam is 0.46 (ASD) and for a girder is 0.21 (ASD). These findings were unexpected and required the engineering team to investigate why the original design did not rate well. This is discussed further in Section 3.3 below. Columns and transfer girder framing system rated well for pedestrian live load of 100psf.

As-Built Load Rating Findings (Concrete Deck Section):

The longitudinal stringers can carry a maintenance vehicle's concentrated wheel load of 8 kips. The stringers, floorbeams, and columns are found to rate well for a pedestrian live load of 100psf, with the exception of one floorbeam at Bent 24. Floorbeam 24-6 supports the base of the existing canopy.

As-Inspected Load Rating Findings (Both Timber and Deck Section):

Only structural components with significant deterioration were re-computed for section properties based on the field measurements. These revised section properties were then incorporated to calculate the as-inspected load ratings, with the following findings.

- Spans 1-7 (Timber Deck Section): Very few members are deteriorated and need repair. The lowest load rating for floorbeams is 0.46 (ASD) and for girders is 0.21 (ASD);
- Spans 8-18 (Timber Deck Section): More advanced corrosion in stringers and floorbeams need repair (see Note 1). Taking an average loss of 20% reduction to compute the as-inspected load ratings, the lowest load rating for floorbeams is 0.64 (ASD). Stringers and girders are acceptable;
- Spans 19-29 (Concrete Deck Section): Members under leaking expansion joints were deteriorated and will need repair (see Note 1).

Note 1: For Load Rating Summary Table, see Exhibit 11.1.

Note 2: For deteriorated locations, see Appendix A (In-depth Inspection Report).

Note 2: For load rating calculation, see Appendix C.

3.3 Conclusion

It is believed that the Bridge may have been designed in accordance with the AISC Steel Construction Manual of 1961 (5th Edition), which included the "Minimum Design Loads in Buildings and Other Structures" from the American Standard Building Code Requirements A58.1

(1945). This code allowed for the reduction of live load for members supporting large tributary areas, such as the floorbeams and girders in the Timber Deck Section. When taking a live load reduction into consideration, the floorbeams and girders rated acceptably (near 1.0), thus confirming the use of live load reductions in the original design.

Current AASHTO load rating practices and codes do not allow live load reductions, thus, the Bridge ratings are low, especially for members in Spans 1 through 18. The ratings are low for the stringers, floorbeams, and girders, with the exception of the columns. It is not clear whether the original design used live load reduction to design the Bridge based on the 1961 code. Corrosion and section losses were generally not significant for members in Spans 1 through 7 and Spans 19 through 29. On the other hand, members in Spans 8 through 18 have more advanced corrosion in stringers and floorbeams. These spans typically carry the load of the NYTA power cables. The load ratings in these areas were approximated due to the fact that top flanges are not currently exposed with timber planks.

4. Vulnerability Study

4.1 Seismic Assessment

As per the discussion with NYCDDC and NYCDPR, the Passerelle Bridge is not considered to be either a critical or essential bridge, as it is not a link for civil defense, police, fire department, and/or public health agencies to respond to a disaster situation after an event. Any rehabilitation option of the existing bridge that maintains the existing superstructure and substructure (Alternative 1 and Alternative 2) does not require a seismic evaluation.

A detailed seismic analysis was not performed for the existing condition.

Any full superstructure and substructure replacement (Alternative 3) should be designed to current seismic criteria, and NYCDPR may require its design to satisfy such requirements.

4.2 Collision Mitigation

AASHTO LRFD Article 2.3.3.2 specifies an increased vertical clearance for pedestrian bridges that is one foot higher than for vehicular bridges in order to mitigate the risk from vehicle collision with superstructure. The NYSDOT Bridge Manual (section 2.4) refers to a Federal government requirement of 16’-0” vertical clearance over highways, but clearly states that parkway roads are exempt from this requirement. Non-National Highway System (non-NHS) routes should have a minimum vertical clearance of 14'-0", with 14'-6" desired.

The minimum vertical clearance (MVC) over a crossing roadway is under Span 28, where the two roadways of Perimeter Road pass. The MVC was measured to be 15’-9” along the westbound roadway over Stringer S18. Thus, the existing vertical clearance under the bridge should be adequate when compared against typical requirements.

Despite having an adequate vertical clearance, the framing in Span 28 exhibits significant signs of past collisions. It is believed that this is most likely not attributable to insufficient vertical clearance, and is a result of past construction vehicle impacts.

In an alternative that that replaces the superstructure (Alternative 3), there would be an opportunity to increase vertical clearance by either using shallower depth framing, or a revised vertical profile for the bridge.

5. Traffic Study

5.1 Present Pedestrian Traffic Volume

The majority of pedestrians who utilize the bridge are destined for/originate from the NYC Transit subway, located just north of the Bridge. Pedestrian volumes are relatively low during the majority of the year, with users travelling between the subway station and the expansive Flushing Meadows Corona Park during the seasonable periods. Peak usage on the Bridge drastically increases during the two week period (late August/early September) when the US Open occurs at the NTC. In addition, higher volumes occur on the Bridge when a baseball game (or other event) is held at Citi Field, with pedestrians who arrive via the LIRR station, located just south of the Bridge. The pedestrian traffic study focused on data collected during the peak periods of the US Open event, and on a seasonable Sunday with a relatively large baseball event at Citi Field.

5.2 Data Collection Program

The 2013 dates for the US Open were between Monday, August 26th and Monday September 9th. May 2013 Final Environmental Impact Statement (FEIS) for the NTC stated that the greatest attendances occur during the first few days of the first week, when more matches are played simultaneously on the many courts around the NTC main stadiums. In addition, volumes are greatest when a Mets home game (at nearby Citi Field) occurs on the same evening as the first week matches. Peak volumes are expected on the bridge from 4:00PM to 8:00PM, when users:

- leave the day session, where events are held at Arthur Ashe and Louis Armstrong Stadiums within the NTC and around the grounds (begins at 11:00AM, ends at varying times),
- arrive for the evening session (Arthur Ashe Stadium only) at the NTC (begins at 7:00PM, ends after 11:00PM),
- arrive for the evening Mets game at Citi Field (begins at 7:10PM).

Advance ticket sales data from the New York Mets, which showed virtually similar advance sales for each of the three days (20,670; 20,040; and 19,285 respectively) were obtained. Pedestrian counts were obtained on the Bridge on two of these evenings, Monday and Wednesday, based on the above advance sale information and weather forecasts.

In addition, pedestrian counts were obtained on Sunday, September 29th, the final baseball game of the year. Two special events were occurring for this game. The advance ticket sale for this game was 41,891, which is a near sell out. Peak volumes were expected on the bridge from 10:00AM to 2:00PM, when users:

- arrive in the morning to go to Flushing Meadow Corona Park
- arrive for the afternoon Mets game at Citi Field (game began at 1:10PM)

The counts were performed by personnel stationed south of the subway entrance, at the south end of the wooden boardwalk just north of the LIRR, with one responsible to count pedestrians

walking south (towards the NTC and Flushing Meadow Corona Park), the other counting pedestrians walking north (from the NTC/Park). Counts were obtained in 15 minute intervals for the four hour periods.

5.3 Pedestrian Capacity Analysis

Level of service is determined by measuring the flow rate of pedestrians. Pedestrian flow rate can be determined by the amount of pedestrians that pass through an effective width per minute (p/min/ft). The width of the bridge at its narrowest point is approximately thirty-eight (38) feet railing-to-railing. It was observed during the pedestrian count program that an approximate six 6'-6" inch lane was cordoned off as a designated bike taxi lane, delineated by removable bollards. The full thirty-eight (38) foot width will be used for analysis since this bike taxi lane can be removed.

The type of pedestrian flow that occurred during the count program is known as platooning. Platooning is when a large number of pedestrians enter a walkway simultaneously due to the arrival of a train or bus. In this case, it was the #7 train (arriving from either Manhattan or Flushing – the two terminal stations of the #7 line).These trains (both local and express) arrive approximately every two minutes. The level of service criteria for platooning based on pedestrian flow according to the NYCDCP Transportation Division (dated April 2006), are listed in Table 5-1, below.

Table 5-1: Level of Service

LOS	Space (ft^2/p)	Flow Rate (p/min/ft)
A	> 530	≤ 0.5
B	> 90-530	> 0.5-3
C	> 40-90	> 3-6
D	> 23-40	> 6-11
E	> 11-23	> 11-18
F	≤ 11	> 18

In general, any level of service above D is considered acceptable.

A current level of service (LOS) was determined based on the pedestrian volumes and the width of the bridge. In addition to current LOS, an analysis was done for future LOS (an expansion of the NTC will occur as noted in the aforementioned FEIS, which will increase capacity and expected usage). It is necessary to find both current and future LOS to determine how pedestrian traffic would be affected when a portion of the bridge is closed during rehabilitation.

The peak period for US Open dates occurred on Wednesday, August 28th between 6:15PM and 7:15PM with a total of 10,034 visitors (2,309 + 2,162 + 2,553 + 3,010). The peak period for the

Mets game occurred on Sunday September 29th between 11:45PM to 12:45PM with a total of 2,400 visitors (171 + 1016 + 379 + 834). There are spikes in demand during one (1) of the fifteen (15) minute time intervals during both of the peak hours; therefore a peak hour factor should be calculated to adjust both hourly volumes. Peak hour factor is found by dividing the hourly volume by four (4) times the peak fifteen (15) minute volume. The peak hour factors for these periods are:

$$PHF_1 = \frac{\text{V}}{\text{v15x4}} = \frac{10{,}034}{3{,}010\ x4} = 0.83 \text{ (US Open)}$$

$$PHF_2 = \frac{\text{V}}{\text{v15x4}} = \frac{2{,}400}{1{,}016\ x4} = 0.59 \text{ (Mets game)}$$

The adjusted peak hour volume is found by dividing the hourly volume by the peak hour factor. The adjusted peak hour volume is 12,040 (10,034/0.83) for August 28th and 4,064 (2,400/0.59) for September 29th.

Pedestrian volumes of 12,040 and 4,064 would produce flow rates of 5.28 (p/min/ft) and 1.78 (p/min/ft), which would result in an acceptable Levels of Service of C and B, respectively.

5.4 Forecast Pedestrian Traffic Volume

As per the FEIS for the NTC, there is a proposed expansion (estimated construction of 2019) which will produce an estimated increase of 10,000 visitors to the US Open on a daily basis. In addition, the improvements include two new parking garages which will add approximately 389 parking spaces for visitors.

A key part of the future conditions analysis is determining how many of the projected 10,000 additional visitors will be using the Passerelle Bridge in order to get to the NTC. Table 5-2 below shows the anticipated travel demand assumptions and trip generation estimates for the 10,000 additional visitors (table included within the FEIS):

Table 5-2: Travel Demand Assumptions and Trip Generation Estimates

Modal Split	Daily Trip Increment				Peak Period Departure Trip Increment		
	Percent	Person Trips	VOR (1)	Vehicle Trips (2)	Peak Period	Person Trips	Vehicle Trips (2)
Auto	25.9%	2,590	2.01	1,288	35%	907	452
Taxi/Car Service	11.9%	1,190	1.67	713	35%	416	249
Charter Bus	4.2%	420	40.0	11	35%	147	4
MTA NYCT Bus	1.0%	100	--	--	35%	35	--
Subway	40.4%	4,040	--	--	35%	1,414	--
LIRR	13.0%	1,300	--	--	35%	455	--
Other	3.6%	360	--	--	35%	126	--
Total	**100.0%**	**10,000**	**--**	**2,012**	**--**	**3,500**	**705**

Notes: (1) Vehicle Occupancy Rate
(2) Projected total vehicle trip-ends will be 2,725 daily and 952 peak period with the additional taxi/car service round trips.

The percentage of visitors that use automobiles (25.9%) will be able to park in either existing or the new parking facilities adjacent to the NTC, and thus will not cross the Passerelle Bridge. Similarly, those arriving by taxi (11.9%) or charter buses (4.2%) will be dropped off on the west side of the NTC, thus also not using the Bridge. The LIRR Mets – Willett Point Station is immediately adjacent to the NTC, thus that percentage (13.0%) will not use the narrow thirty eight (38) foot wide portion of the Bridge being analyzed.

Visitors who use the #7 train (the largest percentage estimated at 40.9%) will have to cross the Bridge in order to attend the events at the NTC. In additional, those that arrive via a NYCT bus (Q-48 on Roosevelt Avenue) will also use the Bridge.

As per data shown in Table 5-2, an estimated 1,449 (1,414 + 35) additional visitors will be crossing the Bridge from the subway and bus respectively during the peak period. Note that the peak period referred to in this Table from the FEIS is the peak hour (6:00PM to 7:00PM).

Adding the additional pedestrian volume from trip generations to the existing adjusted peak hour volume would produce a pedestrian volume of 13,489 (12,040 + 1,449). A pedestrian volume of 13,489 would produce a flow rate of 5.9(p/min/ft) and an acceptable Level of Service C.

5.5 Vehicular Traffic

There is no vehicular traffic on the bridge other than the maintenance vehicles. Maintenance vehicle accesses is limited to concrete deck section from spans 19 through 29. No vehicle is permitted on the timber deck section from spans 1 through 18. Steel bollards are installed to prevent vehicles onto the timber deck section of the bridge.

A Detailed Traffic Analysis is included in Appendix D.

6. Statements

6.1 Planning Statement

The Passerelle Bridge is the pedestrian gateway to Flushing Meadows Corona Park from the north and is a key connection to a number of facilities in and around the park. The most prominent purpose is to direct event flows to Citi Field at the north and the USTA Billie Jean King National Tennis Center for the US Open at the south. Within the park, the Bridge also serves the recently renovated Queens Museum, new Corona Park Aquatic Center, the Al Oerter Recreation Center, Queens Theater in the Park, and the New York State Pavilion. There are a number of planned projects which will have a significant impact on the flows of the Bridge. The USTA's $500 million expansion has been recently approved, demolishing and rebuilding two of the aging stadiums within the site and adding capacity. Willets Point, just north of the Bridge, is a 62 acre development with multiple mixed-use buildings. Immediately adjacent to the Bridge, at its north end, will be two parking structures, possibly directly connecting to the Bridge for ease of traveling over Roosevelt Avenue. The Jackson Heights-Corona Business Improvement District to the west and the Flushing Riverfront plans to the east will also shorten the distance between these two adjacent communities.

6.2 Right-of-Way Statement and Temporary Easement

The Right of Way Map is shown in Appendix 11.2.

No additional Right-of-Way will be required for the rehabilitation the Bridge, however, temporary easements will be required from the following agencies for rehabilitation:

- Long Island Railroad
- New York City Transit
- New York City Parks and Recreation.
- New York Mets

The Passerelle Pedestrian Bridge spans two block and seven lots. Of these seven lots, the southernmost lot is owned by the City of New York and the United States Tennis Association National Tennis Center Inc. The other two lots at the south end of the Bridge are owned by Long Island Rail Road. The northernmost lot is owned by Sterling Mets and J.P. Morgan Chase Bank. The remaining three lots at the north end of the Bridge are owned by the MTA - New York City Transit.

Table 6-1: Property Ownership

Block	Lot	Owner
2018	1	The City of New York The United States Tennis Association National Tennis Center Inc.
2018	100	New York City Transit Authority
2018	150	The Bank of New York Mellon (Lease)
2018	300	Long Island Rail Road
2018	350	Long Island Rail Road
1787	20	Sterling Mets, L.P. JP Morgan Chase Bank, N. A.

6.3 Historical Significance

The Bridge was built for the 1939 World's Fair, providing a direct connection from the elevated Flushing train line. Large flags for the nations represented at the Fair lined both sides of the Bridge. This complemented a large Long Island Railroad Station with an arched hall to the south. This hall was subsequently torn down and for the 1964 World's Fair. Three platforms for the LIRR were connected to the bridge with a distinctive folded canopy over the ticket area and along the south edge of the bridge. These can be easily recognized in historical photos, lined with lights along the underside. This has remained a strong link as described in the planning statement, adapted for Mets and US Open crowds. For the US Open in particular, part of the bridge is blocked off for a Pedi cab lane.

6.4 Agencies having Special Interest in the Project

In addition to NYCDDC, input is anticipated from NYC Parks, MTA Bus/LIRR/NYCT, the New York Mets, NYCOMB, NYCDOT, NYC Public Design Commission, NYCDEP, NESDEC, USTA National Tennis Stadium, and Queens Community Boards 3, 4 and 7. Specific coordination will be required with the upcoming renovation at the Willets Point Station tentatively planned by LIRR for 2014.

7. Alternatives Study

7.1 Objectives

- Determine the structural condition of the existing bridge
- Develop alternatives that will provide a 75 year service life
- Compare alternatives and prepare a recommendation
- Develop architectural treatments for the recommendation. Alternatives to be consistent with the bridge as a gateway between transit modes and Flushing Meadows Park/Tennis Center and Citifield

7.2 Alternatives

The following alternatives were selected for study after discussion with the New York City Department of Design and Construction:

Alternative 1: Replacement of Existing Deck in Kind and Rehabilitation of Existing Structure

Alternative 2: Replacement of Existing Deck with a New Concrete Deck and Rehabilitation of Existing Structure

Alternative 3: Replacement of Existing Structure using Existing Foundations

For the rehabilitation and replacement alternatives, the scope of work and cost of the bridge structure are divided into two sections**:**

- Section 1: Timber Deck Sections, for Span 1 through Span 18,
  - Approximate area of 48,500 sf. Length is approximately 725'
- Section 2: Concrete Deck Section, for Span 19 through Span 29,
  - Approximate area of 57,500 sf., Length is approximately 386'

7.2.1 Alternative 1: Replacement of Bridge Deck In-Kind

7.2.1.1 Design Criteria/Assumptions

- Live Load = 100 psf for Concrete and Timber Decks
- H-10 truck load for Concrete Deck only
- AASHTO Standard Specifications for Highway Bridges, 17th Edition, with current interims and as amended by NYSDOT (Blue Pages)
- Retrofit steel members to meet AASHTO Working Stress Methods
- Use A50 steel for repairs and for new steel
- Use A325 HS bolts for new connection
- Use 4,000 psi concrete and composite concrete deck
- Existing bridge structure is classified as "Other" ("Not Critical or Essential"). No Seismic design retrofit is required for rehabilitation.
- AASHTO Guide for the Development of Bicycle Facilities

7.2.1.2 Scope of Work for Timber Deck Section

For reference, see Drawings SK-2 and SK-4 in Exhibit 11.4.

- Replace existing Timber Deck "in kind" with timber planks
- Replace all deteriorated stringers supporting Timber Deck
- Repair deteriorated floorbeams, girders, and columns
- Retrofit deficient floorbeams and girders as necessary
- Replace existing bolts and rivets with new A325 HS bolts as necessary
- Sand blast, clean, and repaint existing steel members
- Retrofit existing footings to support design loads
- Install improved railing and lighting, subject to PDC approval
- Deck treatment, subject to PDC Approval

Table 7-1 below summarizes the quantities of major elements:

Table 7-1: Alternative 1 Timber Deck Section

	No. of Structural Elements to be Replaced	**Approximate Weight of Repair Steel**	
Steel Stringers	117 (of 524)	100,000 lbs	
Steel Floorbeams	88 (of 120)	50,000 lbs	
Steel Girders	18 (of 78)	20,000 lbs	
Steel Columns	There are 52 columns. Extent of repairs will not be known until the members are sandblasted and cleaned.	20,000 lbs as a Contingency	
Deck Area	48,500 sf	100%	Timber

7.2.1.3 Scope of Work for Concrete Deck Section

For reference, see Drawings SK-3 and SK-5 in Exhibit 11.4.

- Replace existing Concrete Deck "in kind"
- Replace all deteriorated stringers supporting Concrete Deck
- Repair girders and columns
- Retrofit deficient floorbeams (pier cap beams) and girders as necessary
- Replace existing bolts and rivets with new A325 HS bolts as necessary
- Sand blast, clean, and repaint existing steel members
- Install improved railing and lighting, subject to PDC approval
- Retrofit existing footings to support design loads
- Deck Treatment, subject to PDC approval
- Strengthening of steel frame system to support canopy roof structure

Table 7-2 below summarizes the quantities of major elements.

Table 7-2: Alternative 1 Concrete Deck Section

	No. of Structural Elements to be Replaced	**Approximate Weight of Repair Steel**	
Steel Stringers	15 (of 275)	30,000 lbs	
Steel Floorbeams	9 (of 66)	30,000 lbs	
Steel Girders	2 (of 7)	10,000 lbs	
Steel Columns	Extent of repairs will not be known until the members are sandblasted and cleaned (81 Total)	20,000 lbs as a Contingency	
Deck Area	57,500 sf	100%	Concrete

7.2.1.4 Critical Issues

- Design exception approval required since the rehabilitated structure will not meet current AASHTO Pedestrian Bridge Design Criteria for H-10 vehicular load (no vehicular live load on timber deck spans)
- The exact extent of steel repairs is not known until the removal of deck and cleaning of steel members
- Steel members in timber deck sections will not be protected from water and even if they are, paint will continue to deteriorate. Continuous repairs will be required at all scheduled future maintenance cycles.
- The superstructure framing requires extensive strengthening to support canopy structure.

7.2.1.5 Construction Cost Estimate and Construction Duration

The estimated construction duration for Alternative 1 is 24 Months. The estimated construction cost of rehabilitation/reconstruction is $91.6 Million. See Exhibit 11.6 for a cost breakdown summary.

7.2.2 Alternative 2: Replacement of Existing Deck with a New Concrete Deck

7.2.2.1 Design Criteria/Assumptions

- Live Load = 100 psf or H-10 Truck Load
- AASHTO Standard Specifications for Highway Bridges, 17th Edition, with current interims and as amended by NYSDOT (Blue Pages)
- Retrofit steel members to meet AASHTO Working Stress Method
- Use A50 steel for repairs and for new steel
- Use A325 HS bolts for new connection
- Use 4,000 psi concrete and composite deck
- Existing bridge structure is classified as “Other” (“Not Critical or Essential”). No seismic retrofit is required for rehabilitation.
- AASHTO Guide for the Development of Bicycle Facilities

7.2.2.2 Scope of Work for Timber Deck Section

For reference, see Drawings SK-6 and SK-8 in Exhibit 11.4.

- Replace existing Timber Deck with new Concrete Deck
- Replace all existing deficient stringers supporting Timber Deck
- Repair deteriorated floorbeams
- Retrofit or replace deficient floorbeams and girders as necessary
- Replace existing bolts and rivets with new A325 HS bolts as necessary
- Retrofit existing footings to support design loads
- Sand blast, clean, and repaint existing steel members
- Install improved railing and lighting, subject to PDC approval
- Deck treatment, subject to PDC approval

Table 7-3 summarizes the quantities of major elements:

Table 7-3: Alternative 2 Timber Deck Section

	No. of Structural Elements to be Replaced	**Approximate Weight of Repair Steel**	
Steel Stringers	524 (of 524)	120,000 lbs (100% Replacement)	
Steel Floorbeams	88 (of 120)	50,000 lbs	
Steel Girders	18 (of 78)	100,000 lbs	
Steel Columns	There are 52 columns. Extent of repairs will not be known until the members are sandblasted and cleaned.	40,000 lbs as a Contingency	
Deck Area	48,500 sf	100%	from Timber to Concrete

7.2.2.3 Scope of Work for Concrete Deck Section

For reference, see Drawings SK-7 and SK-9 in Exhibit 11.4.

- Replace existing Concrete Deck "in kind"
- Replace all deteriorated stringers supporting Concrete Deck
- Repair girders and columns
- Retrofit deficient floorbeams (pier cap beams) and girders as necessary
- Replace existing bolts and rivets with new A325 HS bolts as necessary
- Sand blast, clean, and repaint existing steel members
- Install improved railing and lighting, subject to PDC approval
- Retrofit existing footings to support design loads
- Deck Treatment, subject to PDC approval
- Strengthening of steel frame system to support canopy roof structure

Table 7-4: Alternative 2 Concrete Deck Section

	No. of Structural Elements to be Replaced	**Approximate Weight of Repair Steel**	
Steel Stringers	15 (of 275)	30,000 lbs	
Steel Floorbeams	9 (of 66)	30,000 lbs	
Steel Girders	2 (of 7)	10,000 lbs	
Steel Columns	Extent of repairs will not be known until the members are sandblasted and cleaned (81 Total)	20,000 lbs as a Contingency	
Deck Area	57,500 sf	100%	Concrete

7.2.2.4 Critical Issues

- The exact extent of steel repairs is not known until the removal of deck and cleaning of steel members
- The new concrete deck requires expansion joints
- Requires extensive modification to existing steel framing to install new deck joints in spans 1 through 18. Could lead to several constructability issues and high rehabilitation cost.
- Requires extensive temporary supports for framing modifications.
- The superstructure framing requires extensive strengthening to support canopy structure.

7.2.2.5 Construction Cost Estimate and Construction Duration

The estimated construction duration for Alternative 2 is 30 Months. The estimated construction cost of rehabilitation/reconstruction is $102.8 Million. See Exhibit 11.6 for a cost breakdown summary.

7.2.3 Alternative 3: Replacement of Existing Structure over Existing Foundations

7.2.3.1 Design Criteria/Assumptions

All pedestrian bridges will be designed in accordance with NYSDOT LRFD Bridge Design Specifications and the AASHTO LRFD Guide Specifications for Design of Pedestrian Bridges, December 2009. The owner may waive the fracture critical member requirements for design of tubular members.

- Live Load = 100 psf or H-10 Truck Load.
- Use A50 steel for repairs and for new steel.
- Use A325 HS bolts for new connections.
- Use 4000 psi concrete and composite concrete deck
- New bridge superstructure or substructure shall be designed as "Essential."
- AASHTO Guide for the Development of Bicycle Facilities

7.2.3.2 Scope of Work for Timber Deck Section

For reference, see Drawings SK-10 and SK-12 in Exhibit 11.4.

- Demolish superstructure and substructure
- Replace existing Timber Deck with new precast or cast-in-place concrete deck
- Replace steel stringers, floorbeams, girders, and columns over existing foundations
- Retrofit existing footings to support design loads
- Install improved railing and lighting, subject to PDC approval
- Deck treatment, subject to PDC approval

Table 7-5 below summarizes the quantities of major elements.

Table 7-5: Alternative 3 Timber Deck Section

	Approximate Replacement Percentage		**Weight of Steel Members**
Superstructure Steel (Stringers)	100%		700,000 lb
Substructure Steel (Floorbeams, Girder and Columns)	100%		500,000 lb
Deck Area	48,500 sf	100%	from Timber to Concrete

7.2.3.3 Scope of Work for Concrete Deck Section

For reference, see Sketches SK-11 and SK-13 in Exhibit 11.4.

- Demolish superstructure and substructure
- Replace existing concrete deck with new precast or cast-in-place concrete deck
- Replace steel stringers, floorbeams, girders, and columns over existing foundations
- Retrofit existing footings to support design loads
- Install improved railing and lighting, subject to PDC approval
- Deck treatment, subject to PDC approval

Table 7-6 below summarizes the quantities of major elements.

Table 7-6: Alternative 3 Concrete Deck Section

	Approximate Replacement Percentage		**Weight of Steel Members**
Superstructure Steel (Stringers)	100%		900,000 lb
Substructure Steel (Floorbeams, Girder and Columns)	100%		400,000 lb
Deck Area	57,500 sf	100%	Concrete

7.2.3.4 Critical Issues

- Temporary structure needed to support NYCTA power and communication cables.
- Separate structure required to maintain pedestrian traffic during replacement of floorbeams.
- Reconstruction shall be performed in stages.
- The superstructure framing requires extensive strengthening to support canopy structure.

7.2.3.5 Construction Cost Estimate and Construction Duration

The estimated construction duration for Alternative 3 is 36 Months. The estimated construction cost of reconstruction is $122.6 Million. See Exhibit 11.6 for a cost breakdown summary.

7.3 Construction Staging Issues

7.3.1 Maintenance of NYCT Power and Signal Cables

The NYCTA signal and power cables are supported by the superstructure and substructure in spans 7 through 19. For all the alternatives, extensive temporary supports for these cables will be required. It is estimated that the rehabilitation of the structure with in place cable supports would add approximately 6 to 8 months to the construction duration.

Figure 7-1: Typical Depiction of Underdeck Cables from Spans 7 through 19

As an alternative to temporary supports for the cable, the cables could be permanently relocated outside the bridge structure on a separate structure or in ground during the pre-construction stage or prior to start of construction. Shown below in Figure 7- is a diagram showing the typical location of power and signal cables along the bridge framing.

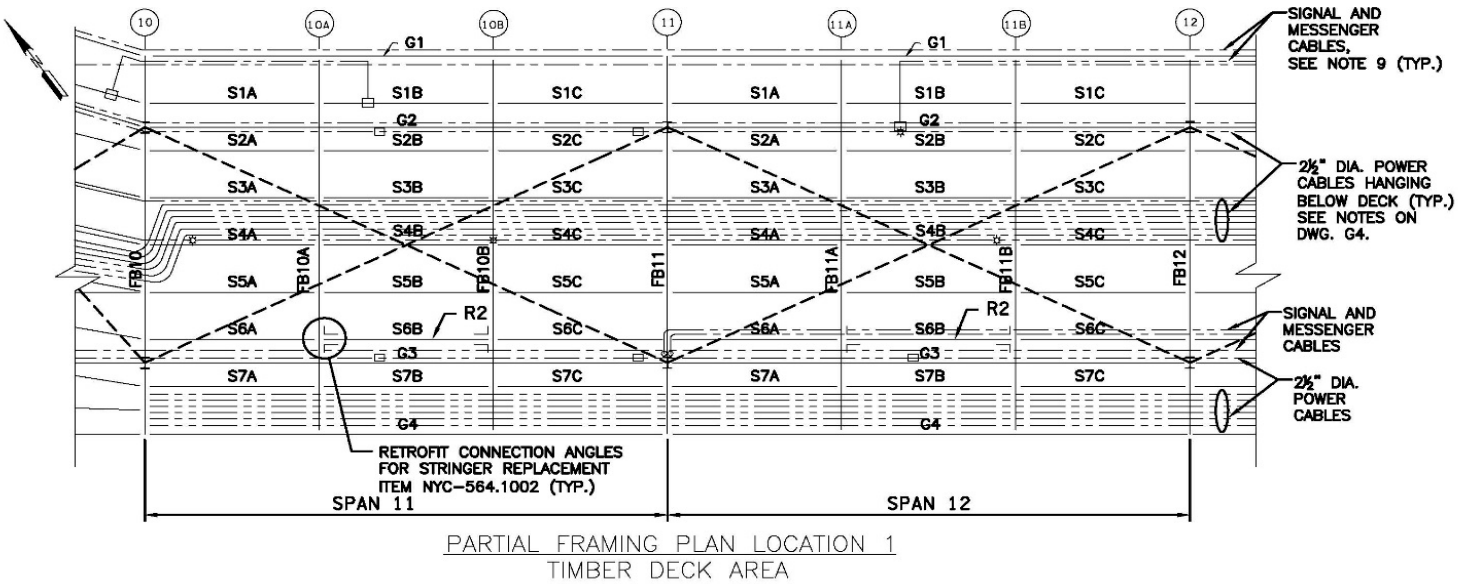


Figure 7-2: Typical Location of Power and Signal Cables

7.3.2 Maintenance of Pedestrian Traffic

7.3.2.1 Option 1: Stage Construction

Under this option, shown in Figure 7- the bridge will be open to pedestrian traffic for the entire duration of construction. The bridge will be constructed in two stages, leaving half of the walkway width intact.

Advantages:

- Pedestrian traffic on the bridge will be maintained at all times.

Disadvantages:

- Longer construction duration and a detour route in order to allow the bridge to be closed
- Longer disruption to NYCT Subway and NYCT Bus facilities will occur and force account costs will be higher.
- Due to the temporary supports, it would be necessary to coordinate with NYCT to develop a detailed MPT plan during the final design phase in order to maintain efficient operations for their facilities.

- The reduction in capacity to half the width of the bridge would significantly reduce the level of service. The impact would be significant on game days at Citi Field (approximately 80 days between April and September and special events) and during the US Open at the Tennis Center.

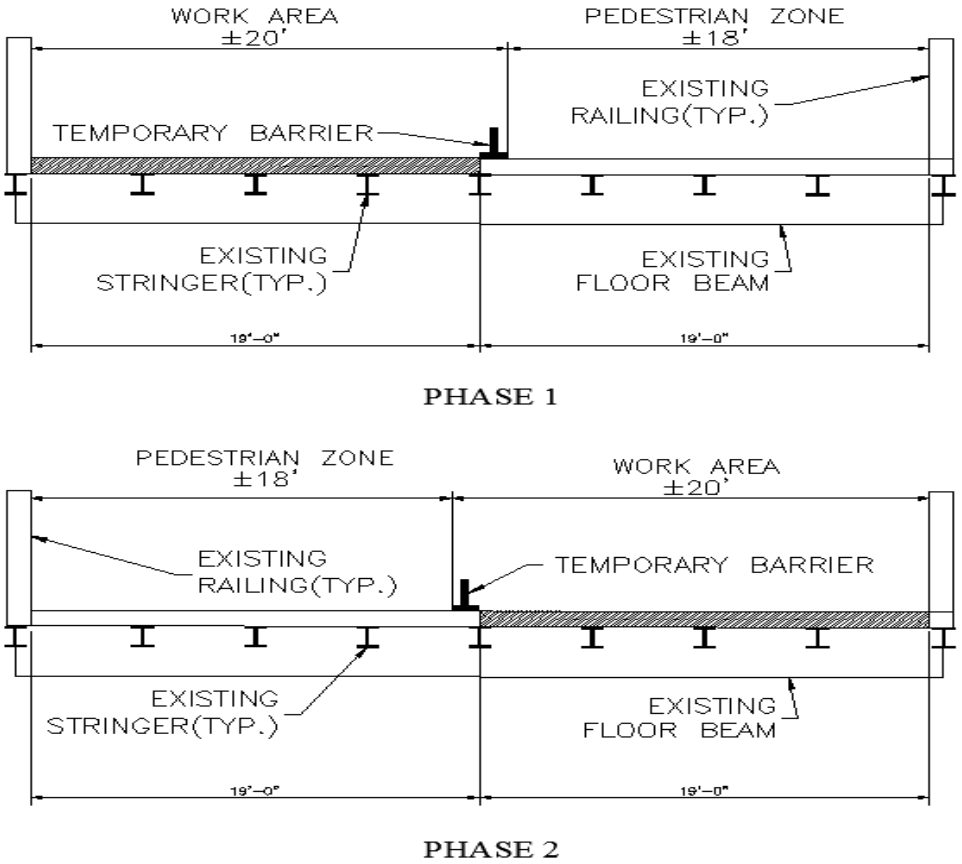


Figure 7-3: Stage Construction

7.3.2.2 Option 2: Full Bridge Closure and On-Site Detour

Under this option, the bridge deck from Spans 1 through 18 will be closed to public during demolition and construction. To detour pedestrian traffic, a temporary passageway will be built below the viaduct including temporary stairs and an elevator or ADA Ramp at the south end of the timber deck to reroute the pedestrian traffic from below to the upper level or a temporary structure alongside of the existing structure. To address NYCT security concern, a chain link fence will be required along the temporary passage to seclude the passageway from the NYCT facilities. Two automated security gates will be required for NYCT personnel to walk out through the fenced walkway. Although, this may be inconvenient to NYCT, this option is much safer to bridge users as well as the NYCT personnel. A meeting with NYCT Maintenance facility will be essential to explore this option further.

Advantages:

- Shorter construction duration

Disadvantages:

- The area under Spans 8 through 11 sees significant bus traffic. To accommodate the pedestrian detour, it would be necessary to coordinate with NYCT to develop a detailed MPT plan during the final design phase in order to maintain efficient operations for their facilities.

7.3.3 Removal and Replacement of Canopy Structures at LIRR Plaza

The canopy structure's columns are framed to steel beams via the concrete deck. The anchorage of the canopy's supporting steel members will be removed once the concrete deck is removed. For all Alternatives, the canopies shall be removed, stored, and reinstalled once the superstructure rehabilitation is completed.

7.4 Construction Cost Estimate and Life Cycle Cost Estimate

The Estimate is based on 2014 prices for steel and deck materials, plus estimates for other notable items. The Estimate includes major repair work, maintenance and protection of traffic with stage construction, railroad force account work, and a 30% contingency.

The Construction Cost Estimate is included in Exhibit 11.6.

The Life Cycle Cost Analysis was performed for all three alternatives with the following assumptions:

Maintenance Schedule for Alternative 1

<u>Routine Maintenance (Every 5 Years)</u>	
Deck Joint Replacement	
Bridge Cleaning and Washing	
<u>Routine Maintenance (10th, 30th, 50th and 70th Years)</u>	
Timber Deck Partial Replacement	Assume 20% of 48,500 sf. x $60/sf.
Concrete Deck Repair	Assume 5% 57,500 sf. x $120/sf.
Steel Member Repair	
Repainting of Steel Members	Localized Painting
Railing and Lighting Repair	
<u>Preventative Maintenance (20th and 60th Years)</u>	
Timber Deck Full Replacement	Assume 100% 48,500 sf. x $50/sf.
Concrete Deck Repair	Assume 5% 57,500 sf. x $120/sf.
Steel Member Repair	
Repainting of Steel Members	Full Repainting
Railing and Lighting Removal and Reinstallation	

Rehabilitation Schedule (40th Year)	
Timber Deck Full Replacement	Assume 100% 48,500 sf. x $50/sf.
Concrete Deck Full Replacement	Assume 100% 57,500 sf. x $100/sf.
Steel Member Repair	
Repainting of Steel Members	Full Repainting
Railing and Lighting Removal and Reinstallation	

Maintenance Schedule for Alternative 2

Routine Maintenance (Every 5 Years)	
Deck Joint Replacement	
Bridge Cleaning and Washing	
Routine Maintenance (10th, 30th and 50th Years)	
Steel Member Repair	
Repainting of Steel Members	Localized Painting
Routine Maintenance (20th and 60th Years)	
Concrete Deck Repair	Assume 10% 106,000 sf. x $120/sf.
Steel Member Repair	
Repainting of Steel Members	Full Repainting
Rehabilitation Schedule (40th Year)	
Concrete Deck Full Replacement	Assume 100% 106,000 sf. x $100/sf.
Steel Member Repair	
Repainting of Steel Members	Full Repainting
Railing and Lighting Replacement	

Maintenance Schedule for Alternative 3

Routine Maintenance (Every 5 Years)	
Deck Joint Replacement	
Bridge Cleaning and Washing	
Routine Maintenance (20th and 60th Years)	
Concrete Deck Repair	Assume 10% 106,000 sf. x $120/sf.
Repainting of Steel Members	Full Repainting
Routine Maintenance (30th and 70th Years)	
Concrete Deck Repair	Assume 10% 106,000 sf. x $120/sf.
Rehabilitation Schedule (40th Year)	
Concrete Deck Full Replacement	Assume 100% 106,000 sf. x $80/sf.
Steel Member Repair	
Repainting of Steel Members	Full Repainting
Railing and Lighting Replacement	

Initial Construction Costs for all alternatives are calculated based on the current price history (2014) projected to the year 2022 with 4% inflation.

Maintenance Costs are calculated based on 2022 price.

EUAC (Equal Uniform Annual Costs) for all alternatives are calculated based on the (Present Worth) of all costs over the analysis period with the following:

EUAC (Capital Recovery Method) = Sum of PW * D (1+D)^N/((1+D)^N-1)

Use D = 2% Discount Rate

N = Length of Analysis Period = 75

PW = Sum of Maintenance Costs + Initial Construction Cost

Present Worth = C*(1+R)^n1+M1*(1+R)^n1/(1+I)^n1+M2*(1+R)^n2/(1+I)^n2+
…..MN*(1+R)^nn/(1+I)^nn

C = Initial Construction Cost

R = Inflation Rate, use 4% for Maintenance Cost

M1, M2……..MN = Maintenance Costs throughout the design period

n1, n2,……..nn = Number of years from 2022 to the analysis period. (n1=1, nn=75)

Salvage values are neglected for all alternatives.

7.5 Bridge Inspection and Preventative Maintenance Prior to Scheduled 2020 Rehabilitation

Based on the in-depth inspection performed in October 2013, there are several active structural yellow flags for the severely deteriorated structural members that were not repaired in the emergency repair contract completed in August 2014. In the interest of the safety and welfare of the public, an annual bridge inspection is required until the bridge structure is replaced or rehabilitated or reconstructed. This inspection is required to detect and monitor the existing condition of the bridge structure, including structural elements and connections, appurtenances, and adjacent features or elements thereof that could potentially affect the condition and safety of the structure. The annual inspection of the existing bridge shall be performed in accordance with the standard engineering practice and, when applicable, in accordance with the New York State Department of Transportation bridge inspection procedures.

The total deck area is approximately 106,000 square feet. The timber deck and the concrete deck are deteriorating, exhibiting cracks, and spalled concrete, and will continue to deteriorate due to water infiltration. NYCDPR continuously performs maintenance work to provide safe conditions for the public. There are approximately 535 steel stringers in the Timber Deck Section. In general, the stringers are fair to poor condition and exhibit heavy corrosion and section loss. These stringers are exposed to water and will continue to deteriorate. We anticipate that an interim repair contract for deteriorated bridge elements may be needed prior to scheduled rehabilitation program of 2020.

Table 7-7: Bridge Inspection and Maintenance Costs Prior to 2020 Rehabilitation

Year	Bridge Inspection	Routine Maintenance	Preventative Maintenance	Total
2015	$ 150,000.00 (I)	$ 50,000.00	-	$ 200,000.00
2016	$ 250,000.00 (B)	$ 54,000.00	-	$ 304,000.00
2017	$ 170,000.00 (I)	$ 56,000.00	-	$ 226,000.00
2018	$ 300,000.00 (B)	$ 59,000.00	$ 4,000,000.00	$ 4,359,000.00
2019	$ 185,000.00 (I)	$ 61,000.00	-	$ 246,000.00
2020	$ 320,000.00 (B)	$ 63,000.00	-	$ 383,000.00
Total	$ 1,375,000.00	$ 343,000.00	$ 4,000,000.00	$ 5,718,700.00

(I) = Interim Inspection (B) = Biennial Inspection

7.6 Recommendations

Alternative 1 and Alternative 2 both replace the existing deck, rehabilitate the bridge structure with extensive repairs, and increase the service life to 75 years with scheduled maintenance at every 10 years. In both Alternative 1 and Alternative 2, the repair of steel members cannot be quantified until the removal of the existing bridge deck occurs. Due to the timber deck in Alternative 1, the steel members will continue to deteriorate more rapidly than in Alternative 2. Alternative 1 does not provide the same level of service as Alternatives 2 and 3 as it cannot carry a service vehicle in spans 1 through 18. Therefore, Alternative 1 is not recommended.

Alternative 2 will require significant modification to the existing framing system to install expansion joints for the new concrete deck and may lead to added maintenance costs. It will provide the load capacity for a vehicle but will not meet seismic code.

Alternative 3 is more expensive than Alternative 1 and Alternative 2, but provides the required design load capacity, and conforms to most of the seismic design codes, while Alternative 1 only maintains the existing load carrying capacity, and Alternative 2 improves the load capacity with the exception of seismic forces. The architectural opportunities to enhance the bridge deck area as a gateway to the Park and sports facilities are greater with Alternatives 3, as well as Alternative 2, which contain a concrete deck. However, compared with Alternative 2, Alternative 3 can provide a stronger superstructure and may handle greater deck development.

The initial costs of bridge rehabilitation, summarized in Table 7-7, for Alternative 1 and Alternative 2 are more than 65% of the total bridge replacement cost of Alternative 3, which is a NYSDOT Bridge Design Manual guideline for opting for replacement versus rehabilitation. Considering the life cycle cost analysis and extensive maintenance schedule for Alternatives 1 and 2, Alternative 3 is more cost effective than Alternatives 1 and 2 and is considered to be the most favorable alternative. The new bridge structure provided by Alternative 3 will improve the community environment and avoid disruption of pedestrian traffic and railroad traffic compared to the other two alternatives.

Refer to Exhibit 11.6 for Detailed Cost Analysis.

Table 7-8 on the following page summarizes a comparison of all three alternatives.

Table 7-8: Passerelle Pedestrian Bridge Alternative Comparison

Aspect	**Alternative 1: Replacement of Bridge Deck in Kind and Rehabilitation of Existing Structure**	**Alternative 2: Replacement of Existing Deck with a New Concrete Deck and Rehabilitation of Existing Structure**	**Alternative 3: Replacement of Existing Structure Using Existing Foundations**
Estimated Construction Cost for Bridge, Exhibit 11.6, Table 1	$91.6 Million	$102.8 Million	$122.6 Million
Estimated Construction Cost for Passerelle Building and ADA Ramp at the South End of the Bridge	$12 Million	$12 Million	$12 Million
Estimated Construction Duration	24 Months	30 Months	36 Months
Estimated Life Cycle Cost (75 years) Future Value, Exhibit 11.6, Table 2	$593.6 Million	$413.9 Million	$292.1 Million
Inspection and Preventative Maintenance Costs Prior to 2020 Rehabilitation, Table 7-7	$5.7 million	$5.7 million	$5.7 million
Meets Current AASHTO Codes	No	Yes	Yes
Meets Seismic Force Demand	No	No	Possible
Pedestrian Service Levels (Design Yr.)	C	C	C
Facility Space below Deck	Same as Current	Same as Current	Opportunity to Increase with Longer Spans
Architectural Opportunities	Limited w/Timber Deck	Good w/Concrete Deck Limited by Superstructure	Best w/Concrete Deck and Stronger Superstructure
Meets ADA Requirements*	Yes *	Yes	Yes
Need for Temp Construction Easements	Yes	Yes	Yes
Environmental Issues	Extensive Lead Paint Removal Protection	Extensive Lead Paint Removal Protection	Moderate Lead Paint Removal Protection
Construction Staging	Half at a Time	Half at a Time	Half at Time w/Temporary Columns
Construction Impacts to Bus/RR Facilities	Limited to Work Area	Limited to Work Area	Temporary Column Foundations Restrict Space Beneath

* For the timber deck, 1/8 inch space maximum between planks will have to be maintained which becomes problematic over time. Note that LIRR is planning to provide ADA Access via elevators to the station. Also note that the Park side ramp access does not meet ADA standards.

Refer to Exhibit 11.6 for Detailed Cost Analysis.

8. Foundation Evaluation

8.1 Evaluation of Existing Pile Foundations

The existing bridge is to be rehabilitated to provide an additional 75 years of service life. Three alternatives are currently being considered.

Alternative 1: Replacement of the bridge deck in-kind (timber and concrete decks) with repairs as needed to the superstructure

Alternative 2: Replacement of the entire deck with a new concrete deck with repairs, as needed, to the superstructure

Alternative 3: Replacement of the existing deck, superstructure, columns, and limited replacement of foundation pile caps

The pile group capacities of all pile foundations are shown in Table 8-1 below. These available capacities can be compared the proposed approximate future loading conditions under the alternatives in Tables 8-2 and 8-3, which include the percentage of overstress (based on design loads that do not include current seismic loading factors). We assume that additional retrofit piles will be required where overstresses are greater than 110 percent which includes most of the pile foundations in the western half of the bridge (which were constructed circa 1937) and a few foundations in the eastern half of the bridge (which were constructed circa 1964). The yellow-highlighted foundations shown in Tables 8-2 (for Alternative 1) and 8-3 (for Alternatives 2 and 3) are those foundations which will require retrofit with additional piles.

In summary, we estimate that approximately 27 existing foundations will require retrofit with additional piles under Alternative 1. Under Alternatives 2 and 3, approximately 44 foundations will require retrofit with additional piles.

Table 8-1: Pile Foundation Summary

Pile Foundation Summary Tables
Passerelle Pedestrian Bridge

Pile capacities from past contract drawings

References:
1) 1937-1940 Original Foundation Construction Drawings ST-101 thru ST-105, ST-111, ST-111 shts 1 thru 5
2) 1961 Willets Point Pedestrian Overpass Foundation Drawings no. 18 to 21

West Half	Piles in Pile Group				Pile group capacity*				
Bent	J	K	L	N/M	J	K	L	N/M	Comments
					tons	tons	tons	tons	
1	4	7	8	4	60	105	120	60	
2	5	10	12	5	75	150	180	75	1K load-tested at 160T in 1961
3	5	9	12	6	75	135	180	90	3J load-tested at 110T, 3L load-tested at 270T in 1961
4	NA	11	10	4	NA	165	150	60	4N load-tested at 120T in 1961
5	NA	10	8	4	NA	150	120	60	5L load-tested at 160T in 1961
6	NA	9	7	4	NA	135	105	60	6K load-tested at 210T in 1961
7	NA	7	6	NA	NA	105	90	NA	7L load-tested at 135T in 1961
8	NA	6	6	NA	NA	90	90	NA	
9 to 17	NA	5	5	NA	NA	75	75	NA	11L, 14K, and 17L all load-tested at 110T
18	NA	7	7	NA	NA	105	105	NA	

*According to dwg. ST-101, design based on pile bearing capacity of --> 15 tons

East Half	Piles in Pile Group									Pile group capacity**								
Bent	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I
										tons	tons	tons	tons	tons	tons	tons	tons	tons
19	NA	NA	NA	NA	5	8	5	NA	NA	NA	NA	NA	NA	100	160	100	NA	NA
20	NA	NA	NA	NA	14	15	15	13	10	NA	NA	NA	NA	280	300	300	260	200
20	NA	NA	NA	NA	14	15	15	13	10	NA	NA	NA	NA	280	300	300	260	200
22	NA	NA	NA	14	13	13	14	14	13	NA	NA	NA	280	260	260	280	280	260
23	NA	NA	NA							NA	NA	NA						
24	NA	8	8	8	8	8	8	8	5	NA	160	160	160	160	160	160	160	100
25	13	16	15	15	15	15	15	16	13	260	320	300	300	300	300	300	320	260
26																		
27	5	9	9	9	9	9	9	9	5	100	180	180	180	180	180	180	180	100
28	5	10	10	9	9	9	10	10	5	100	200	200	180	180	180	200	200	100
29	8	6	9	9	5	9	9	6	8	160	120	180	180	100	180	180	120	160

**According to dwg. No. 18, design based on pile bearing capacity of --> 20 tons

Table 8-2: Pile Foundation Summary Table

Pile Foundation Summary Tables
Passerelle Pedestrian Bridge

Pile capacity vs. demand - Alternate 1: Timber/Concrete Deck Replaced In-Kind

West Half	Pile group capacity*				Future Column load/demand				Future Column load/demand - %			
Bent	J	K	L	N/M	J	K	L	N/M	J	K	L	N/M
	tons	tons	tons	tons	tons	tons	tons	tons				
1	60	105	120	60	32	110	130	36	53%	105%	109%	60%
2	75	150	180	75	56	179	214	63	75%	120%	119%	84%
3	75	135	180	90	60	155	197	73	80%	115%	109%	81%
4	NA	165	150	60	NA	165	165	61	NA	100%	110%	102%
5	NA	150	120	60	NA	187	192	73	NA	125%	160%	121%
6	NA	135	105	60	NA	159	158	64	NA	118%	151%	107%
7	NA	105	90	NA	NA	143	141	NA	NA	136%	157%	NA
8	NA	90	90	NA	NA	104	104	NA	NA	116%	116%	NA
9 to 17	NA	75	75	NA	NA	97	97	NA	NA	129%	129%	NA
18	NA	105	105	NA	NA	120	120	NA	NA	114%	114%	NA

*According to dwg. ST-101, design based on pile bearing capacity of --> 15 tons

Assumptions
Column loads are DL + pedestrian LL of 100 psf
Assume LIRR platform at Bents 22/23 and 25/26 have LL of 100 psf
Red values denotes Future Load exceeds Capacity
Yellow highlighted columns exceed 110% of capacity --> Retrofit
Assume new concrete deck is normal weight

East Half	Pile group capacity**									Future Column load/demand								
Bent	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I
	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons
19	NA	NA	NA	NA	100	160	100	NA	NA	NA	NA	NA	NA	89	157	75	NA	NA
20	NA	NA	NA	NA	280	300	300	260	200	NA	NA	NA	NA	97	138	113	106	86
21	NA	NA	NA	NA	280	300	300	260	200	NA	NA	NA	NA	101	113	124	123	94
22	NA	NA	NA	280	260	260	280	280	260	NA	NA	NA	184	219	219	243	255	187
23	NA	NA	NA							NA	NA	NA						
24	NA	160	160	160	160	160	160	160	100	NA	74	106	129	129	134	156	172	102
25	260	320	300	300	300	300	300	320	260	208	266	231	219	259	269	252	262	243
26																		
27	100	180	180	180	180	180	180	180	100	72	140	135	130	130	130	137	143	70
28	100	200	200	180	180	180	200	200	100	92	174	173	151	144	151	173	174	92
29	160	120	180	180	100	180	180	120	160	76	105	114	111	93	111	114	104	77

**According to dwg. No. 18, design based on pile bearing capacity of --> 20 tons

	Future Column load/demand - %								
Bent	A	B	C	D	E	F	G	H	I
19	NA	NA	NA	NA	89%	98%	75%	NA	NA
20	NA	NA	NA	NA	35%	46%	38%	41%	43%
21	NA	NA	NA	NA	36%	38%	41%	47%	47%
22	NA	NA	NA	66%	84%	84%	87%	91%	72%
23	NA	NA	NA						
24	NA	46%	66%	80%	80%	83%	98%	107%	102%
25	80%	83%	77%	73%	86%	90%	84%	82%	93%
26									
27	72%	78%	75%	72%	72%	72%	76%	79%	70%
28	92%	87%	86%	84%	80%	84%	86%	87%	92%
29	48%	87%	63%	62%	93%	62%	63%	87%	48%

Table 8-3: Pile Foundations Summary

Pile Foundation Summary Tables
Passerelle Pedestrian Bridge

Pile capacity vs. demand - Alternate 2 or 3: New Deck throughout with overlay or pavers

West Half	Pile group capacity*				Future Column load/demand				Future Column load/demand - %			
Bent	J	K	L	N/M	J	K	L	N/M	J	K	L	N/M
	tons	tons	tons	tons	tons	tons	tons	tons				
1	60	105	120	60	43	154	180	49	71%	146%	150%	82%
2	75	150	180	75	76	253	300	86	101%	169%	166%	115%
3	75	135	180	90	85	221	279	102	113%	164%	155%	114%
4	NA	165	150	60	NA	234	237	89	NA	142%	158%	148%
5	NA	150	120	60	NA	260	268	102	NA	173%	224%	170%
6	NA	135	105	60	NA	220	220	89	NA	163%	210%	149%
7	NA	105	90	NA	NA	198	196	NA	NA	188%	217%	NA
8	NA	90	90	NA	NA	144	144	NA	NA	161%	160%	NA
9 to 17	NA	75	75	NA	NA	133	133	NA	NA	178%	178%	NA
18	NA	105	105	NA	NA	149	149	NA	NA	142%	142%	NA

*According to dwg. ST-101, design based on pile bearing capacity of --> 15 tons

Assumptions
Assume 7" new deck + 3" overlay/pavers
Column loads are DL + pedestrian LL of 100 psf
Assume LIRR platform at Bents 22/23 and 25/26 have LL of 100 psf
Red values denotes Future Load exceeds Capacity
Yellow highlighted columns exceed 110% of capacity --> Retrofit
Assume new concrete deck is normal weight

East Half	Pile group capacity**									Future Column load/demand								
Bent	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I
	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons
19	NA	NA	NA	NA	100	160	100	NA	NA	NA	NA	NA	NA	112	198	94	NA	NA
20	NA	NA	NA	NA	280	300	300	260	200	NA	NA	NA	NA	113	165	129	118	94
21	NA	NA	NA	NA	280	300	300	260	200	NA	NA	NA	NA	118	132	144	142	105
22	NA	NA	NA	280	260	260	280	280	260	NA	NA	NA	214	255	255	280	292	208
23	NA	NA	NA							NA	NA	NA						
24	NA	160	160	160	160	160	160	160	100	NA	93	130	159	159	164	188	205	121
25	260	320	300	300	300	300	300	320	260	236	308	265	256	307	316	294	303	276
26																		
27	100	180	180	180	180	180	180	180	100	92	180	174	167	167	167	176	183	84
28	100	200	200	180	180	180	200	200	100	114	215	213	189	182	189	213	215	114
29	160	120	180	180	100	180	180	120	160	90	129	137	134	115	134	137	129	91

**According to dwg. No. 18, design based on pile bearing capacity of --> 20 tons

	Future Column load/demand - %								
Bent	A	B	C	D	E	F	G	H	I
19	NA	NA	NA	NA	112%	124%	94%	NA	NA
20	NA	NA	NA	NA	40%	55%	43%	45%	47%
21	NA	NA	NA	NA	42%	44%	48%	55%	53%
22	NA	NA	NA	76%	98%	98%	100%	104%	80%
23	NA	NA	NA						
24	NA	58%	81%	99%	99%	102%	118%	128%	121%
25	91%	96%	88%	85%	102%	105%	98%	95%	106%
26									
27	92%	100%	96%	93%	93%	93%	98%	102%	84%
28	114%	108%	106%	105%	101%	105%	106%	108%	114%
29	56%	108%	76%	74%	115%	74%	76%	107%	57%

8.2 Supplemental Drilled-In Piles

Each of the three alternatives will reuse the existing timber piles, as well as existing pile caps, to the extent possible. New piles would be added to supplement or replace existing piles as required due to the required loads or the condition of the existing piles. For Foundations Retrofit Plans, see Exhibit 11.4.

Provided the Bridge does not need to meet current seismic design criteria and overstress on the existing piles is more than 10 percent, new piles will be required to support the additional loads. The new piles should be relatively compatible with the existing timber piles with respect to compressibility. It is recommended that 7 inch (nominal) diameter drilled-in mini-piles be used to provide additional support. The piles would be founded in the same lower sand stratum as the existing timber piles with allowable loads that could range from 20 to 50 tons depending on the additional capacity required. The new piles could also be battered and provide tension capacity, if required.

In accordance with the NYC building code, at least two load tests would be required to confirm the capacity of the new piles in each area of usage. Thus if used in both the eastern and western areas of the site, potentially 4 pile load tests would be required. The specific number of load tests will be determined once the number and locations of new piles required has been determined.

8.3 Resistance of Lateral Loads

Where existing piles can be reused for support of the renovated bridge, lateral loads should be resisted by the battered component of the existing pile groups. Passive pressure is not generally strain compatible with the much stiffer resistance of battered piles and should not be included where piles are battered. However, should a group of piles consist of all vertical piles, passive pressure on the sides of the foundation can be assumed as a pressure based on an equivalent fluid unit weight of soil of 300 pcf.

8.4 Re-grading and Protection of Exposed Piles

Site settlements have occurred throughout the area. Specifically in the western portion of the site, pile caps have become exposed and in some cases the piles themselves are exposed. It is recommended that, where possible, the site is regarded to cover existing piles and pile caps to provide protection against elements.

8.5 New Piles with Seismic Capacity

At the time of the original installation, down drag due to seismic events was not considered and the piles do not have adequate capacity to resist down drag loads, present during a seismic event. Current pile design typically includes down drag caused by the densification of liquefaction susceptible soils and those above any liquefiable zone. At the site, this zone may extend as deep as 60 feet below grade and result in down drag forces which are equal to or exceed the design capacity of the piles.

If current seismic design criteria must be met, it is recommended that new pile foundations with capacity to resist seismically induced down drag loads be installed at all locations and existing piles shall be abandoned. New Piles would include an allowance for potential down drag from liquefaction induced settlements. It is possible for a large variety of drilled-in or driven piles to be used at this site; however, considering the adjacent facilities, it is currently recommended that drilled-in mini-piles be considered for this option. Again, with new construction a large range of pile capacities is possible depending on the loads required. Anticipating that the general layout of columns will remain the same with column loads ranging from 100 to 300 tons and anticipating that 3 to 4 piles are required under each foundation, it is recommended that 9-5/8 inch diameter piles with a capacity of 120 tons be used. We anticipate that a down drag allowance of 40 tons will be required to meet seismic design criteria resulting in an allowable, usable pile capacity of 80 tons.

The piles could be battered to resist lateral loads similar to the existing design. Up to 40 tons of uplift may be assumed for each pile. Alternatively, lateral resistance of vertical piles of up to 4 tons each may be assumed for piles spaced at least three feet on center.

For further details see the Foundation and Subsurface Evaluation in Appendix E.

9. Architectural Treatments of Recommended Alternatives

9.1 NYCDPR Program Recommendations

Following the presentation on June 17, 2014 NYCDPR provided the following recommendations.

1. The bridge should be considered as a gateway to the park and as a functional transportation element as opposed to a destination or attraction. Designs on the bridge need not incorporate benches, overlooks or similar amenities along the span.
2. Elaborate on the need for wayfinding systems and propose preliminary schemes.
3. A concrete walking surface is preferred over wood or other decking. Options for decorative, functional or otherwise significant embellishments (e.g. plaques, wayfinding, coloring) should be mentioned as possible under a full design project.
4. Ease of maintenance is a high priority. Do not include plantings or other installations with heavy maintenance requirements along the narrow span of the structure. Low-maintenance plantings at the southern end and near the shade structures are appropriate.
5. The southern area of the bridge, the rooftops of the Passerelle building and the entrance plaza to the park must be redesigned in concert with the bridge. The south end ramp must be made ADA accessible. While these locations are not within the original scope of work, their development is critical to the “gateway” concept and would be included in the final design. This is discussed further in Section 10.1. A concept sketch and cost estimate would be included in the scoping documents and presentation to OMB.
6. Lighting must be able to be maintained by DOT
7. Fence design with an overhang is inappropriate for a pedestrian bridge in a park. Include instead options for low railing and verify code requirements.
8. Keep historic look of the southern shade structures. Include modest modernizing options like greenroofs and solar panels.
9. Shade structures at the north end are not necessary.
10. Landscape/Architectural design must relate to the park and reflect historic importance as entrance to World's Fairs.

9.2 Alternatives

The design options presented look to achieve multiple goals:

- Flexible design for peak/off-peak use
- Park legacy of “Futurism”
- Reduce clutter to make for effective wayfinding
- Create better park connections at plaza
- Design paving to be low maintenance

The questions posed in reviewing the current functions of the bridge are:

- How can the signage and the architecture work together?
- Is there a way of making routes to the park clearer?
- What role can fencing, lighting and graphics play in orientating visitors to the park?
- The bridge is largely empty outside of events, how can design help this situation?

Included are some ideas of increasing the "high performance design" potential of the project by adding a sedum or "green" roof to the rehabilitated canopy structures at the Passerelle Plaza and considering combining a sedum roof with a PV installation and a potential for solar power. Three paving options are presented using an ashlar joint pattern, similar to that used in ashlar joint construction, that is imprinted onto the overlay of the future deck. The first option is a series of colored lines with Mets colors, orange and blue accents toward the north side, and US Open/Park green accents to the south (Figure 9-1). A series of commemorative bands (Figure 9-2) or commemorative plaques (Figure 9-3) could also connect to the history of the bridge or by user interests.

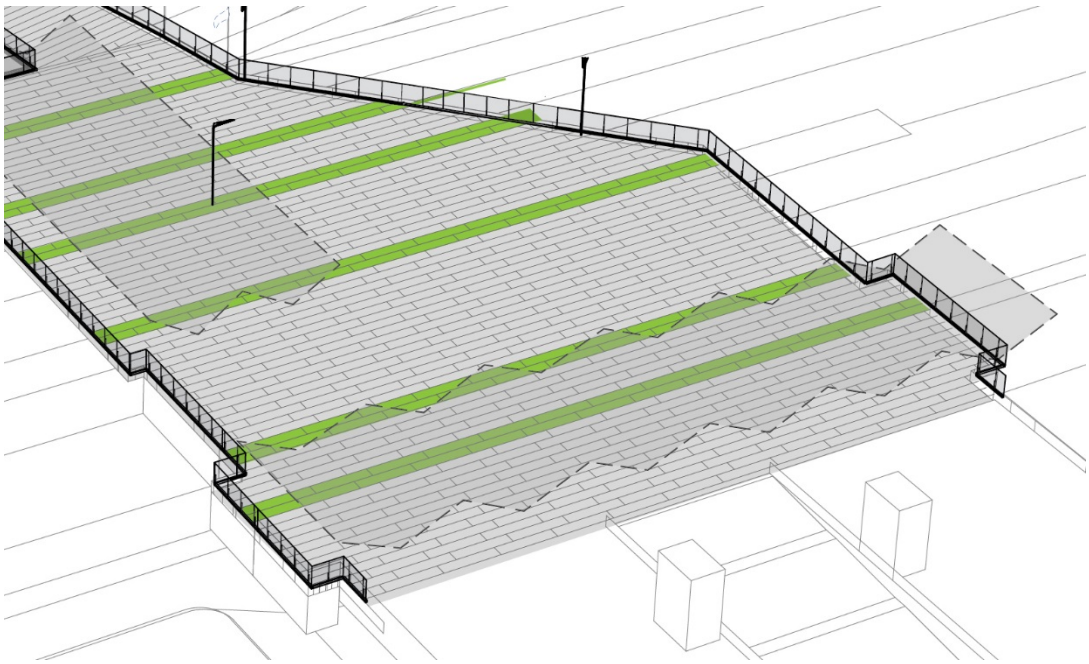


Figure 9—1: Paving Option 1 – Lines

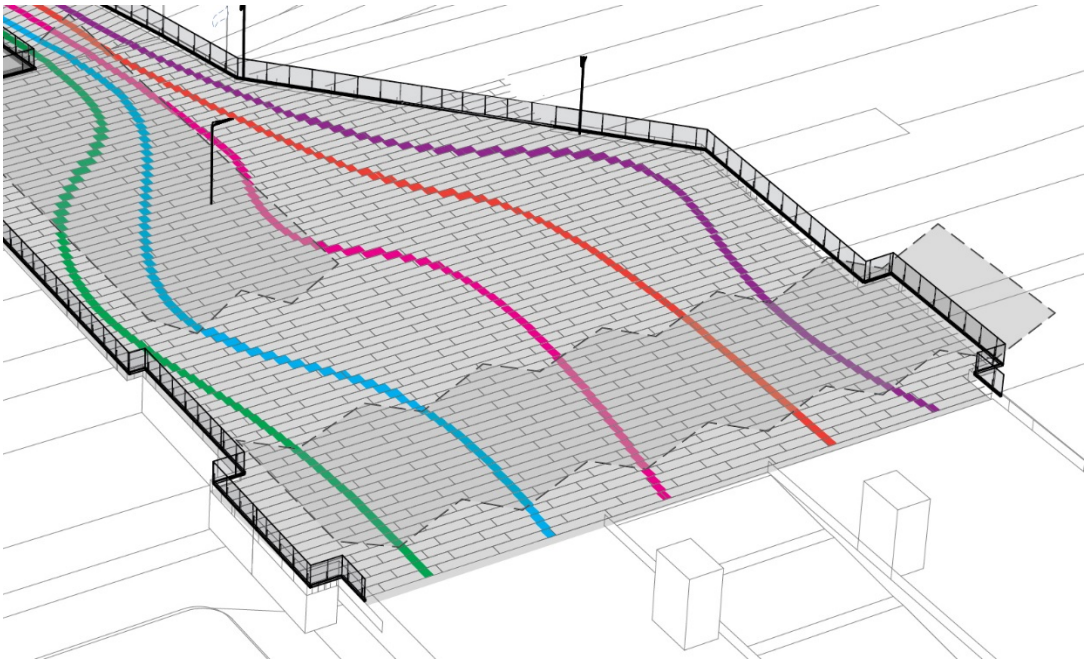


Figure 9—2: Paving Option 2 – Commemorative Bands

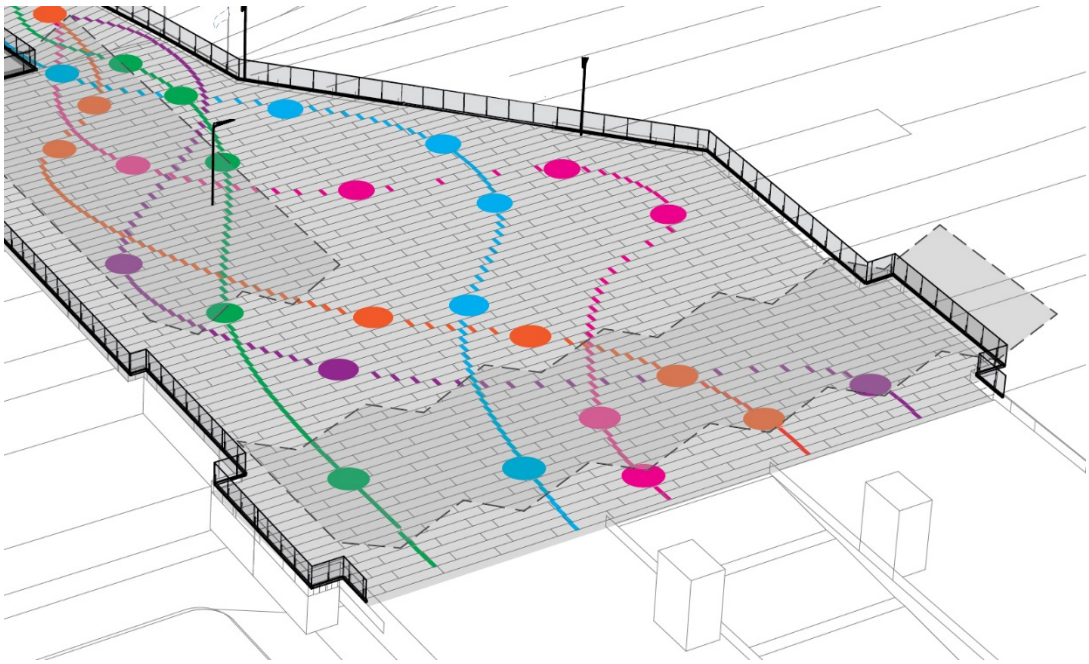


Figure 9—3: Paving Option 2 – Commemorative Plaques

A standard double railing with a 42” pedestrian railing inside and 8’ fencing behind is proposed for the Bridge. CityLights would be spaced at 128’ with flags at 32’ increments opposite (Figure 9-4). Fencing and flags could be angled inward to make a more dynamic room inside.

Figure 9—4: Standard Double Railing

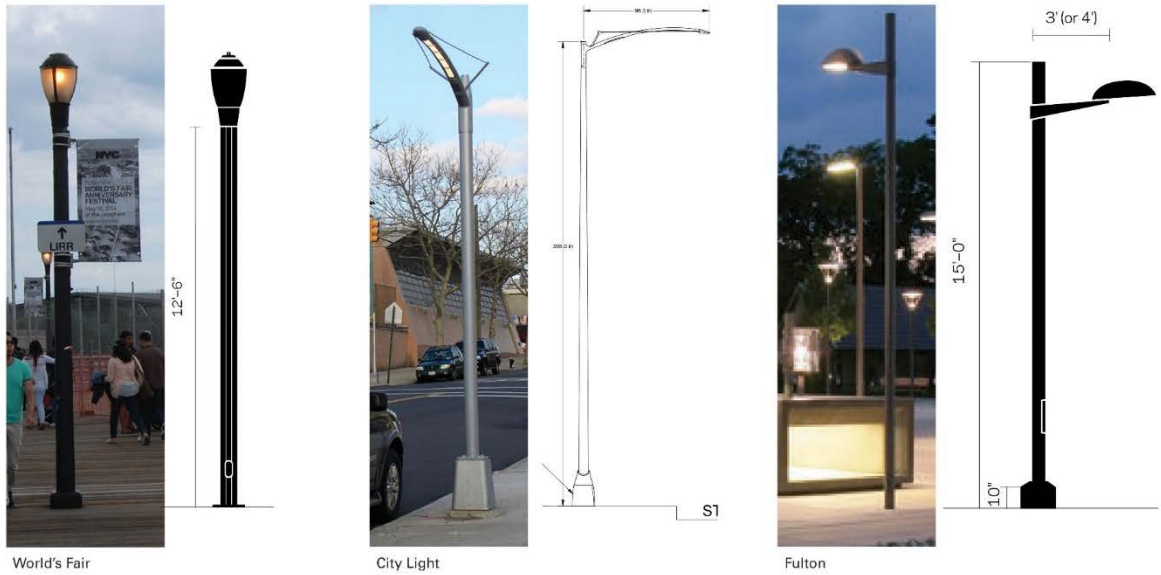


Figure 9—5: Lighting Options

Figure 9—6: Fencing Options

9.3 Recommendation

9.3.1 Context Sensitive Design

The objective of this contract is to conceive, scope, design, and build a project that incorporate design standards, safety measures, environmental stewardship, aesthetics, and community sensitive planning and design. This project offers opportunities for context sensitive design, which would include structural materials and/or design that blend or enhance the overall aesthetic appearance in the project area.

For the fencing and railing strategy, we recommend an 8 feet high vertical fence. With a well finished concrete, this has the greatest potential in design, experience, and maintenance. This streamlined profile works with the distinctive language of the canopies and the futurism style they represent. There are also possibilities to embed historical elements and wayfinding in the railings as well as the ground.

10. Extended Scope of Work

On June 30th, 2014, NYCDPR requested that the building and the ramp structures be redesigned along with the Bridge.

10.1 Rooftop of Passerelle Building Reconstruction

The Passerelle Building is located at the south end of the bridge along both sides of the south approach ramp. The ramp and the building were built in 1964 along with the bridge reconstruction. The building is occupied by the NYCDPR maintenance group. The rooftop of the building is a publicly accessible space that often serves as an event space. The building and the ramp consist of a multi-span steel frame with a concrete deck that has a total area of 45,300 sf. The exterior of the building is enclosed with block masonry walls with a brick facing. The pre-scoping does not include the inspection and rehabilitation of the ramp and building structure, therefore, the condition of these structures is unknown until an in-depth inspection is performed.

It is estimated that the rehabilitation/ reconstruction cost of this structure will be in the range of $10 million and the estimated construction duration is 24 months.

10.2 ADA Ramp at South End of Bridge

At the south end of the Bridge, the existing ramp adjacent to the Passerelle Building is approximately 206 feet long, 60 feet wide, and has an 8% longitudinal slope. Pictures of the ramp are shown Figure 10-1 and Figure 10-2. From the edge of the bridge deck to a distance of 164 feet, the ramp is supported on a steel frame structure and beyond that, the remaining length is on grade. The existing ramp does not meet ADA Design Standards. The ADA Ramp construction will consist of a 6 feet wide, 230 feet long ramp at an 8% slope with 5 feet long landings every 30 feet. To maintain uniformity, ADA ramps shall be added along both walls of the Passerelle Building.

Figure 10-1: South Approach Ramp, Looking North

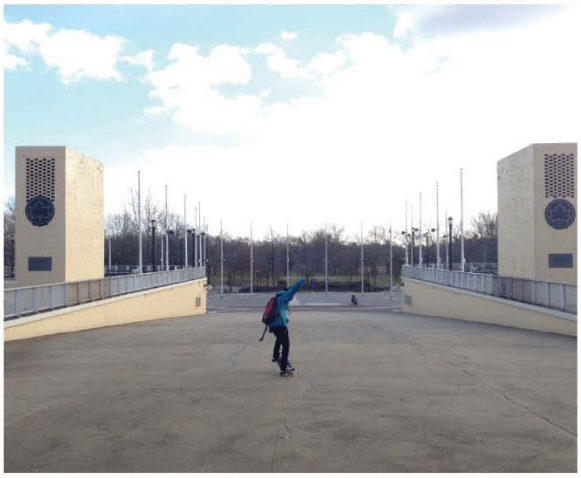


Figure 10-2: South Approach Looking South

Table 10-1 below summarizes the estimate construction cost of the two ADA ramps.

Table 10-1: ADA Ramp Cost Summary

Item Description	**Cost**
Ramp Wall, length= 230 feet and 12 inch wide= 26 cyd	$26,000
Concrete Walkway= 1200 sf	$18,000
Pedestrian Railing= 230 Lf	$57,500
Waterproofing, Joint Sealing and Structural Modification to Ramp Frame, approximately 1280 sf of deck area	$256,000
Lightweight Concrete= 130 cyd	$58,500
Modification to Existing Building Amenities.	$100,000
Total for ADA Ramp on one side (with 30% contingency)	$670,000
Inspection and Design	$100,000
Total for Both Ramps	**$1,340,000**
Say	**$1,500,000**

11. Exhibits

11.1 Load Rating Summary Tables

Summary for Load Rating (ASD and LFD methods) - Stringers

	Location	Span	Stringer	Length (ft)	Section	As Built (ASD)				As Inspected (ASD)				As Inspected (LFD)			
						Inventory LR		Operating LR		Inventory LR		Operating LR		Inventory LR		Operating LR	
						LRm	LRv	LRm	LRv	LRm	LRv	LRm	LRv	LRm	LRv	LRm	LRv
*	1	1	S1-S12	7.333	16WF36	See span 2				See span 2				See span 2			
*	2	2	S1-S12	21.000	16WF36	1.15	7.60	1.66	10.62	-	-	-	-	-	-	-	-
*	3	3-6	S1-S12	14.667	10WF21	0.54	4.14	0.82	5.81	0.53	-	0.81	-	0.51	-	0.85	-
	4	7	S13, S14	12.667	10WF21	0.70	4.20	1.02	5.87	0.67	-	0.98	-	0.61	-	1.01	-
	5	23	S13	10.000	12WF27	1.59	5.22	2.27	7.33	-	-	-	-	-	-	-	-
	6	24	S5-S19	32.161	24WF68	1.67	8.87	2.61	12.44								
*	7	24	S20	32.161	24WF110	0.86	6.53	2.40	10.62	0.86	-	2.40	-	1.95	-	3.26	-
*	8	25	S25	37.000	24WF145	0.75	9.19	2.32	13.48	0.75	-	2.32	-	1.91	-	3.20	-
	9	25	S26	37.000	24WF76	1.12	7.41	1.86	10.45	-	-	-	-	-	-	-	-
	10	26	S4	10.000	12WF27	1.58	5.20	2.26	7.30	-	-	-	-	-	-	-	-
	11	27	S4	45.958	24WF110	1.10	6.89	1.85	9.75	-	-	-	-	-	-	-	-
	12	27	S25	45.958	24WF110	1.19	7.22	1.97	10.21	1.10	-	1.85	-	-	-	-	-
*	13	27	S27	45.958	24WF160	1.19	7.43	2.32	11.20	-	-	-	-	-	-	-	-
	14	28	S4	36.500	24WF76	1.18	7.53	1.94	10.60	-	-	-	-	-	-	-	-
	15	28	S25	36.500	24WF76	1.27	7.89	2.06	11.10	1.25	-	2.04	-	-	-	-	-
	16	29	S13	47.500	24WF110	1.13	7.31	1.90	10.33	0.98	-	1.69	-	1.23	-	2.06	-
	17	29	S27	47.500	24WF110	0.97	6.63	1.67	9.40	0.97	-	1.67	-	1.24	-	2.07	-
	18	29	S26	47.500	24WF160 pl	1.03	5.88	2.85	9.53	-	-	-	-	-	-	-	-

Summary for Load Rating (ASD method and LFD methods) - Floorbeams

	Location	Span	FB	Length (ft)	Section	As Built (ASD)				As Inspected (ASD)				As Inspected (LFD)			
						Inventory LR		Operating LR		Inventory LR		Operating LR		Inventory LR		Operating LR	
						LRm	LRv	LRm	LRv	LRm	LRv	LRm	LRv	LRm	LRv	LRm	LRv
*	1	1	1-2	48.000	33WF130	0.57	4.92	1.00	6.94	0.57	-	1.00	-	0.77	-	1.29	-
	2	1	1-1,1-3	16.000	14WF34	0.84	3.87	1.34	5.47	0.84	-	1.34	-	0.97	-	1.63	-
	3	3	2A,B-2	48.000	30WF124	0.51	5.44	0.97	7.70	0.51	-	0.97	-	0.77	-	1.28	-
	4	3	3A,B-1	16.000	14WF30	0.64	3.56	1.08	5.06	0.64	-	1.08	-	0.79	-	1.32	-
	5	4	4A, 4B	48.000	30WF108	0.46	5.82	0.90	8.22	0.46	-	0.90	-	0.72	-	1.21	-
*	6	6	6-1	48.000	36WF300	2.88	11.37	4.25	15.87	-	-	-	-	-	-	-	-
*	7	6	6-2	31.000	24WF145	2.32	3.56	3.46	5.16	2.26	-	3.40	-	-	-	-	-
	8	7	6A-3	25.000	16WF50	0.56	4.39	1.01	6.24	0.53	-	0.98	-	0.75	-	1.25	-
*	9	7	7	74.667	36WF300	3.12	9.48	4.56	13.23	-	-	-	-	-	-	-	-
*	10	22	22-4	30.000	33WF141	0.43	8.10	1.63	11.86	0.43	-	1.63	-	1.46	-	2.44	-
*	11	24	24-6	30.000	33WF152	-0.42	4.13	0.25	6.32	-0.49	-	0.16	-	0.34	-	0.56	-
	12	24	24-5	27.500	33WF130	1.03	5.61	1.79	8.04	0.73	-	1.35	-	1.05	-	1.75	-
*	13	25	25-7	30.000	33WF141	0.01	7.12	1.10	10.54	0.01	-	1.10	-	1.10	-	1.83	-
*	14	26	26-7	30.000	33WF141	0.50	6.10	1.39	8.92	0.50	-	1.39	-	1.19	-	1.98	-
*	15	27	27-7	30.000	36WF170	0.73	4.72	1.41	6.84	0.67	-	1.32	-	0.97	-	1.62	-
	16	27	27-6	27.500	36WF150	0.80	4.31	1.44	6.24	0.74	-	1.35	-	1.07	-	1.78	-
*	17	28	28-8	30.000	36WF194	0.46	4.79	1.22	7.17	0.46	-	1.22	-	1.05	-	1.75	-
*	18	28	28-6	27.500	36WF160	0.88	4.47	1.56	6.46	0.88	-	1.56	-	1.21	-	2.02	-
*	19	29	29-8	30.000	30WF132	0.80	5.83	1.56	8.59	0.44	-	1.20	-	1.03	-	1.72	-
	20	29	29-6	27.500	30WF116	1.34	9.37	2.05	13.15	1.00	-	1.71	-	1.32	-	2.20	-

Summary for Load Rating (ASD method) - Girders

	Location	Span	Girder	Length (ft)	Section	As Built (ASD)				As Inspected (ASD)				As Inspected (LFD)			
						Inventory LR		Operating LR		Inventory LR		Operating LR		Inventory LR		Operating LR	
						LRm	LRv	LRm	LRv	LRm	LRv	LRm	LRv	LRm	LRv	LRm	LRv
	1	3	G1	44.000	24WF130	0.76	5.52	1.36	7.86	0.76	-	1.36	-	1.01	-	1.69	-
*	2	3	G2	44.000	36WF230	0.49	3.44	0.97	5.00	0.49	-	0.97	-	0.60	-	1.01	-
	3	4	G2	38.000	33WF130	0.36	4.37	0.79	6.27	0.36	-	0.79	-	0.49	-	0.82	-
	4	5	G1	38.000	33WF130	0.65	6.00	1.22	8.53	0.65	-	1.22	-	0.76	-	1.27	-
	5	6	G1	44.000	24WF76	0.67	8.78	1.21	12.29	0.67	-	1.21	-	0.75	-	1.26	-
	6	6	G2	44.000	33WF152	0.21	4.11	0.59	5.92	0.21	-	0.59	-	0.38	-	0.63	-
	7	7	G2	38.000	33WF130	0.36	4.37	0.79	6.27	0.36	-	0.79	-	0.49	-	0.82	-
	8	7	G4	42.120	24WF100	1.11	8.25	1.82	11.58	1.08	-	1.77	-	-	-	-	-
*	9	23-24	G2	59.920	33WF152	0.59	7.51	1.19	10.64	0.59	-	1.19	-	0.95	-	1.58	-

* *See hand calculations*

Group 1: ***FB 1-2****, FB 2-2, and FB 3-2 (****FB 1-2*** *governs);*

Group 2: ***FB 1-1****, FB 1-3, FB 2-1, FB 2-3, FB 3-1, and FB 3-3 (****FB 1-1*** *governs);*

Group 3: ***FB 2A-2, FB 2B-2,*** *FB 5A-2, and FB 5B-2 (****FB 2A,B-2*** *govern);*

Group 4: FB 2A-1, FB 2B-1, FB 5A-1, FB 5B-1,
FB 3A-1*, FB 3B-1, FB 6A-1, and FB 6B-1 (****FB 3A-1*** *governs);*

Group 5: FB 3A-2, FB 3B-2, ***FB 4A-2, FB 4B-2****, FB 6A-2, and FB 6B-2 (****FB 4A,B-2*** *govern);*

Group 6: FB 4-1, FB 5-1, and ***FB 6-1*** *(****FB 6-1*** *governs);*

Group 7: FB 23, ***FB 24*** *(****FB 24*** *governs);*

Summary for Load Rating (ASD method) - Columns

					As-built (ASD)								
	Location	Span	Column	L (ft)	Section	A (in2)	ry (in)	Pdl (kips)	Psdl (kips)	Pped (kips)	Pcan (kips)	Inventory LR LRm	Operating LR LRm
*	1	1	1K	15.250	14WF74	21.76	2.48	66.00	9.20	91.78	-	**2.29**	**3.06**
	2	1	1L	15.250	14WF84	24.71	3.02	96.00	13.80	137.67	-	**1.70**	**2.32**
*	3	2	2K	15.130	14WF95	27.94	3.71	127.30	21.00	210.57	-	**1.22**	**1.69**
	4	2	2L	15.130	14WF119	34.99	3.75	164.00	27.00	265.00	-	**1.20**	**1.67**
*	5	3	3K	16.380	14WF78	22.94	3.00	112.50	15.50	155.20	-	**1.19**	**1.69**
	6	3	3L	16.380	14WF111	32.65	3.73	127.60	17.90	180.00	-	**1.79**	**2.43**
*	7	4	4K	18.760	14WF87	25.56	3.70	95.40	14.10	142.00	-	**1.73**	**2.35**
	8	4	4L	18.760	14WF95	27.94	3.71	119.70	17.10	175.00	-	**1.44**	**1.99**
	9	5	5K,5L	-	14WF84	24.71	3.02	Not govern			-	See 4L	See 4L
	10	6	6K,6L	-	14WF78	22.94	3.00	Not govern			-	See 3K	See 3K
	11	7	7K,7L	-	14WF78	22.94	3.00	Not govern			-	See 3K	See 3K
*	12	22	22H	19.900	14WF61	17.94	2.45	53.68	5.72	57.24	40.57	**1.79**	**2.67**
*	13	23	23H	19.720	14WF61	17.94	2.45	51.64	5.57	55.74	28.53	**2.12**	**3.03**
*	14	24	24E	23.170	14WF87	25.56	3.70	85.91	9.51	95.10	0.00	**2.50**	**3.36**
*	15	24	24H	23.170	14WF87	25.56	3.70	94.44	10.37	103.74	54.79	**1.67**	**2.46**
*	16	25	25H	18.440	14WF78	22.94	3.00	59.09	6.30	63.00	47.21	**2.99**	**4.17**
*	17	26	26H	18.250	14WF78	22.94	3.00	73.34	7.64	76.44	26.34	**2.55**	**3.53**
*	18	27	27E	20.550	14WF87	25.56	3.70	105.69	11.34	113.38	0.00	**2.03**	**2.78**
*	19	27	27H	20.550	14WF95	27.94	3.71	115.04	12.37	123.69	6.31	**1.99**	**2.74**
*	20	28	28H	19.270	14WF95	27.94	3.71	117.72	12.60	126.00	30.59	**1.79**	**2.54**
*	21	29	29H	17.020	14WF61	17.94	2.45	69.56	7.13	64.13	42.06	**1.63**	**2.49**

ee hand calculations

Summary for Load Rating (ASD method)

	Location	Span	Stringer	Length (ft)	Spacing 1 (ft)	Spacing 2 (ft)	/ped (kips)	VH10 (kips)	Vcanopy (kips)	Inventory LR		Operating LR	
										LRm	LRv	LRm	LRv
*	1	1	S1-S12	7.333	5.333	5.333				See span 2		See span 2	
*	2	2	S1-S12	21.000	5.333	5.333	5.28	5.69	0.00	1.15	7.60	1.66	10.62
*	3	3-6	S1-S12	14.667	5.333	5.333	3.91	5.69	0.00	0.54	4.14	0.82	5.81
	4	7	S13, S14	12.667	5.333	5.333	3.38	5.69	0.00	0.70	4.20	1.02	5.87
	5	23	S13	10.000	6.875	7.500	3.59	5.45	0.00	1.59	5.22	2.27	7.33
	6	24	S5-S19	32.161	6.875	6.875	1.06	6.25	0.00	1.67	8.87	2.61	12.44
*	7	24	S20	32.161	7.500	7.500	2.06	6.82	44.97	0.86	6.53	2.40	10.62
*	8	25	S25	37.000	7.500	7.500	3.88	6.82	22.08	0.75	9.19	2.32	13.48
	9	25	S26	37.000	7.500	7.500	3.88	6.82	0.00	1.12	7.41	1.86	10.45
	10	26	S4	10.000	7.500	7.500	3.75	5.45	0.00	1.58	5.20	2.26	7.30
	11	27	S4	45.958	7.500	7.500	7.23	6.82	0.00	1.10	6.89	1.85	9.75
	12	27	S25	45.958	6.875	7.500	6.52	6.82	0.00	1.19	7.22	1.97	10.21
*	13	27	S27	45.958	7.500	7.500	7.23	6.82	32.27	1.19	7.43	2.32	11.20
	14	28	S4	36.500	7.500	7.500	3.69	6.82	0.00	1.18	7.53	1.94	10.60
	15	28	S25	36.500	6.875	7.500	3.12	6.82	0.00	1.27	7.89	2.06	11.10
	16	29	S13	47.500	6.875	6.875	6.33	6.25	0.00	1.13	7.31	1.90	10.33
	17	29	S27	47.500	7.500	7.500	7.81	6.82	0.00	0.97	6.63	1.67	9.40
	18	29	S26	47.500	7.500	7.500	7.81	6.82	52.63	1.03	5.88	2.85	9.53

* *See hand calculations*

Summary for Load Rating (ASD method)

	Location	Span	FB	Length (ft)	Spacing 1 (ft)	Spacing 2 (ft)	/ped (kips)	VH10 (kips)	Vcanopy (kips)	Inventory LR		Operating LR	
										LRm	LRv	LRm	LRv
*	1	1	1-2	48.000	5.333	5.333	8.00	10.00	0.00	0.57	4.92	1.00	6.94
	2	1	1-1,1-3	16.000	5.333	5.333	9.50	10.00	0.00	0.84	3.87	1.34	5.47
	3	3	2A,B-2	48.000	5.333	5.333	1.20	10.00	0.00	0.51	5.44	0.97	7.70
	4	3	3A,B-1	16.000	5.333	5.333	5.80	10.00	0.00	0.64	3.56	1.08	5.06
	5	4	4A, 4B	48.000	5.333	5.333	7.20	10.00	0.00	0.46	5.82	0.90	8.22
*	6	6	6-1	48.000	5.333	5.333	0.90	20.00	0.00	2.88	11.37	4.25	15.87
*	7	6	6-2	31.000	5.333	5.333	7.33	0.00	0.00	2.32	3.56	3.46	5.16
*	8	7	6A-3	25.000	5.333	5.333	3.32	10.00	0.00	0.56	4.39	1.01	6.24
*	9	7	7	74.667	5.333	5.333	6.96	10.00	0.00	3.12	9.48	4.56	13.23
*	10	22	22-4	30.000	7.500	7.500	1.47	10.00	24.88	0.43	8.11	1.63	11.87
*	11	24	24-6	30.000	7.500	7.500	8.90	10.00	33.46	-0.42	4.13	0.25	6.32
	12	24	24-5	27.500	6.875	6.875	5.67	10.00	0.00	0.88	4.93	1.55	7.08
*	13	25	25-7	30.000	7.500	7.500	3.56	10.00	28.96	0.01	7.12	1.10	10.54
*	14	26	26-7	30.000	7.500	7.500	8.67	10.00	16.14	0.50	6.10	1.39	8.92
*	15	27	27-7	30.000	7.500	7.500	6.38	10.00	3.86	0.73	4.72	1.41	6.84
	16	27	27-6	27.500	6.875	6.875	6.50	10.00	0.00	0.80	4.32	1.44	6.24
*	17	28	28-8	30.000	7.500	7.500	7.25	10.00	33.13	0.46	4.79	1.22	7.17
*	18	28	28-6	27.500	6.875	6.875	7.25	10.00	0.00	0.88	4.47	1.56	6.46
*	19	29	29-8	30.000	7.500	7.500	7.00	10.00	20.00	0.44	5.83	1.20	8.59
	20	29	29-6	27.500	7.500	7.500	7.00	10.00	0.00	1.00	9.38	1.71	13.16

* *See hand calculations*

Group 1: ***FB 1-2****, FB 2-2, and FB 3-2 (****FB 1-2*** *governs);*

Group 2: ***FB 1-1****, FB 1-3, FB 2-1, FB 2-3, FB 3-1, and FB 3-3 (****FB 1-1*** *gover*

Group 3: ***FB 2A-2, FB 2B-2,*** *FB 5A-2, and FB 5B-2 (****FB 2A,B-2*** *govern);*

Group 4: FB 2A-1, FB 2B-1, FB 5A-1, FB 5B-1,

FB 3A-1*, FB 3B-1, FB 6A-1, and FB 6B-1 (****FB 3A-1*** *governs);*

Summary for Load Rating (ASD method) - Girders

								As-built (ASD)																	
	Location	Span	Girder	Length (ft)	Spacing 1 (ft)	Spacing 2 (ft)	DF	Section	d (in)	tw (in)	Sx (in3)	Mdl (kip.ft)	Msdl (kip.ft)	Mped (kip.ft)	MH10 (kip.ft)	Mcanopy (kip.ft)	Vdl (kips)	Vsdl (kips)	Vped (kips)	VH10 (kips)	Vcanopy (kips)	Inventory LR		Operating LR	
																						LRm	LRv	LRm	LRv
	1	3	G1	44.000	5.333	5.333	1.00	24WF130	24.25	0.565	330.70	233.23	33.00	300.67	96.00	0.00	18.75	2.58	23.43	5.00	0.00	0.76	5.52	1.36	7.86
*	2	3	G2	44.000	5.333	5.333	1.00	36WF230	35.88	0.765	835.50	698.31	94.60	945.85	96.00	0.00	52.63	7.03	70.36	5.00	0.00	0.49	3.44	0.97	5.00
	3	4	G2	38.000	5.333	5.333	1.00	33WF130	33.10	0.580	404.80	370.44	51.93	513.00	81.00	0.00	29.89	4.10	40.50	5.00	0.00	0.36	4.37	0.79	6.27
	4	5	G1	38.000	5.333	5.333	1.00	33WF130	33.10	0.580	404.80	317.24	38.00	385.07	81.00	0.00	25.69	3.00	30.40	5.00	0.00	0.65	6.00	1.22	8.53
	5	6	G1	44.000	5.333	5.333	1.00	24WF76	23.91	0.440	175.40	127.11	18.33	176.00	96.00	0.00	9.11	1.25	12.00	5.00	0.00	0.67	8.78	1.21	12.29
	6	6	G2	44.000	5.333	5.333	1.00	33WF152	33.50	0.635	486.40	516.02	68.93	689.33	96.00	0.00	36.06	4.70	47.00	5.00	0.00	0.21	4.11	0.59	5.92
	7	7	G2	38.000	5.333	5.333	1.00	33WF130	33.10	0.580	404.80	370.44	51.93	513.00	81.00	0.00	29.89	4.10	40.50	5.00	0.00	0.36	4.37	0.79	6.27
	8	7	G4	42.120	5.333	5.333	1.00	24WF100	24.00	0.468	248.90	141.22	21.06	189.54	91.30	0.00	10.61	1.50	13.50	5.00	0.00	1.11	8.25	1.82	11.58
*	9	23-24	G2	59.920	7.500	6.875	1.00	33WF152	33.50	0.635	486.40	426.66	43.74	440.89	-	0.00	26.85	2.74	27.20	-	0.00	0.59	7.51	1.19	10.64

* *See hand calculations*

Summary for Load Ratings (ASD Method) - Stringers

Stringer	Length (ft)	Section	As Built (ASD)	
			LR Inventory	LR Operating
Span 8 and Span 9	11.67	W10X21	**3.23**	**4.48**
Span 10 - Span 18	16.83	W10X25	**2.12**	**2.98**

Summary for Load Ratings (ASD Method) - Floorbeams

Floor Beam	Length (ft)	Section	As Built (ASD)	
			LR Inventory	LR Operating
FB8	61.00	W33X152	**2.34**	**3.31**
FB8A(2)	48.00	W24X94	**0.99**	**1.45**
FB8B(2)	48.00	W24X76	**0.96**	**1.40**
FB9	49.00	W27X102	**1.86**	**2.63**
FB9A	43.00	W21X73	**0.98**	**1.59**
FB10 to FB17B	38.50	W21X62	**2.23**	**3.14**
FB18	38.50	W30X108	**2.32**	**3.45**

Summary for Load Ratings (ASD Method) - Girders

Floor Beam	Length (ft)	Section	As Built (ASD)	
			LR Inventory	LR Operating
Span 8, G1 and G4	39.00	W24X76	**2.19**	**3.14**
Span 8, G2 and G3	37.00	W24X120	**1.69**	**2.59**
Span 9, G1 and G4	37.00	W24X120	**2.08**	**2.99**
Span 9, G2 and G3	37.00	W24X120	**1.29**	**2.00**
Span 10, G1 and G4	37.00	W24X120	**3.91**	**5.61**
Span 10, G2	37.00	W24X120	**1.77**	**3.67**
Span 10, G3	37.00	W24X120	**1.09**	**1.95**
Span 11 to Span 18, G1 and G4	50.50	W24X76	**25.50**	**34.92**
Span 11 to Span 18, G2 and G3	50.50	W36X160	**2.03**	**3.00**

Summary for Load Ratings (ASD Method) - Columns

Column	Length (ft)	Section	As Built (ASD)	
			LR Inventory	LR Operating
8K, 8L	20.00	W14X61	1.39	-
11K, 11L	20.00	W14X68	1.98	-
18K, 18L	20.00	W14X84	2.65	-

Alt 1: Load Rating Summary for Transfer Girder

REFERENCE: AASHTO MANUAL FOR BRIDGE EVALUATION

E	29000	ksi	Inventory	Bending	0.55	fy	*TABLE 6B.5.2.1-1*
				Shear	11	ksi	
				Axial	2.12	S.F.	
			Operating	Bending	0.75	fy	*TABLE 6B.5.2.1-2*
				Shear	0.45	fy	
				Axial	1.7	S.F.	

	f_y (ksi)	Sx (in^3)	d (in)	tw (in)	Mdl (k-ft)	Msdl (k-ft)	Mped (k-ft)	Vdl (k)	Vsdl (k)	Vped (k)	Inventory		Operating	
											Bending	Shear	Bending	Shear
Bent 9 Floorbeam	50	572.51	23.00	0.50	300.23	61.87	618.86	22.69	4.88	48.81	1.53	2.03	2.31	4.74
Bent 10 Floorbeam	50	572.51	23.00	0.50	307.79	67.55	675.64	22.98	4.94	49.42	1.39	1.99	2.09	4.67
Plate Girder 8-10-E	50	2578.34	74.50	0.50	1617.43	247.48	2475.19	55.63	7.75	77.50	1.63	4.47	2.50	10.00
Plate Girder 8-10-W	50	4682.77	87.50	0.50	2998.01	433.78	4338.40	82.84	10.84	108.43	1.68	3.57	2.58	8.21
Bent 17 Floorbeam	50	293.75	23.50	0.63	136.33	39.18	391.45	12.64	3.42	34.15	1.27	4.26	1.90	9.21
Plate Girder 16B-17B-E	50	950.31	38.81	0.81	359.44	74.87	748.00	23.66	4.50	44.94	2.33	7.09	3.39	15.16
Exist. G2 @ Span 18	33	542.22	36.00	0.65	166.93	55.61	555.56	11.16	3.37	33.67	1.08	7.21	1.61	9.89

	f_y (ksi)	K	H (ft)	ry (in)	As (in^2)	Pdl (k)	Psdl (k)	Pped (k)	KL/r	Cc	Fa_Inven (ksi)	Fa_Oper (ksi)	Inventoy	Operating
Add. Column 8K	50	1.00	17.81	3.97	44.25	58.44	7.75	77.50	53.80	107.00	20.60	25.69	10.91	13.82
Add. Column 8L	50	1.00	18.89	4.01	71.13	87.64	10.84	108.43	56.59	107.00	20.29	25.30	12.40	15.69
Add. Column 10B-K	50	1.00	17.81	3.97	44.25	54.88	7.05	70.55	53.80	107.00	20.60	25.69	12.04	15.24
Add. Column 10B-L	50	1.00	18.90	4.01	71.13	78.78	8.92	89.16	56.62	107.00	20.28	25.29	15.20	19.19
Add. Column 16B-K	50	1.00	15.00	3.69	24.97	25.00	4.50	44.94	48.75	107.00	21.14	26.36	11.09	13.99
Add. Column 17B-K	50	1.00	15.00	3.64	28.81	17.20	2.34	23.33	49.44	107.00	21.07	26.27	25.18	31.61

Alt 2: Load Rating Summary for Transfer Girder

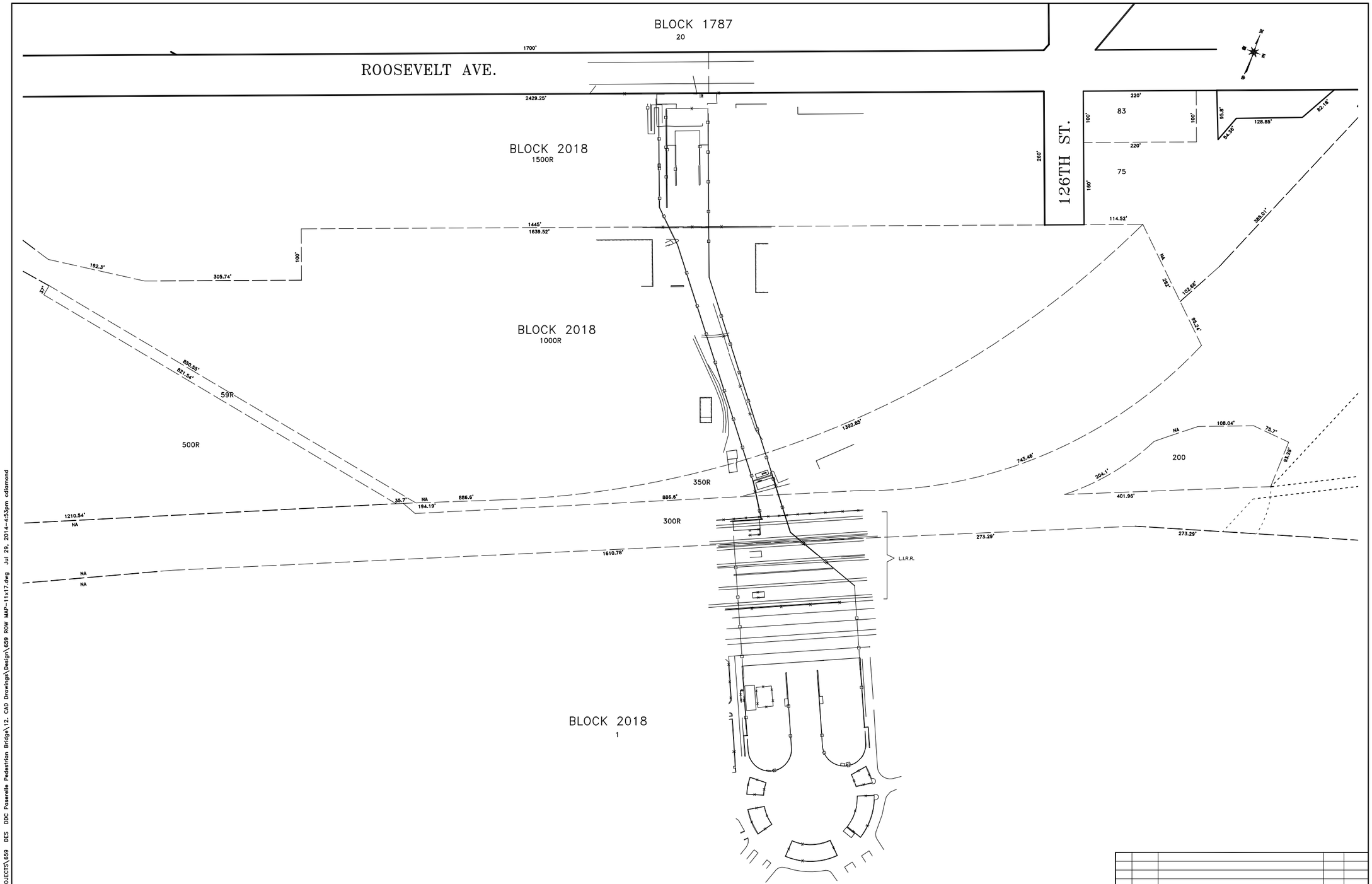
REFERENCE: AASHTO MANUAL FOR BRIDGE EVALUATION

E	29000	ksi	Inventory	Bending	0.55	fy	*TABLE 6B.5.2.1-1*
				Shear	11	ksi	
				Axial	2.12	S.F.	
			Operating	Bending	0.75	fy	*TABLE 6B.5.2.1-2*
				Shear	0.45	fy	
				Axial	1.7	S.F.	

	f_y (ksi)	Sx (in^3)	d (in)	tw (in)	Mdl (k-ft)	Msdl (k-ft)	Mped (k-ft)	Vdl (k)	Vsdl (k)	Vped (k)	Inventory		Operating	
											Bending	Shear	Bending	Shear
Bent 9 Floorbeam	50	572.51	23.00	0.50	900.15	61.87	618.86	71.59	4.88	48.81	0.57	1.03	1.34	3.73
Bent 10 Floorbeam	50	572.51	23.00	0.50	984.70	67.55	675.64	72.52	4.94	49.42	0.38	0.99	1.09	3.67
Plate Girder 8-10-E	50	2578.34	74.50	0.50	4093.88	247.48	2475.19	133.31	7.75	77.50	0.63	3.47	1.50	8.99
Plate Girder 8-10-W	50	4682.77	87.50	0.50	7342.09	433.78	4338.40	191.50	10.84	108.43	0.68	2.57	1.58	7.21
Bent 17 Floorbeam	50	293.75	23.50	0.63	524.65	39.18	391.45	46.52	3.42	34.12	0.28	3.27	0.90	8.22
Plate Girder 16B-17B-E	50	950.31	38.81	0.81	1101.45	74.87	748.00	68.24	4.50	44.94	1.34	6.10	2.40	14.17
Exist. G2 @ Span 18	33	542.22	36.00	0.65	722.37	55.61	555.56	44.82	3.37	33.67	0.08	6.21	0.61	8.89

	f_y (ksi)	K	H (ft)	ry (in)	As (in^2)	Pdl (k)	Psdl (k)	Pped (k)	KL/r	Cc	Fa_Inven (ksi)	Fa_Oper (ksi)	Inventoy	Operating
Add. Column 8K	50	1.00	17.81	3.97	44.25	136.13	7.75	77.50	53.80	107.00	20.60	25.69	9.91	12.81
Add. Column 8L	50	1.00	18.89	4.01	71.13	196.30	10.84	108.43	56.59	107.00	20.29	25.30	11.40	14.68
Add. Column 10B-K	50	1.00	17.81	3.97	44.25	125.61	7.05	70.55	53.80	107.00	20.60	25.69	11.04	14.23
Add. Column 10B-L	50	1.00	18.90	4.01	71.13	168.14	8.92	89.16	56.62	107.00	20.28	25.29	14.19	18.19
Add. Column 16B-K	50	1.00	15.00	3.69	24.97	69.57	4.50	44.94	48.75	107.00	21.14	26.36	10.10	13.00
Add. Column 17B-K	50	1.00	15.00	3.64	28.81	40.35	2.34	23.33	49.44	107.00	21.07	26.27	24.19	30.62

11.2 ROW Map



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R.O.W. MAP

PASSERELLE PEDESTRIAN BRIDGE

PROJECT ID:	DATE:	SHEET	DWG No.
HBPED700Q	04/02/14	XX OF –	1

CONSULTANT DESIGN

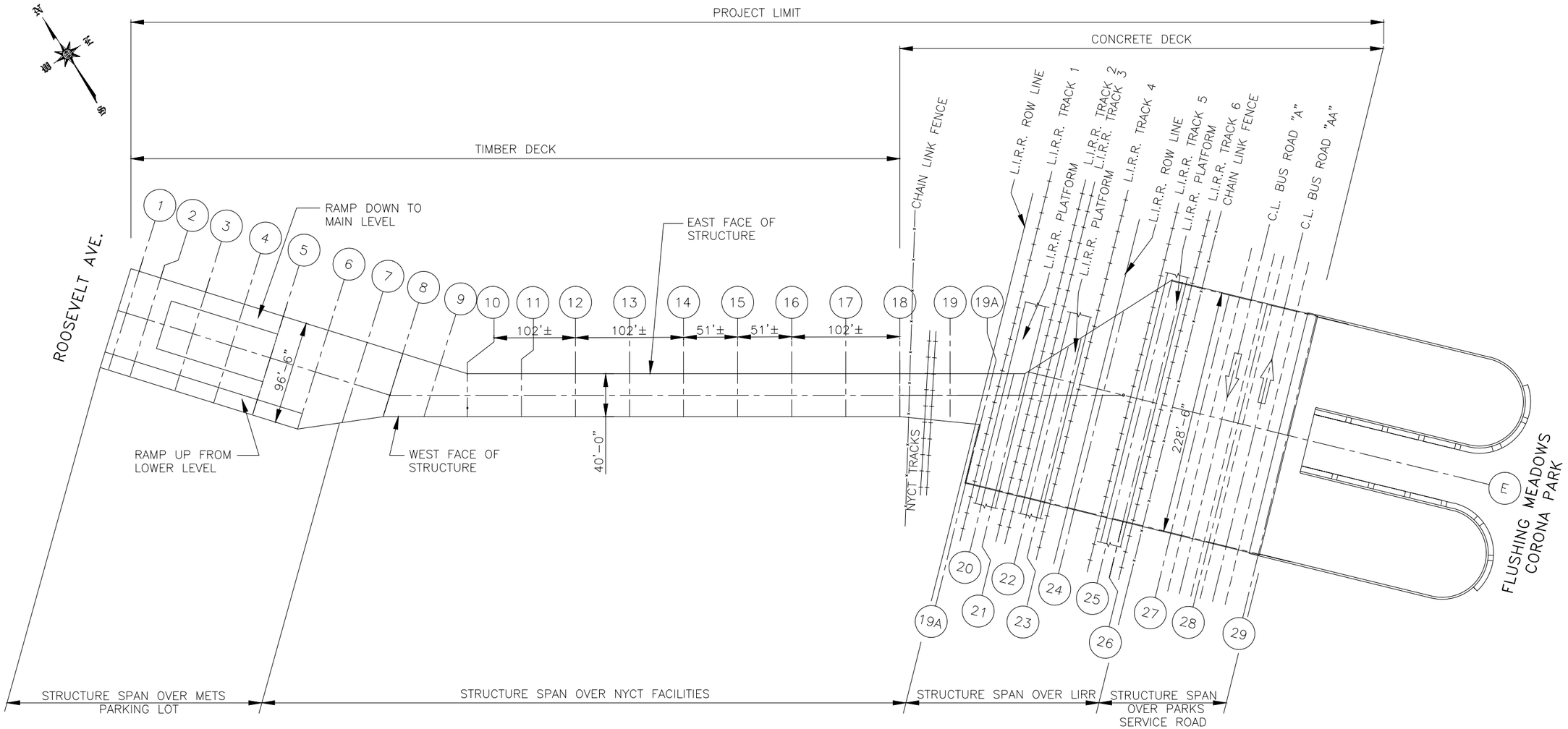
File name: R:\005.NY PROJECTS\659 DES DDC Passerelle Pedestrian Bridge\12. CAD Drawings\Design\659 ROW MAP-11x17.dwg Jul 29, 2014-4:53pm cdiamond

11.3 Comparison of Alternatives Table

Exhibit 11.3 Alternative Comparison for the Passerelle Pedestrian Bridge

Alternative and Scope of Work	Advantages	Disadvantages	Est. Const. Cost / Duration
Exhibit 11.3.1: Alternative 1- Replacement of Bridge Deck in Kind.			
Alternative 1: Replacement of Bridge Deck in Kind • Replace Existing Timber in spans 1 thru 18 and concrete deck in spans 19 thru 29 • Replace All Deteriorated Stringers Supporting Deck • Repair Deteriorated Floorbeams, Girders, and Columns • Retrofit Deficient Floorbeams and Girders as Necessary • Replace Existing Bolts and Rivets with New A325 HS Bolts as Necessary • Sand Blast, Clean and Repaint Existing Steel Members • Install Improved Railing and Lighting, Subject to PDC Approval • Deck Treatment, Subject to PDC Approval • Install Improved Railing and Lighting, Subject to PDC Approval • Strengthening of Steel Frame System to Support Canopy Roof Structure	• No constructability issue. • Low rehabilitation cost	• Does not meet Current AASHTO Codes. • Will not provide 75 Year Service Life. • Connections may not be able to resist seismic forces. • Extent of steel repairs is not known until the removal of deck and cleaning of steel members and could lead to a high cost of repairs or replacement. • Extensive and difficult steel repairs • Steel members in timber deck section will continue to deteriorate • Need frequent maintenance. • High maintenance cost compared to all alternatives	Estimated Construction Duration: 24 Months Estimated Construction Cost: $91.6 Million for Bridge $12 Million for Building
Exhibit 11.3.2: Alternative 2- Replacement of Bridge Deck with a Concrete Deck			
Alternative 2: Replacement of Existing Deck with a New Concrete • Replace Existing Timber Deck with New Concrete Deck • Replace All Existing Deficient Stringers Supporting • Repair Deteriorated Floorbeams • Retrofit or Replace Deficient Floorbeams and Girders as Necessary • Replace Existing Bolts and Rivets with New A325 HS Bolts as Necessary • Sand Blast, Clean and Repaint Existing Steel Members • Install Improved Railing and Lighting, Subject to PDC Approval • Strengthening of Steel Frame System to Support Canopy Roof Structure • Deck Treatment, Subject to PDC Approval	• Meets current AASHTO design codes. • Low rehabilitation cost compared to Alternative 3	• Will not provide required 75 year service life • Connections may not be able to resist seismic forces. • Extent of steel repairs is not known until the removal of deck and cleaning of steel members and could lead to a high cost of repairs or replacement. • Extensive and difficult steel repairs • Require extensive modification to existing steel framing to install new deck joints in spans 1 thru 18. Could lead to several constructability issues and high rehabilitation cost. • Require extensive temporary support for framing modifications. • High maintenance and protection of traffic cost for TA facilities compared to Alternative 1 • High maintenance cost compared to Alternative 3	Estimated Construction Duration: 30 Months Estimated Construction Cost : $102.8 Million for Bridge $12 Million for Building
Exhibit 11.3.3: Alternative 3- Replacement of Bridge Superstructure and Substructure on Existing Foundation			
• Demolish superstructure and Substructure • Replace Existing Timber Deck with New Precast or Cast-In-Place Concrete Deck • Replace Steel Stringers, Floorbeams, Girders, and Columns over Existing Foundations • Retrofit Foundations as Necessary • Install Improved Railing and Lighting, Subject to PDC Approval • Deck Treatment, Subject to PDC Approval	• Structure could be designed to meet most seismic demand forces • Meet Current AASHTO Design Codes • Do not anticipate constructability issues • Provide 75 year service life • Low maintenance cost • Meets project objectives	• High construction cost.	Estimated Construction Duration: 36 Months Estimated Construction Cost: $122.6 Million for Bridge $12 Million for Building

11.4 Rehabilitation Alternatives Drawings



KEY PLAN

N.T.S.

NOTES:

1. FOR BRIDGE FRAMING PLAN ALTERNATIVE 1, SEE SK–2 AND SK–3.
2. FOR BRIDGE FRAMING PLAN ALTERNATIVE 2, SEE SK–6 AND SK–7.
3. FOR BRIDGE FRAMING PLAN ALTERNATIVE 3, SEE SK–10 AND SK–11.

SK– 1

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BRIDGE KEY PLAN

PASSERELLE PEDESTRIAN BRIDGE

PROJECT ID: HBPED700Q | DATE: | SHEET OF -- | DWG No.

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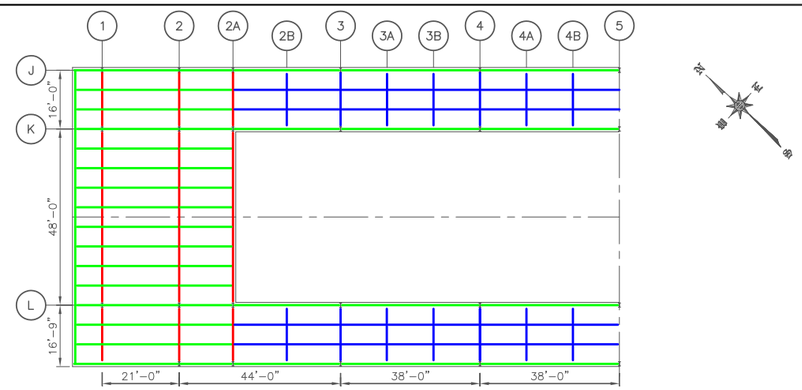
SCOPE OF WORK
TIMBER DECK SECTION (SPANS 1 THRU 18)

ALTERNATIVE 1: REPLACEMENT OF BRIDGE DECK IN KIND AND REHABILITATION OF EXISTING STRUCTURE

- REPLACE EXISTING TIMBER DECK IN KIND
- REPLACE ALL DETERIORATED STRINGERS SUPPORTING TIMBER DECK
- REPAIR DETERIORATED FLOORBEAMS, GIRDERS, AND COLUMNS
- RETROFIT DEFICIENT FLOORBEAMS AND GIRDERS AS NECESSARY
- REPLACE DETERIORATED BOLTS AND RIVETS WITH NEW A325 HS BOLTS WHERE REQUIRED
- SAND BLAST, CLEAN AND REPAINT EXISTING STEEL MEMBERS IN PLACE
- INSTALL IMPROVED RAILING AND LIGHTING, SUBJECT TO PDC APPROVAL

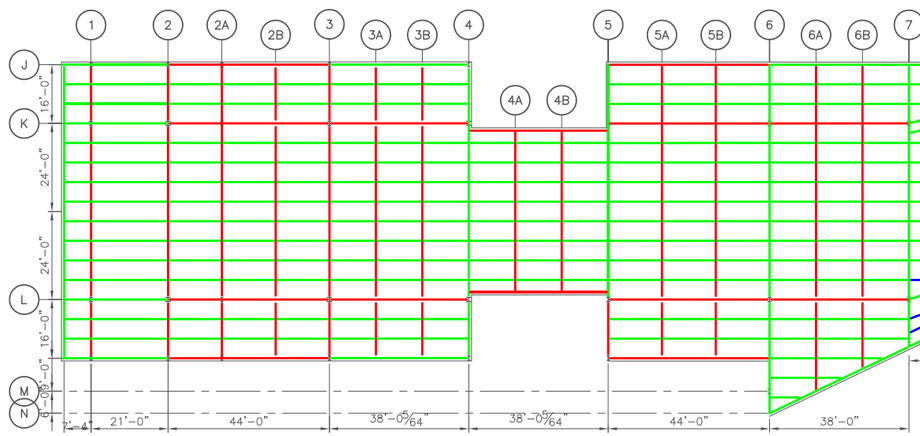
NOTES:

1. FOR BRIDGE FRAMING PLAN SPANS 19 THRU 29, SEE SK-3.
2. FOR BRIDGE CROSS SECTION, SEE SK-4.



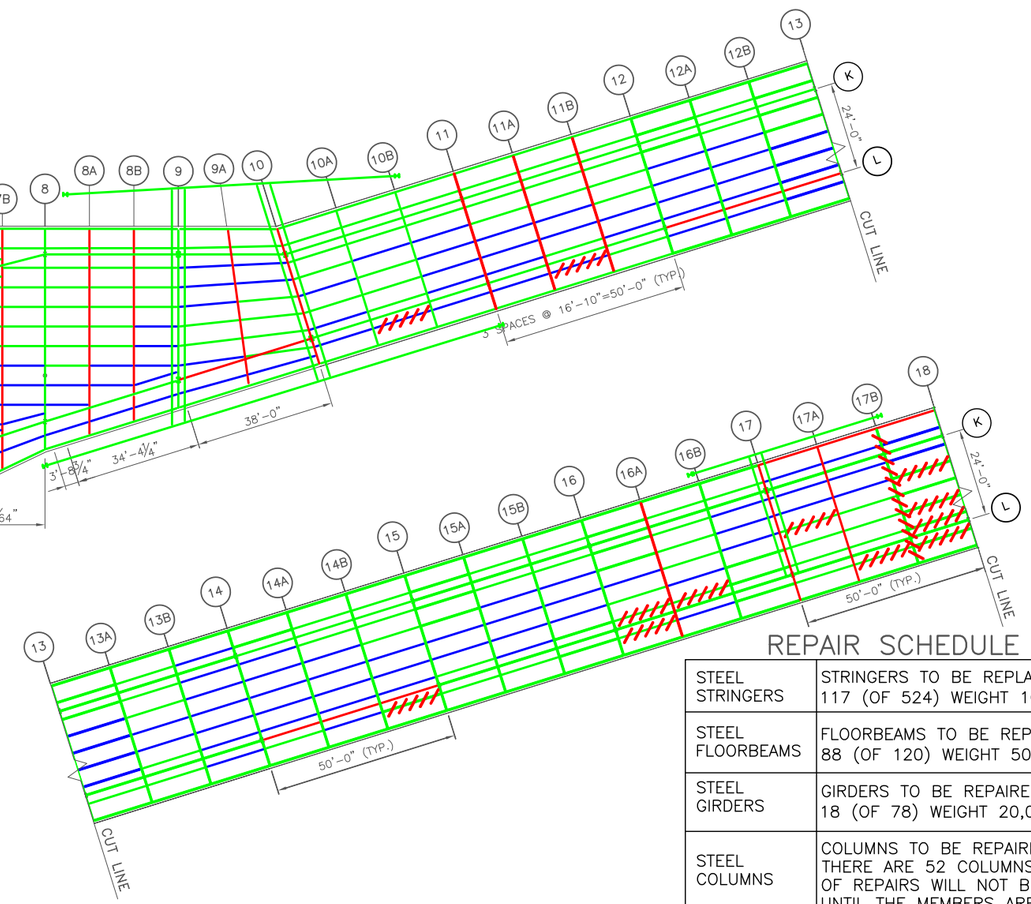
FRAMING PLAN UPPER LEVEL AND RAMPS

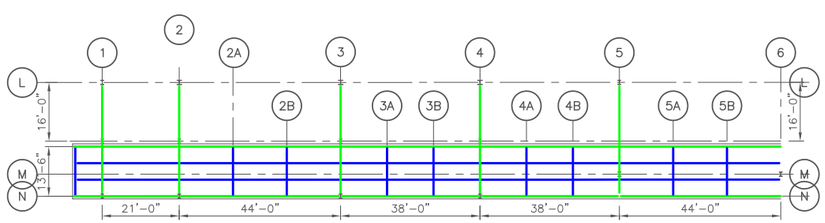
SCALE: $\frac{1}{16}$"=1'-0"



FRAMING PLAN MAIN LEVEL

SCALE: $\frac{1}{16}$"=1'-0"





FRAMING PLAN LOWER LEVEL RAMP

SCALE: $\frac{1}{16}$"=1'-0"

REPAIR SCHEDULE

STEEL STRINGERS	STRINGERS TO BE REPLACED: 117 (OF 524) WEIGHT 100,000 LB
STEEL FLOORBEAMS	FLOORBEAMS TO BE REPAIRED: 88 (OF 120) WEIGHT 50,000 LB
STEEL GIRDERS	GIRDERS TO BE REPAIRED: 18 (OF 78) WEIGHT 20,000 LB
STEEL COLUMNS	COLUMNS TO BE REPAIRED: THERE ARE 52 COLUMNS. EXTENT OF REPAIRS WILL NOT BE KNOWN UNTIL THE MEMBERS ARE SANDBLASTED AND CLEANED. WEIGHT 20,000 LB
DECK AREA	AREA OF DECK TO BE REPLACED 48,500 SF

LEGEND:

- MEMBER TO BE REPLACED
- MEMBERS TO BE REPAIRED
- MEMBERS TO REMAIN
- RED-FLAG MEMBERS REPAIRED

SK-2

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BRIDGE FRAMING PLAN
SPANS 1 THRU 18
ALTERNATIVE 1

PASSERELLE PEDESTRIAN BRIDGE

PROJECT ID: HBPED700Q | DATE: | SHEET OF - | DWG No.

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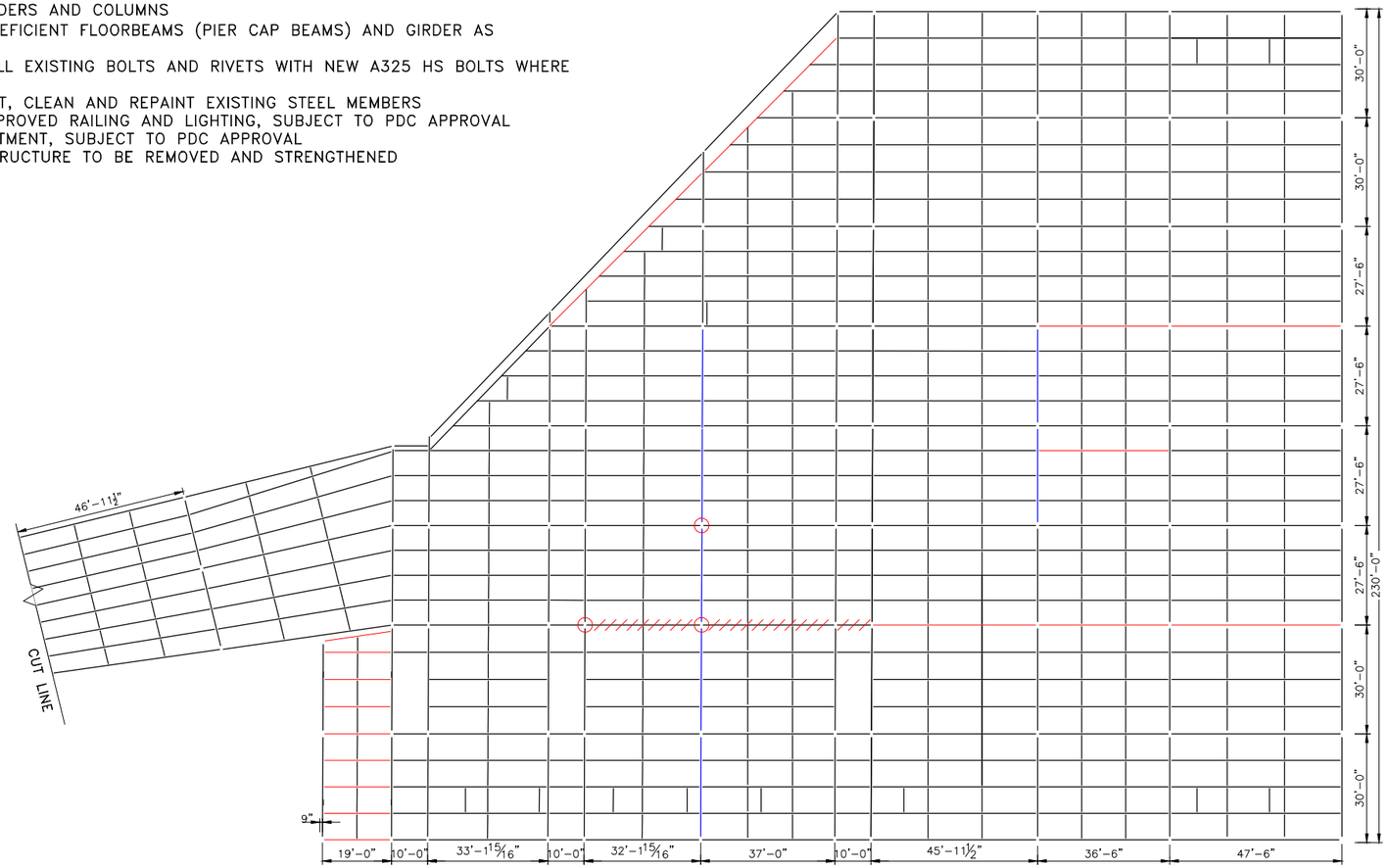
File name: R:\005_NY PROJECTS\659 DES DDC Passerelle Pedestrian Bridge\12. CAD Drawings\Design\Proposal-Alt1, Alt2, Alt3\Alternatives Sheet SSK-2 A1 Timber Framing Plan.dwg Oct 20, 2014-8:40am kwalker

SCOPE OF WORK
CONCRETE DECK SECTION (SPANS 19 THRU 29)

ALTERNATIVE 1: REPLACEMENT OF BRIDGE DECK IN KIND AND REHABILITATION OF EXISTING STRUCTURE

- REPLACE EXISTING CONCRETE DECK IN KIND
- REPLACE ALL DETERIORATED STRINGERS SUPPORTING CONCRETE DECK
- REPAIR GIRDERS AND COLUMNS
- RETROFIT DEFICIENT FLOORBEAMS (PIER CAP BEAMS) AND GIRDER AS NECESSARY
- REPLACE ALL EXISTING BOLTS AND RIVETS WITH NEW A325 HS BOLTS WHERE REQUIRED
- SAND BLAST, CLEAN AND REPAINT EXISTING STEEL MEMBERS
- INSTALL IMPROVED RAILING AND LIGHTING, SUBJECT TO PDC APPROVAL
- DECK TREATMENT, SUBJECT TO PDC APPROVAL
- CANOPY STRUCTURE TO BE REMOVED AND STRENGTHENED



FRAMING PLAN MAIN LEVEL

SCALE: $\frac{1}{16}$"=1'-0"

NOTES:

1. FOR BRIDGE FRAMING PLAN SPANS 1 THUR 18, SEE SK-2.
2. FOR BRIDGE CROSS SECTION, SEE SK-5.

REPAIR SCHEDULE

STEEL STRINGERS	STEEL STRINGERS TO BE REPLACED: 15 (OF 275) WEIGHT 30,000 LB
STEEL FLOORBEAMS	FLOORBEAMS TO BE REPAIRED: 9 (OF 66) WEIGHT 30,500 LB
STEEL GIRDERS	GIRDERS TO BE REPAIRED: 2 (OF 7) WEIGHT 10,000 LB
STEEL COLUMNS	COLUMNS TO BE REPAIRED: THERE ARE 2 COLUMNS. EXTENT OF REPAIRS WILL NOT BE KNOWN UNTIL THE MEMBERS ARE SANDBLASTED AND CLEANED. WEIGHT 20,000 LB
DECK AREA	AREA OF DECK TO BE REPLACED 57,500 SF

LEGEND:

- MEMBER TO BE REPLACED
- MEMBER TO BE REPAIRED
- MEMBER TO REMAIN
- MEMBER TO REMAIN
- RED-FLAGGED MEMBER REPAIRED

SK- 3

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BRIDGE FRAMING PLAN
SPANS 19 THRU 29
ALTERNATIVE 1

PASSERELLE PEDESTRIAN BRIDGE

PROJECT ID: HBPED700Q | DATE: FEB 2014 | SHEET 3 OF - | DWG No. SK-3

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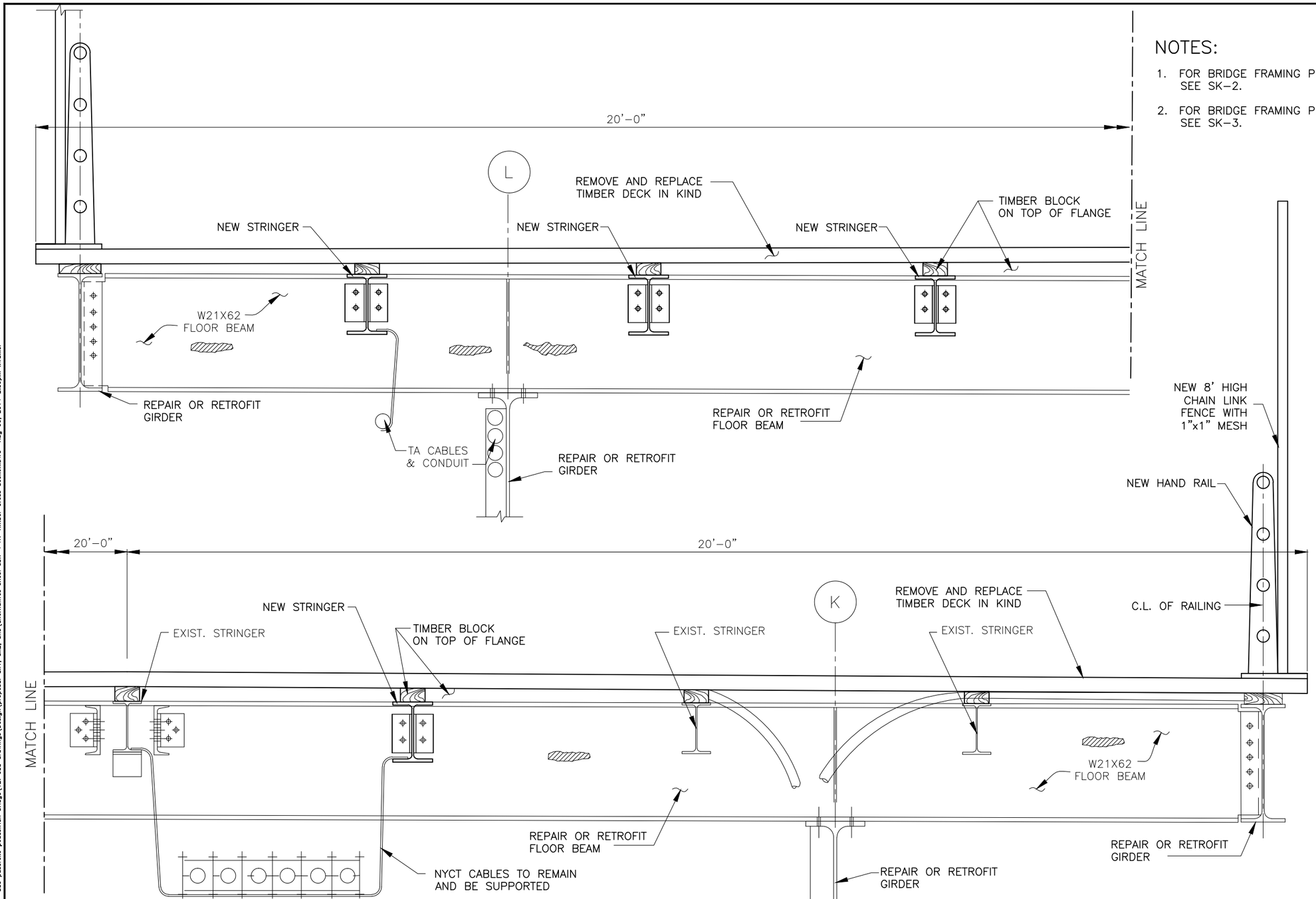
NOTES:

1. FOR BRIDGE FRAMING PLAN SPANS 1 THRU 18, SEE SK–2.
2. FOR BRIDGE FRAMING PLAN SPANS 19 THRU 29, SEE SK–3.



FLOOR BEAM TYPICAL ELEVATION (SPANS 1 THRU 18)

SCALE: 1½"=1'–0"

SK–4

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TIMBER DECK CROSS SECTION
SPANS 1 THRU 18
ALTERNATIVE 1

PASSERELLE PEDESTRIAN BRIDGE

PROJECT ID: HBPED700Q | DATE: | SHEET OF – | DWG No.

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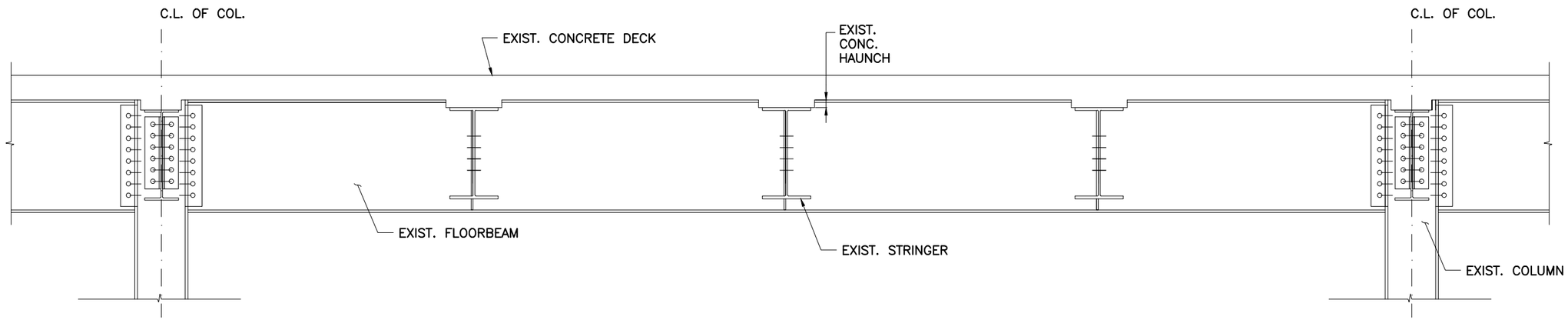
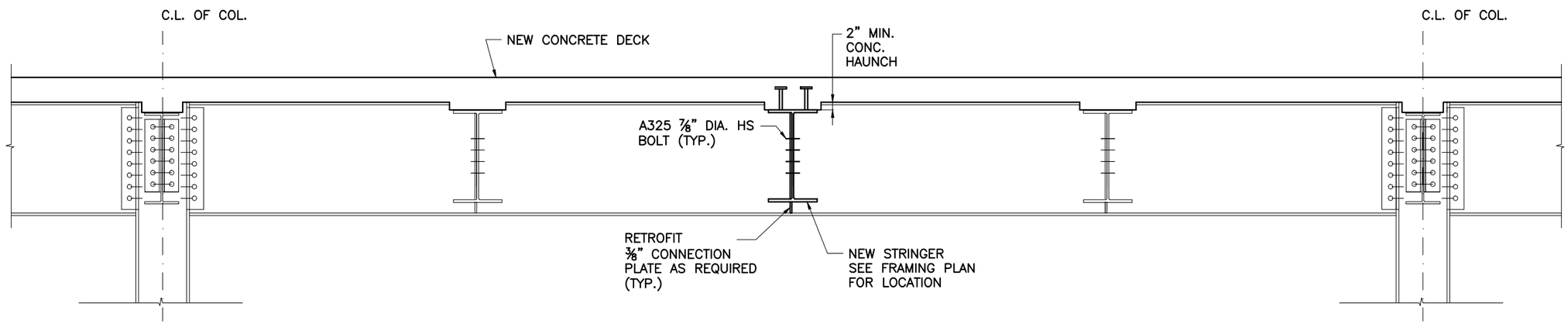
NOTES:

1. FOR BRIDGE FRAMING PLAN SPANS 1 THUR 18, SEE SK-2.
2. FOR BRIDGE FRAMING PLAN SPANS 19 THUR 29, SEE SK-3.



TYPICAL EXISTING STRINGER AND CONCRETE DECK



TYPICAL NEW STRINGER AND CONCRETE DECK REPLACEMENT

FRAMING PLAN MAIN LEVEL

SCALE: 1/16"=1'-0"

SK- 5

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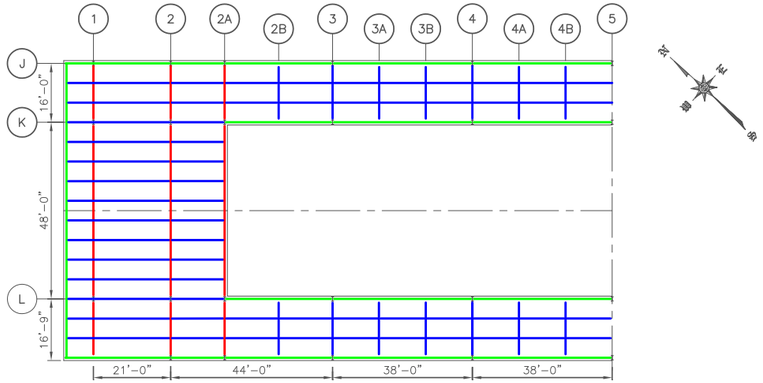
CONCRETE DECK CROSS SECTION SPANS 19 THRU 29 ALTERNATIVE 1

PASSERELLE PEDESTRIAN BRIDGE

PROJECT ID: HBPED700Q | DATE: FEB 2014 | SHEET 5 OF - | DWG No. SK-5

CONSULTANT DESIGN

File name: R:\005.ny projects\659 des ddc passerelle pedestrian bridge\12. cad drawings\Design\proposal-alt1, alt2, alt3\alternatives sheet sSK-5 A1 Concrete Cross Section.dwg Aug 06, 2014-2:39pm kwalker



FRAMING PLAN UPPER LEVEL AND RAMPS

SCALE: $\frac{1}{16}$"=1'-0"

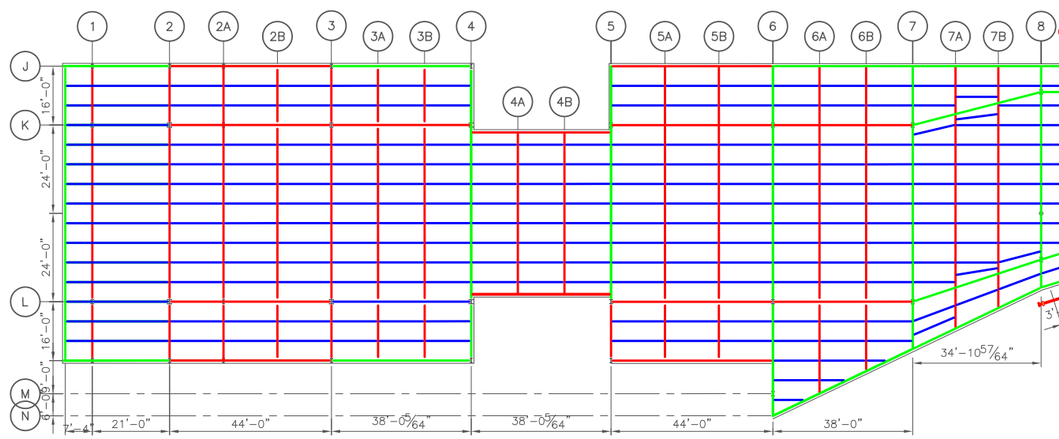
SCOPE OF WORK
TIMBER DECK SECTION (SPANS 1 THRU 18)

ALTERNATIVE 2: REPLACEMENT OF EXISTING DECK WITH A NEW CONCRETE DECK AND REHABILITATION OF EXISTING STRUCTURE

- REPLACE EXISTING TIMBER DECK WITH NEW CONCRETE DECK
- REPLACE ALL EXISTING DEFICIENT STRINGERS SUPPORTING TIMBER DECK
- REPAIR DETERIORATED FLOORBEAMS
- RETROFIT OR REPLACE DEFICIENT FLOORBEAMS AND GIRDERS AS NECESSARY
- REPLACE DETERIORATED EXISTING BOLTS AND RIVETS WITH NEW A325 HS BOLTS WHERE REQUIRED
- SAND BLAST, CLEAN AND REPAINT EXISTING STEEL MEMBERS
- INSTALL IMPROVED RAILING AND LIGHTING, SUBJECT TO PDC APPROVAL

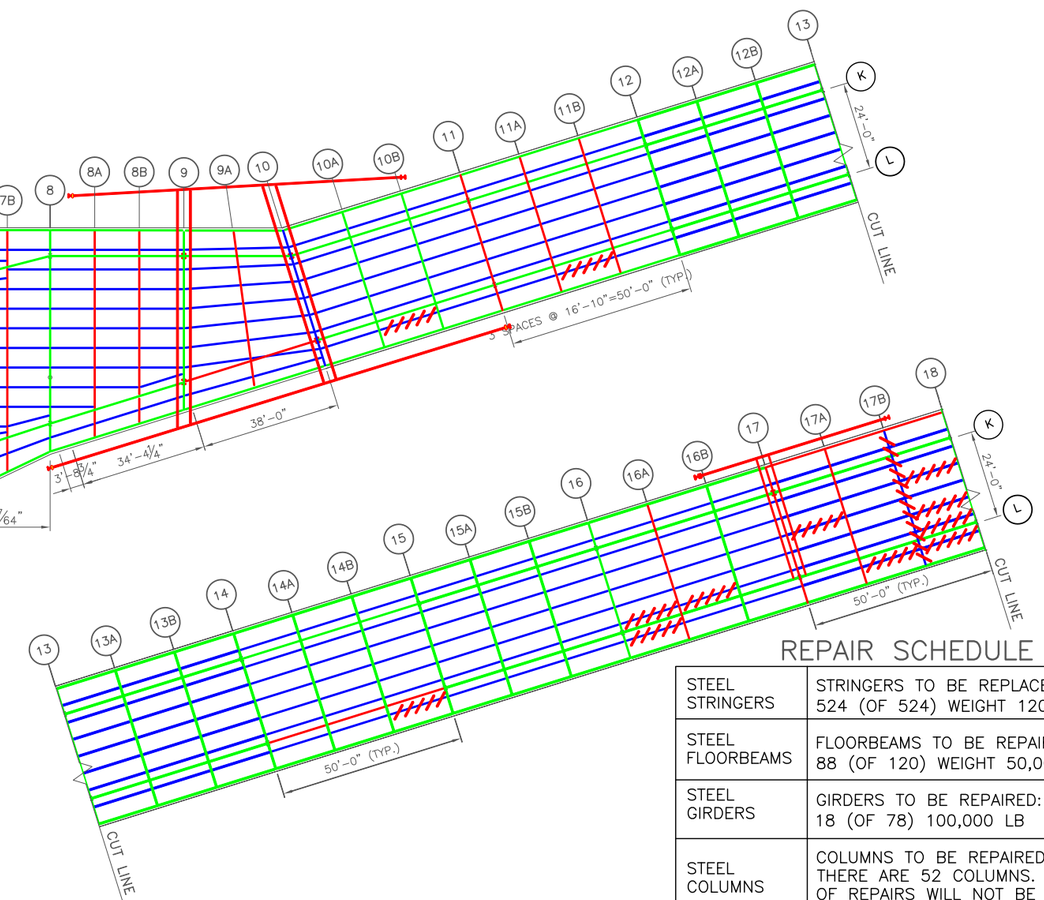
NOTES:

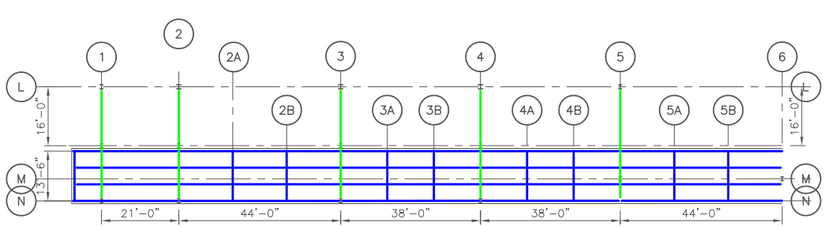
1. FOR BRIDGE FRAMING PLAN SPANS 19 THRU 29, SEE SK-7.
2. FOR BRIDGE CROSS SECTION, SEE SK-8.



FRAMING PLAN MAIN LEVEL

SCALE: $\frac{1}{16}$"=1'-0"





FRAMING PLAN LOWER LEVEL RAMP

SCALE: $\frac{1}{16}$"=1'-0"

REPAIR SCHEDULE

STEEL STRINGERS	STRINGERS TO BE REPLACED: 524 (OF 524) WEIGHT 120,000LB
STEEL FLOORBEAMS	FLOORBEAMS TO BE REPAIRED: 88 (OF 120) WEIGHT 50,000 LB
STEEL GIRDERS	GIRDERS TO BE REPAIRED: 18 (OF 78) 100,000 LB
STEEL COLUMNS	COLUMNS TO BE REPAIRED: THERE ARE 52 COLUMNS. EXTENT OF REPAIRS WILL NOT BE KNOWN UNTIL THE MEMBERS ARE SANDBLASTED AND CLEANED. WEIGHT 40,000 LB
DECK AREA	AREA OF DECK TO BE REPLACED 48,500 SF

LEGEND:

- MEMBER TO BE REPLACED
- MEMBERS TO BE REPAIRED
- MEMBERS TO REMAIN
- RED-FLAG MEMBERS REPAIRED

SK-6

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BRIDGE FRAMING PLAN
SPANS 1 THRU 18
ALTERNATIVE 2

PASSERELLE PEDESTRIAN BRIDGE

PROJECT ID: HBPED700Q | DATE: | SHEET OF -- | DWG No.

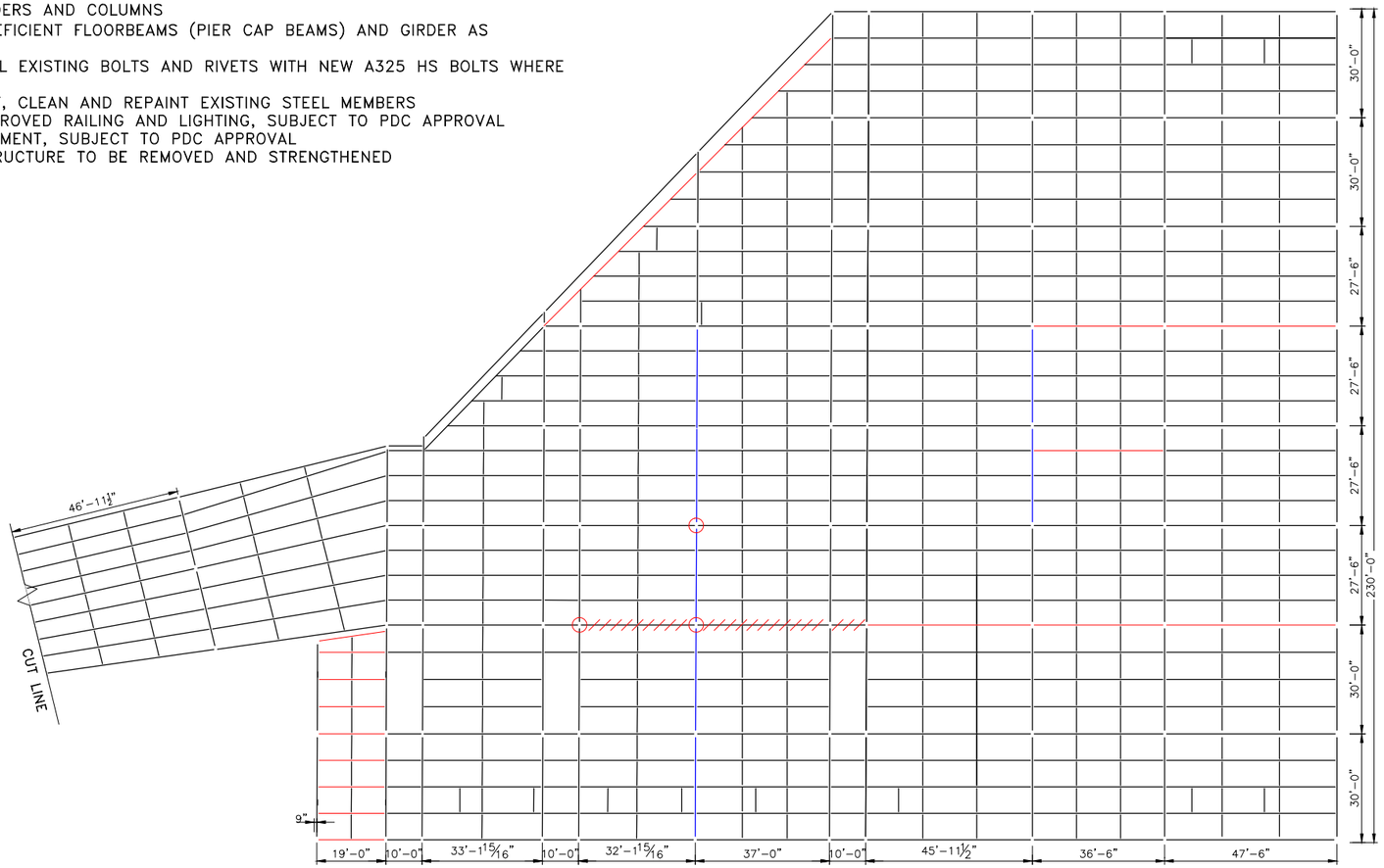
CONSULTANT DESIGN

File name: R:\005.NY PROJECTS\659 DES DDC Passerelle Pedestrian Bridge\12. CAD Drawings\Design\Proposal-Alt1, Alt2, Alt3\Alternatives Sheet SSK-6 A2 Timber Framing Plan.dwg Oct 20, 2014-8:43am kwalker

SCOPE OF WORK
CONCRETE DECK SECTION (SPANS 19 THRU 29)

ALTERNATIVE 2: REPLACEMENT OF BRIDGE DECK IN KIND AND REHABILITATION OF EXISTING STRUCTURE

- REPLACE EXISTING CONCRETE DECK IN KIND
- REPLACE ALL DETERIORATED STRINGERS SUPPORTING CONCRETE DECK
- REPAIR GIRDERS AND COLUMNS
- RETROFIT DEFICIENT FLOORBEAMS (PIER CAP BEAMS) AND GIRDER AS NECESSARY
- REPLACE ALL EXISTING BOLTS AND RIVETS WITH NEW A325 HS BOLTS WHERE REQUIRED
- SAND BLAST, CLEAN AND REPAINT EXISTING STEEL MEMBERS
- INSTALL IMPROVED RAILING AND LIGHTING, SUBJECT TO PDC APPROVAL
- DECK TREATMENT, SUBJECT TO PDC APPROVAL
- CANOPY STRUCTURE TO BE REMOVED AND STRENGTHENED



FRAMING PLAN MAIN LEVEL

SCALE: 1/16"=1'-0"

NOTES:

1. FOR BRIDGE FRAMING PLAN SPANS 1 THUR 18, SEE SK-6.
2. FOR BRIDGE CROSS SECTION, SEE SK-9.

REPAIR SCHEDULE

STEEL STRINGERS	STEEL STRINGERS TO BE REPLACED: 15 (OF 275) WEIGHT 30,000 LB
STEEL FLOORBEAMS	FLOORBEAMS TO BE REPAIRED: 9 (OF 66) WEIGHT 30,000 LB
STEEL GIRDERS	GIRDERS TO BE REPAIRED: 2 (OF 7) WEIGHT 10,000 LB
STEEL COLUMNS	COLUMNS TO BE REPAIRED: THERE ARE 2 COLUMNS. EXTENT OF REPAIRS WILL NOT BE KNOWN UNTIL THE MEMBERS ARE SANDBLASTED AND CLEANED. WEIGHT 20,000 LB
DECK AREA	AREA OF DECK TO BE REPLACED 57,500 SF

LEGEND:

- MEMBER TO BE REPLACED
- MEMBER TO BE REPAIRED
- MEMBER TO REMAIN
- MEMBER TO REMAIN
- RED-FLAGGED MEMBER REPAIRED

SK- 7

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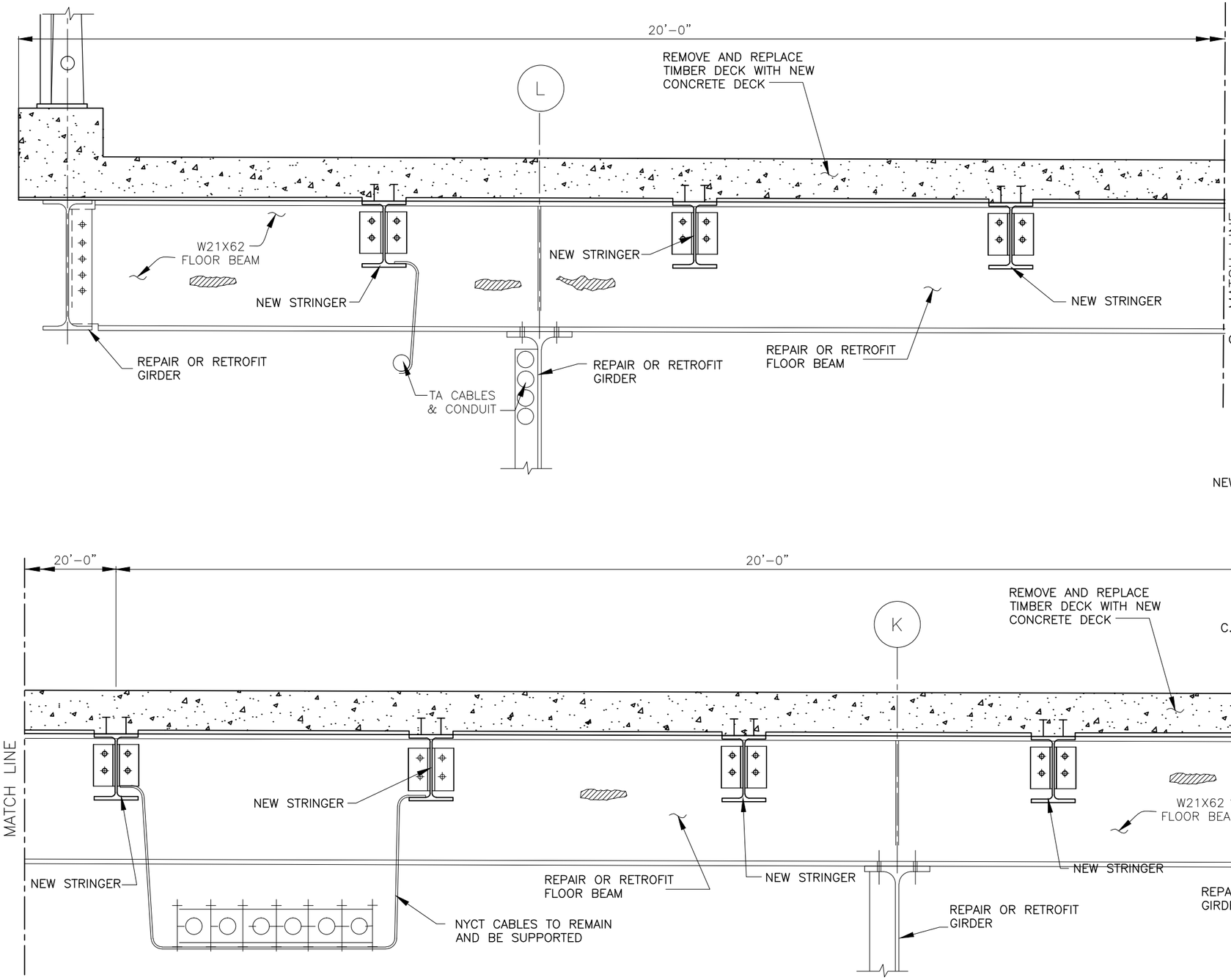
BRIDGE FRAMING PLAN
SPANS 19 THRU 29
ALTERNATIVE 2

PASSERELLE PEDESTRIAN BRIDGE

PROJECT ID: HBPED700Q | DATE: FEB 2014 | SHEET 7 OF - | DWG No. SK-7

CONSULTANT DESIGN

File name: R:\005.ny projects\659 des ddc passerelle pedestrian bridge\12. cad drawings\Design\proposal-alt1, alt2, alt3\alternatives sheet sSK-7 A2 Concrete Framing Plan.dwg Aug 06, 2014-3:09pm kwalker



NOTES:

1. FOR BRIDGE FRAMING PLAN SPANS 1 THRU 18, SEE SK-6.
1. FOR BRIDGE FRAMING PLAN SPANS 19 THRU 19, SEE SK-7.

FLOOR BEAM TYPICAL ELEVATION (SPANS 1 THRU 18)

SCALE: 1½"=1'-0"

SK-8

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CONCRETE DECK CROSS SECTION
SPANS 1 THRU 18
ALTERNATIVE 2

PASSERELLE PEDESTRIAN BRIDGE

PROJECT ID: HBPED700Q | DATE: | SHEET OF – | DWG No.

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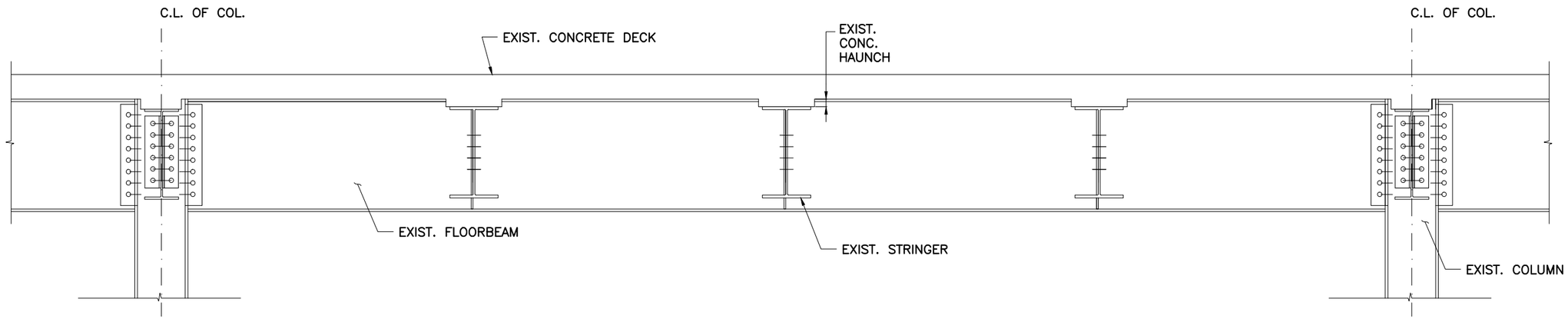
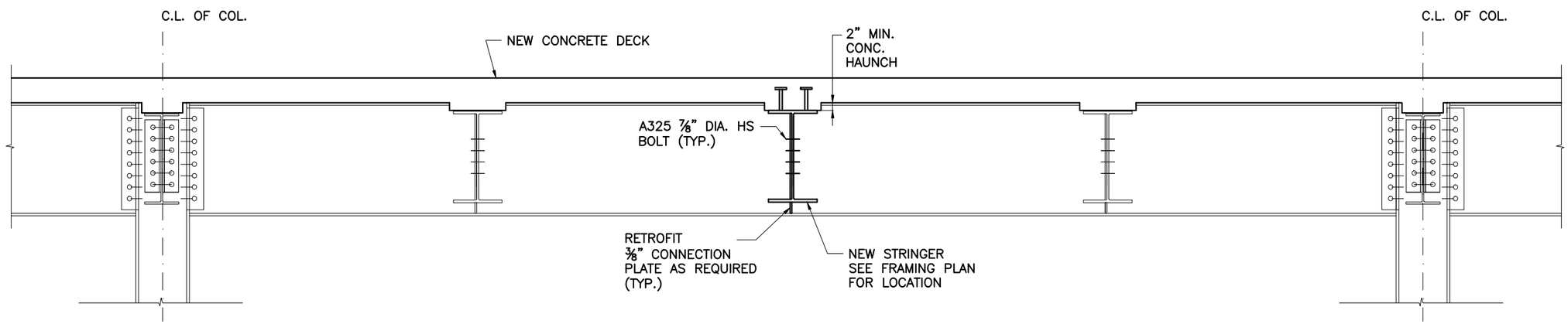
NOTES:

1. FOR BRIDGE FRAMING PLAN SPANS 1 THUR 18, SEE SK-6.
2. FOR BRIDGE FRAMING PLAN SPANS 19 THUR 29, SEE SK-7.



TYPICAL EXISTING STRINGER AND CONCRETE DECK



TYPICAL NEW STRINGER AND CONCRETE DECK REPLACEMENT

FRAMING PLAN MAIN LEVEL

SCALE: 1/16"=1'-0"

SK- 9

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CONCRETE DECK CROSS SECTION
SPANS 19 THRU 29
ALTERNATIVE 2

PASSERELLE PEDESTRIAN BRIDGE

PROJECT ID: HBPED700Q | DATE: FEB 2014 | SHEET 9 OF - | DWG No. SK-9

CONSULTANT DESIGN

File name: R:\005.ny projects\659 des ddc passerelle pedestrian bridge\12. cad drawings\Design\proposal-alt1, alt2, alt3\alternatives sheet s\SK-9 A3 Concrete Deck Section.dwg Aug 06, 2014-2:39pm kwalker

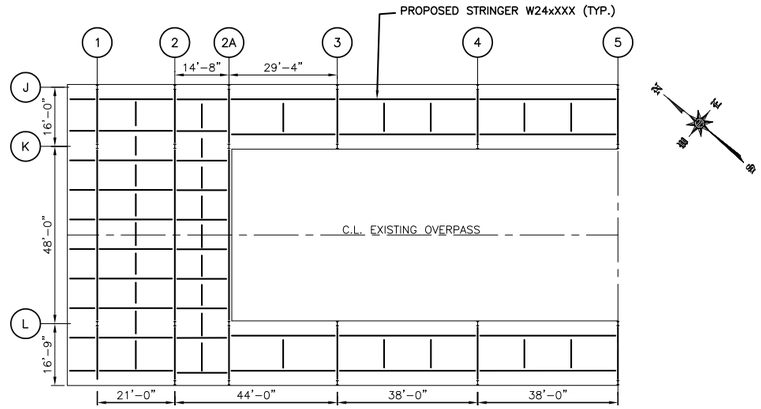
SCOPE OF WORK
TIMBER DECK SECTION (SPANS 1 THRU 18)

ALTERNATIVE 3: REPLACEMENT OF EXISTING STRUCTURE OVER EXISTING FOUNDATIONS

- REPLACE EXISTING TIMBER DECK WITH NEW PRECAST OR CAST–IN–PLACE CONCRETE DECK
- REPLACE STEEL STRINGERS, FLOORBEAMS, GIRDERS, AND COLUMNS OVER EXISTING FOUNDATIONS
- RETROFIT FOUNDATIONS AS NECESSARY
- INSTALL IMPROVED RAILING AND LIGHTING, SUBJECT TO PDC APPROVAL.

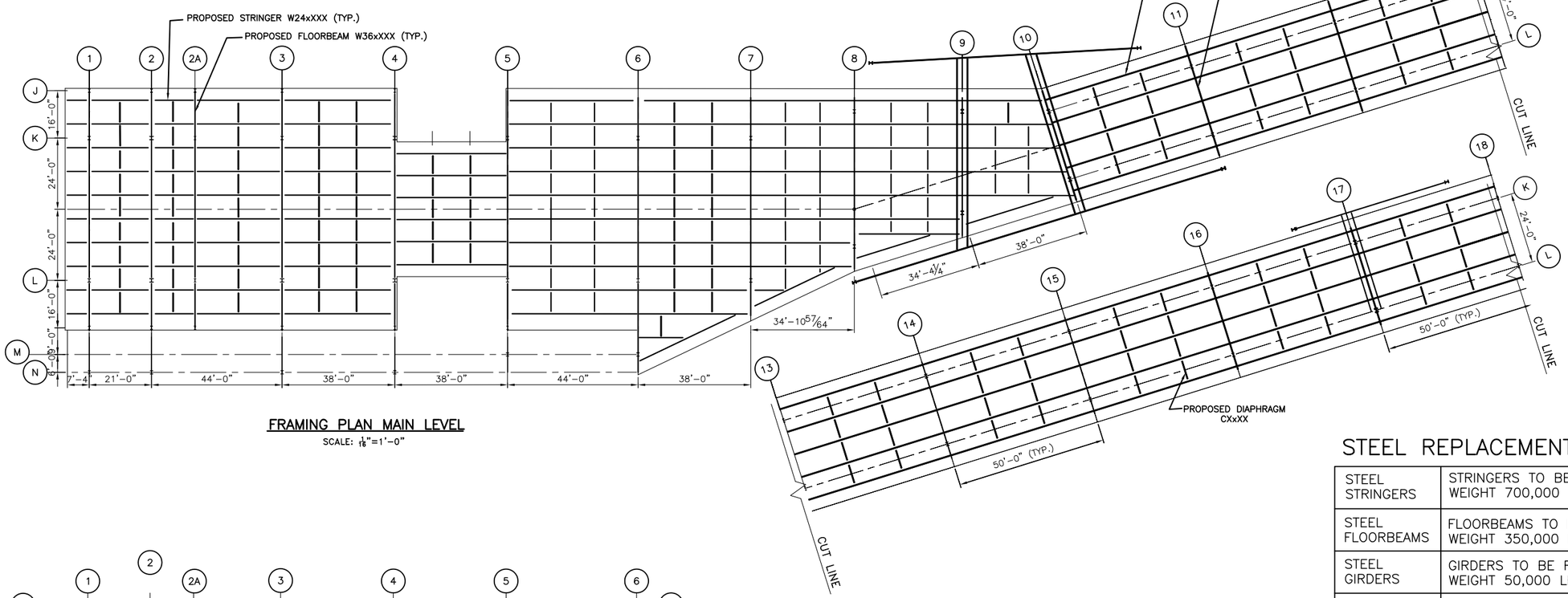
NOTES:

1. FOR BRIDGE FRAMING PLAN SPANS 19 THRU 29, SEE SK–11.
2. FOR BRIDGE CROSS SECTION, SEE SK–12.



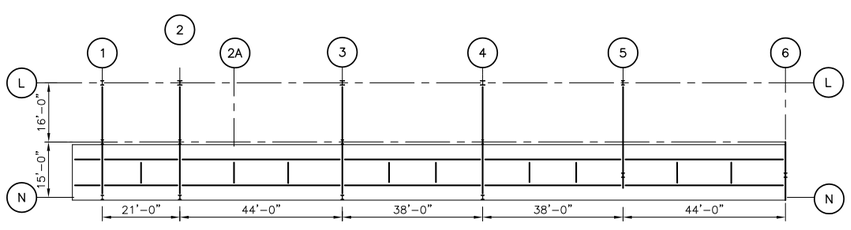
FRAMING PLAN UPPER LEVEL AND RAMPS

SCALE: $\frac{1}{16}$"=1'–0"



FRAMING PLAN MAIN LEVEL

SCALE: $\frac{1}{16}$"=1'–0"



FRAMING PLAN LOWER LEVEL RAMP

SCALE: $\frac{1}{16}$"=1'–0"

STEEL REPLACEMENT SCHEDULE

STEEL STRINGERS	STRINGERS TO BE REPLACED: WEIGHT 700,000 LB
STEEL FLOORBEAMS	FLOORBEAMS TO BE REPLACED: WEIGHT 350,000 LB
STEEL GIRDERS	GIRDERS TO BE REPLACED: WEIGHT 50,000 LB
STEEL COLUMNS	COLUMNS TO BE REPLACED: WEIGHT 100,000 LB
DECK AREA	AREA OF DECK TO BE REPLACED: 48,500 SF

SK–10

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BRIDGE DECK FRAMING PLAN
SPANS 1 THRU 18
ALTERNATIVE 3

PASSERELLE PEDESTRIAN BRIDGE

PROJECT ID: HBPED700Q | DATE: | SHEET OF – | DWG No.

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File name: R:\005.NY PROJECTS\659 DES DDC Passerelle Pedestrian Bridge\12. CAD Drawings\Design\Proposal-Alt1, Alt2, Alt3\Alternatives Sheet SSK-10 A3 Timber Framing Plan.dwg Oct 20, 2014-8:45am kwalker

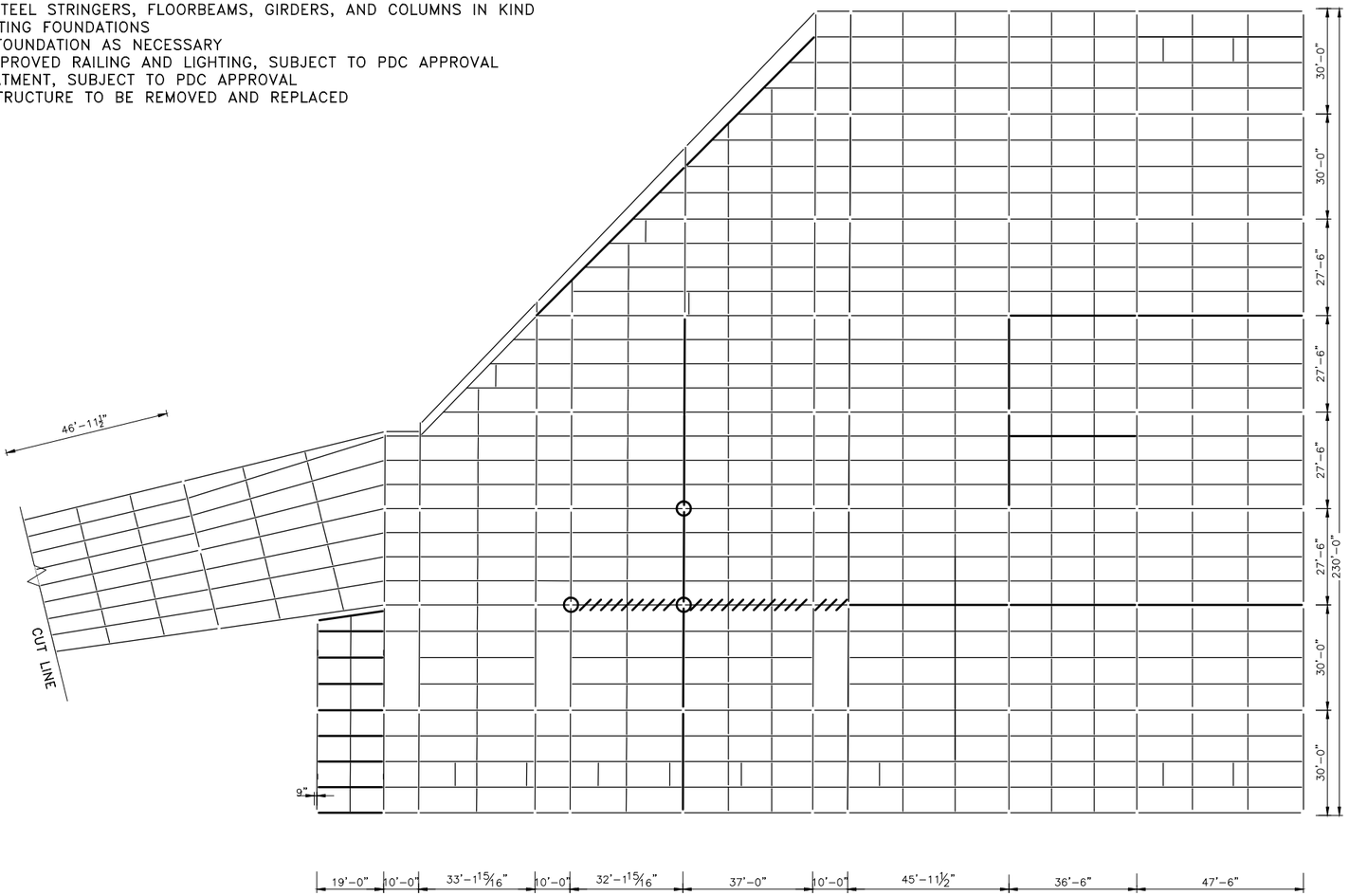
SCOPE OF WORK
CONCRETE DECK SECTION (SPANS 19 THRU 29)

ALTERNATIVE 3: REPLACEMENT OF BRIDGE DECK IN KIND AND REHABILITATION OF EXISTING STRUCTURE

- REPLACE EXISTING CONCRETE DECK WITH NEW PRECAST OR CAST-IN-PLACE CONCRETE DECK
- REPLACE STEEL STRINGERS, FLOORBEAMS, GIRDERS, AND COLUMNS IN KIND OVER EXISTING FOUNDATIONS
- RETROFIT FOUNDATION AS NECESSARY
- INSTALL IMPROVED RAILING AND LIGHTING, SUBJECT TO PDC APPROVAL
- DECK TREATMENT, SUBJECT TO PDC APPROVAL
- CANOPY STRUCTURE TO BE REMOVED AND REPLACED

NOTES:

1. FOR BRIDGE FRAMING PLAN SPANS 1 THUR 18, SEE SK-10.
2. FOR BRIDGE CROSS SECTION, SEE SK-13.



FRAMING PLAN MAIN LEVEL

SCALE: 1/16"=1'-0"

REPAIR SCHEDULE

STEEL STRINGERS	STEEL STRINGERS TO BE REPLACED 275 (OF 275) WEIGHT 900,000 LB
STEEL FLOORBEAMS	FLOORBEAMS TO BE REPLACED 66 (OF 66) WEIGHT 250,000 LB
STEEL GIRDERS	GIRDERS TO BE REPLACED 7 (OF 7) WEIGHT 50,000 LB
STEEL COLUMNS	COLUMNS TO BE REPLACED THERE ARE 81 COLUMNS. WEIGHT 100,000 LB
DECK AREA	AREA OF DECK TO BE REPLACED 57,500 SF

LEGEND:

- MEMBER TO BE REPLACED
- MEMBER TO BE REPAIRED
- MEMBER TO REMAIN
- MEMBER TO REMAIN
- RED-FLAGGED MEMBER REPAIRED

SK- 11

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BRIDGE FRAMING PLAN
SPANS 19 THRU 29
ALTERNATIVE 3

PASSERELLE PEDESTRIAN BRIDGE

PROJECT ID: HBPED700Q | DATE: FEB 2014 | SHEET 11 OF – | DWG No. SK-11

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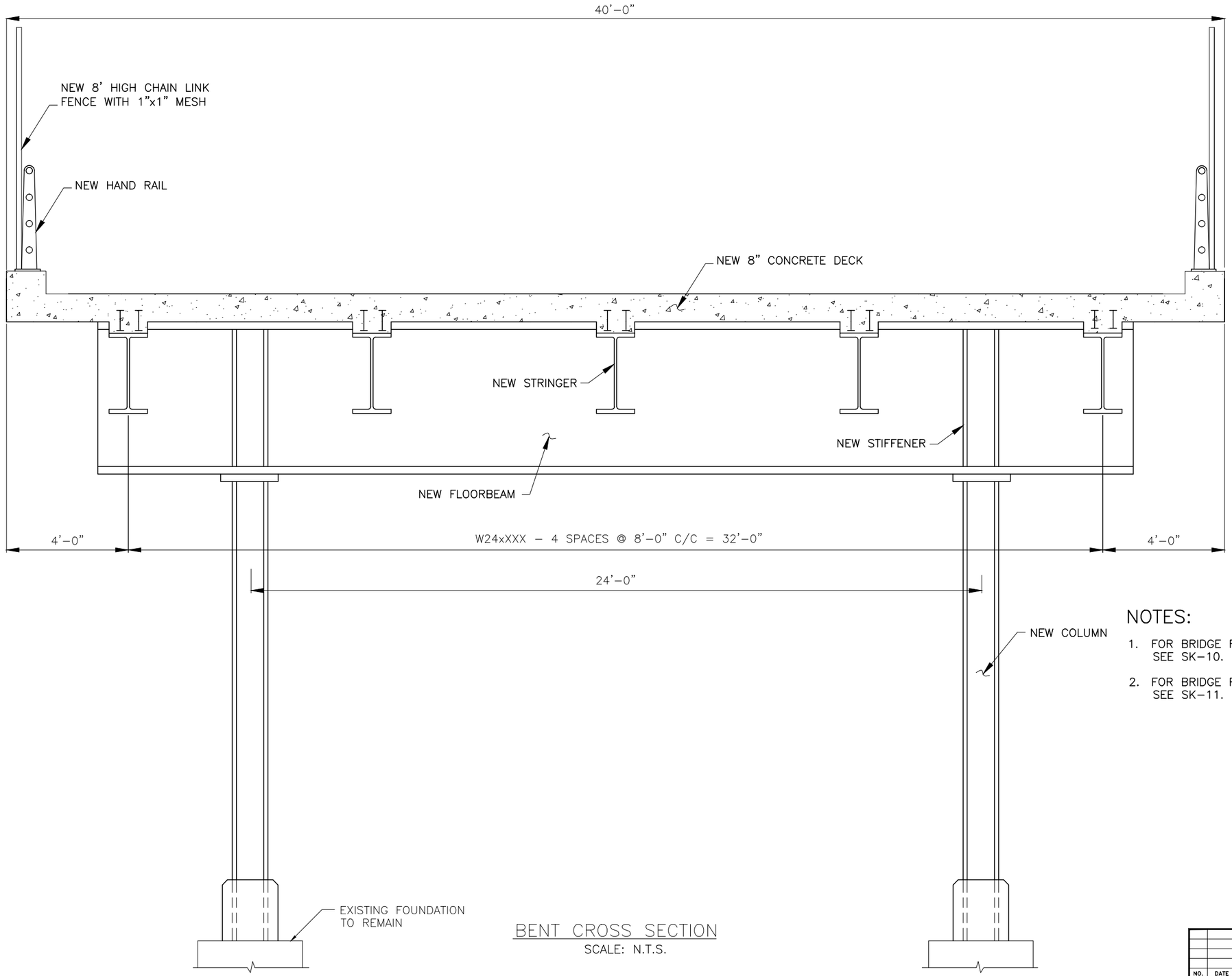
File name: R:\005.ny projects\659 des ddc passerelle pedestrian bridge\12. cad drawings\Design\proposal-alt1, alt2, alt3\alternatives sheet sSK-11 Concrete Framing Plan.dwg Aug 06, 2014-2:39pm kwalker



NOTES:

1. FOR BRIDGE FRAMING PLAN SPANS 1 THRU 18, SEE SK-10.
2. FOR BRIDGE FRAMING PLAN SPANS 19 THRU 19, SEE SK-11.

BENT CROSS SECTION

SCALE: N.T.S.

SK-12

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BRIDGE CROSS SECTION
SPANS 1 THRU 18
ALTERNATIVE 3

PASSERELLE PEDESTRIAN BRIDGE

PROJECT ID: HBPED700Q | DATE: | SHEET OF - | DWG No.

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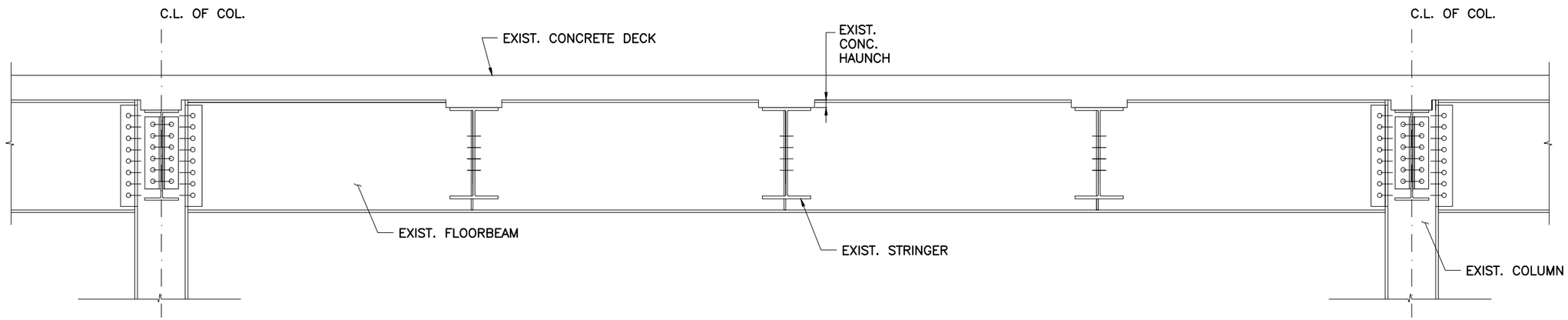
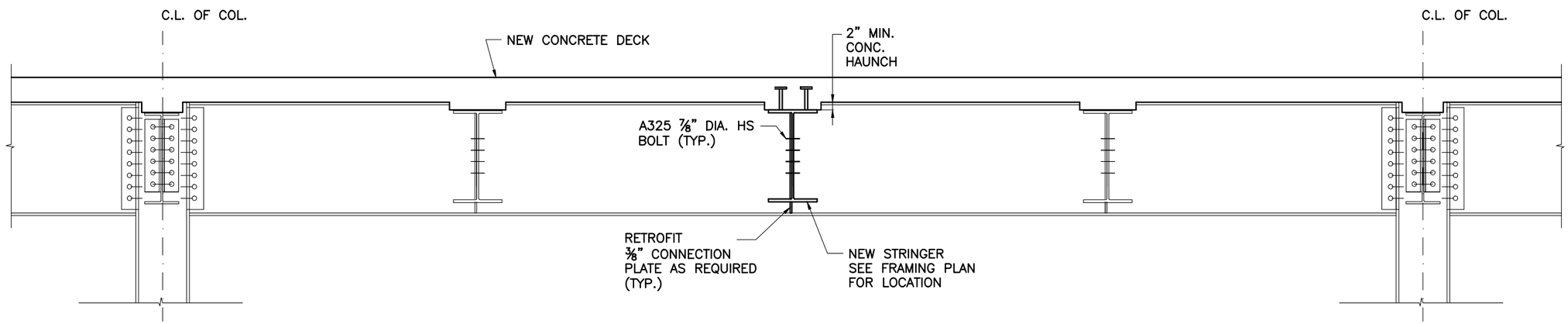
File name: R:\005.ny projects\659 des ddc passerelle pedestrian bridge\12. cad drawings\Design\proposal-alt1, alt2, alt3\alternatives sheet sSK-12 A3 Timber Cross Section.dwg Aug 06, 2014-2:39pm kwalker

NOTES:

1. FOR BRIDGE FRAMING PLAN SPANS 1 THUR 18, SEE SK-10.
2. FOR BRIDGE FRAMING PLAN SPANS 19 THUR 29, SEE SK-11.



TYPICAL EXISTING STRINGER AND CONCRETE DECK



TYPICAL NEW STRINGER AND CONCRETE DECK REPLACEMENT

FRAMING PLAN MAIN LEVEL

SCALE: 1/16"=1'-0"

SK- 13

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CONCRETE DECK CROSS SECTION
SPANS 19 THRU 29
ALTERNATIVE 3

PASSERELLE PEDESTRIAN BRIDGE

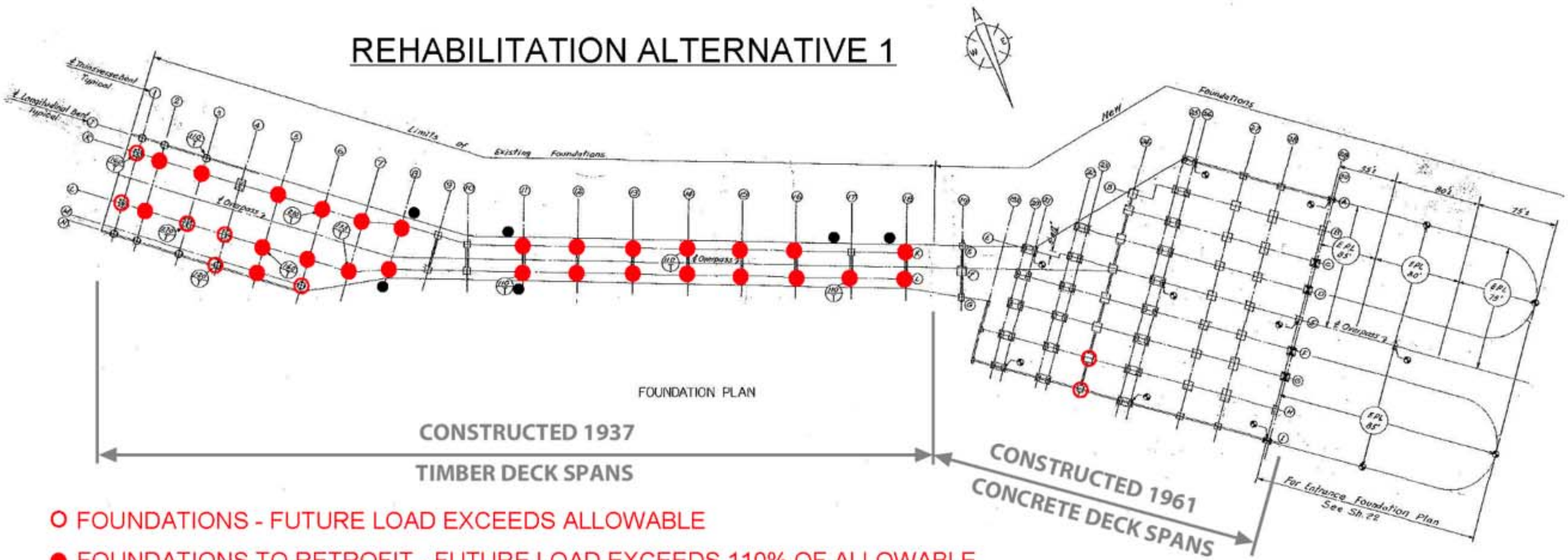
PROJECT ID: HBPED700Q | DATE: FEB 2014 | SHEET 13 OF – | DWG No. SK-13

CONSULTANT DESIGN

File name: R:\005.my projects\659 des ddc passerelle pedestrian bridge\12. cad drawings\Design\proposal-alt1, alt2, alt3\alternatives sheet s\SK-13 A3 Concrete Cross Section.dwg Aug 06, 2014-2:40pm kwalker

11.5 Foundation Retrofit Drawings

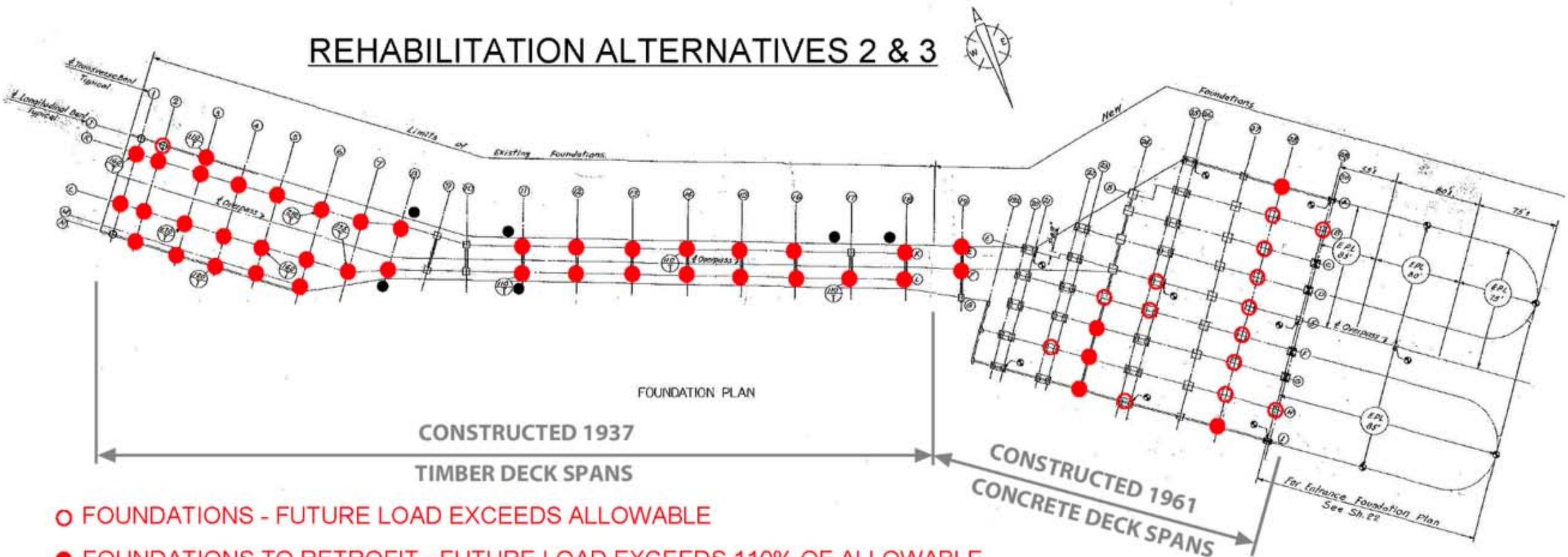
REHABILITATION ALTERNATIVE 1



O FOUNDATIONS - FUTURE LOAD EXCEEDS ALLOWABLE

● FOUNDATIONS TO RETROFIT - FUTURE LOAD EXCEEDS 110% OF ALLOWABLE

REHABILITATION ALTERNATIVES 2 & 3



○ FOUNDATIONS - FUTURE LOAD EXCEEDS ALLOWABLE

● FOUNDATIONS TO RETROFIT - FUTURE LOAD EXCEEDS 110% OF ALLOWABLE

11.6 Cost Estimate

TABLE 1

Major Items			Alternative 1		Alternative 2		Alternative 3	
Rehabilitation of Spans 1 thru 18 (Timber Deck)	**Unit**	**Unit Cost**	**Qty**	**Extended Cost**	**Qty**	**Extended Cost**	**Qty**	**Extended Cost**
Removal of Timber Deck - Alternative 1	SF	$ 12.00	48,500.00	$ 582,000.00	0.00	$ -		$ -
Removal of Timber DecK - Alternatives 2 and 3	SF	$ 9.00	0.00	$ -	48,500.00	$ 436,500.00	48,500.00	$ 436,500.00
Removal of Existing Steel	LB	$ 2.50		$ -		$ -	1,000,000.00	$ 2,500,000.00
NYCT Shielding	LS	$ 250,000.00	1.00	$ 250,000.00	1.00	$ 250,000.00	1.00	$ 250,000.00
Temporary Structure for Construction Staging - Alternative 1	LS	$ 250,000.00	1.00	$ 250,000.00		$ -		$ -
Temporary Structure for Construction Staging - Alternatives 2 and 3	LS	$ 250,000.00		$ -	1.00	$ 250,000.00	1.00	$ 250,000.00
New Timber Deck	SF	$ 45.00	48,500.00	$ 2,182,500.00	0.00	$ -	0.00	$ -
New Concrete Deck	SF	$ 72.00		$ -	48,500.00	$ 3,492,000.00	48,500.00	$ 3,492,000.00
Steel Repairs	LB	$ 48.00	250,000.00	$ 12,000,000.00	250,000.00	$ 12,000,000.00		$ -
Steel Replacement - Superstructure	LB	$ 15.00		$ -	120,000.00	$ 1,800,000.00	1,200,000.00	$ 18,000,000.00
Modification of Steel Framing for New Deck Joints	LS	$ 2,000,000.00		$ -	1.00	$ 2,000,000.00	0.00	$ -
Subtotal for Spans 1 thru 18				**$ 15,264,500.00**		**$ 20,228,500.00**		**$ 24,928,500.00**
Major Items			**Alternative 1**		**Alternative 2**		**Alternative 3**	
Rehabilitation of Spans 19 thru 29 (Concrete Deck)	**Unit**	**Unit Cost**	**Qty**	**Extended Cost**	**Qty**	**Extended Cost**	**Qty**	**Extended Cost**
Removal of Concrete Deck - Alternative 1	SF	$ 20.00	57,500.00	$ 1,150,000.00		$ -		$ -
Removal of Concrete Deck - Alternative 2	SF	$ 20.00		$ -	57,500.00	$ 1,150,000.00		$ -
Removal of Concrete Deck - Alternative 3	SF	$ 18.00		$ -		$ -	57,500.00	$ 1,035,000.00
Removal of Existing Steel	lbs	$ 2.25		$ -		$ -	1,200,000.00	$ 2,700,000.00
LIRR Shielding	LS	$ 500,000.00	1.00	$ 500,000.00	1.00	$ 500,000.00	1.00	$ 500,000.00
Temporary Structure for Construction Staging - Alternatives 1 and 2	LS	$ 350,000.00	1.00	$ 350,000.00	1.00	$ 350,000.00		$ -
Temporary Structure for Construction Staging - Alternative 3	LS	$ 100,000.00		$ -		$ -	1.00	$ 100,000.00
New Concrete Deck	SF	$ 72.00	57,500.00	$ 4,140,000.00	57,500.00	$ 4,140,000.00	57,500.00	$ 4,140,000.00
Steel Repairs - Floorbeams, Girders, Columns	LB	$ 48.00	90,000.00	$ 4,320,000.00	90,000.00	$ 4,320,000.00	0.00	$ -
Steel Replacement	LB	$ 15.00		$ -	130,000.00	$ 1,950,000.00	1,300,000.00	$ 19,500,000.00
Canopy Structure	LS	$ 550,000.00	1.00	$ 550,000.00	1.00	$ 550,000.00	1.00	$ 550,000.00
Subtotal for Spans 19 thru 29				**$ 11,010,000.00**		**$ 12,960,000.00**		**$ 28,525,000.00**
Total for Spans 1 thru 29								
Deck Treatment, Artistic Features, Landscaping	LS	$ 1,200,000.00	1.00	$ 1,200,000.00	1.00	$ 1,200,000.00	1.00	$ 1,200,000.00
Lighting Above Deck and Under Deck	LS	$ 1,300,000.00	1.00	$ 1,300,000.00	1.00	$ 1,300,000.00	1.00	$ 1,300,000.00
Bridge Railing and Fencing	LF	$ 700.00	2,700.00	$ 1,890,000.00	2,700.00	$ 1,890,000.00	2,700.00	$ 1,890,000.00
Foundation Retrofit	LS	$ 6,000,000.00	1.00	$ 5,000,000.00	1.00	$ 6,000,000.00	1.00	$ 6,000,000.00
Painting of Existing Structure - Alternative 1	LS	$ 11,000,000.00	1.00	$ 11,000,000.00		$ -	0.00	$ -
Painting of Existing Structure - Alternative 2	LS	$ 9,000,000.00		$ -	1.00	$ 9,000,000.00	0.00	$ -
MPT Cost for Stage Construction	Months	$ 35,000.00	24.00	$ 840,000.00	30.00	$ 1,050,000.00	36.00	$ 1,260,000.00
Field Office	Months	$ 16,000.00	30.00	$ 480,000.00	36.00	$ 576,000.00	42.00	$ 672,000.00
Contingency (25%)				$ 11,996,125.00		$ 13,551,125.00		$ 16,443,875.00
Mobilization (LS 4%)				$ 2,399,225.00		$ 2,710,225.00		$ 3,288,775.00
TA Cable Relocation				$ 7,000,000.00		$ 7,000,000.00		$ 7,000,000.00
Rail Road Force Account				$ 5,000,000.00		$ 6,000,000.00		$ 7,000,000.00
Total Construction Cost				**$ 74,379,850.00**		**$ 83,465,850.00**		**$ 99,508,150.00**
Engineering and Construction Support Services. Assume 11% of Construction Cost				$ 8,200,000.00		$ 9,200,000.00		$ 11,000,000.00
Construction Inspection and Testing, Assume 12% of Construction Cost				$ 9,000,000.00		$ 10,100,000.00		$ 12,000,000.00
Total			**Alternative 1**	**$ 91,579,850.00**	**Alternative 2**	**$ 102,765,850.00**	**Alternative 3**	**$ 122,508,150.00**
Say				**$ 91,600,000.00**		**$ 102,800,000.00**		**$ 122,600,000.00**

TABLE 2

LIFE CYCLE COSTS - PASSERELLE PEDESTRIAN BRIDGE SUMMARY OF ALL ALTERNATIVES

Mid Point of Construction:	2022	Discount Rate:	2.00%
Calculation Start	2020	Inflation Rate:	4.00%
Completion of Construction:	2024	Interest Rate (effective):	-2.00%
Construction Duration:	3 years	Escalation:	0.00

Year	Alternative	Original Construction	Cleaning, Washing, and Joint Sealing (All 3 Alternatives)	Timber Deck Partial Replacement (Alternative 1 Only)	Timber Deck Full Replacement (Alternative 1 Only)	Steel Repair and Localized Painting	Steel Repair	Concrete Deck Repair (All 3 Alternatives)	Concrete Deck Full Replacement	Steel Painting 100%	Railing and Fence Repair	Railing and Fence Repair Timber Deck	Complete Railing and Fence Replacement Corresponding to Full Deck Replacement	Lighting Repairs	Complete Lighting Replacement Due to Full Deck Replacement	LIRR and TA Force Account for Minor Maintenance	LIRR and TA Force Account for Preventative Maintenance	LIRR and TA Force Account for Rehabilitation	Total Maintenance Cost with 50% Contingency (before inflation)	Present Worth Factor	**Present Worth of Total Major Maintenance Costs**
Frequency (in years)		-	5th Year	10th Year	20th Year	10th Year	20th Year	10th Year	40th Year	20th Year	10th Year	20th Year	40th Year	10th Year	40	5th Year	10th Year	40th Year			
2021	1	$ 30,533,333	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30,533,333.33	1.00	**$ 30,533,333**
	2	$ 34,266,667	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	34,266,666.67	1.00	**$ 34,266,667**
	3	$ 40,866,667	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	40,866,666.67	1.00	**$ 40,866,667**
2022	1	$ 30,533,333	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30,533,333.33	1.00	**$ 30,533,333**
	2	$ 34,266,667	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	34,266,666.67	1.00	**$ 34,266,667**
	3	$ 40,866,667	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	40,866,666.67	1.00	**$ 40,866,667**
2023	1	$ 30,533,333	$ -		$ -		$ -												30,533,333.33	1.00	**$ 30,533,333**
	2	$ 34,266,667	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	34,266,666.67	1.00	**$ 34,266,667**
	3	$ 40,866,667	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	40,866,666.67	1.00	**$ 40,866,667**
2027	1	$ -	$ 250,000													$ 200,000			$ 675,000	1.15	**$ 773,279**
	2	$ -	$ 250,000									$ -				$ 200,000			$ 675,000	1.15	**$ 773,279**
	3	$ -	$ 250,000									$ -				$ 200,000			$ 675,000	1.15	**$ 773,279**
2032	1	$ -	$ 250,000	$ 582,000		$ 8,250,000	$ -	$ 345,000			$ 100,000			$ 200,000		$ -	$ 2,500,000		$ 18,340,500	1.26	**$ 23,153,102**
	2	$ -	$ 250,000	$ -		$ 3,300,000		$ -			$ -	$ -		$ 100,000		$ -	$ 2,500,000		$ 9,225,000	1.26	**$ 11,645,667**
	3	$ -	$ 250,000	$ -		$ 825,000		$ -			$ -	$ -		$ -		$ 200,000			$ 1,912,500	1.26	**$ 2,414,346**
2037	1	$ -	$ 250,000													$ 200,000			$ 675,000	1.39	**$ 939,004**
	2	$ -	$ 250,000									$ -				$ 200,000			$ 675,000	1.39	**$ 939,004**
	3	$ -	$ 250,000									$ -				$ 200,000			$ 675,000	1.39	**$ 939,004**
2042	1	$ -	$ 250,000	$ -	$ 2,425,000	$ -	$ 15,000,000	$ 345,000		$ 4,608,000	$ -	$ 540,000		$ 200,000		$ -	$ 2,500,000		$ 38,802,000	1.53	**$ 59,481,758**
	2	$ -	$ 250,000	$ -	$ -	$ -	$ 6,000,000	$ 1,272,000		$ 3,686,400	$ 100,000	$ -		$ 100,000		$ -	$ 2,500,000		$ 20,862,600	1.53	**$ 31,981,448**
	3	$ -	$ 250,000	$ -	$ -	$ -	$ 1,500,000	$ 1,272,000		$ 2,304,000	$ 100,000	$ -		$ 100,000		$ -	$ 2,000,000		$ 11,289,000	1.53	**$ 17,305,540**
2047	1	$ -	$ 250,000													$ 200,000			$ 675,000	1.69	**$ 1,140,248**
	2	$ -	$ 250,000									$ -				$ 200,000			$ 675,000	1.69	**$ 1,140,248**
	3	$ -	$ 250,000									$ -				$ 200,000			$ 675,000	1.69	**$ 1,140,248**
2052	1	$ -	$ 250,000	$ 582,000		$ 8,250,000		$ 345,000			$ 100,000			$ 200,000		$ -	$ 2,500,000		$ 18,340,500	1.86	**$ 34,140,709**
	2	$ -	$ 250,000	$ -		$ 3,300,000		$ 1,272,000			$ 100,000	$ -		$ 100,000		$ -	$ 2,500,000		$ 11,283,000	1.86	**$ 21,003,223**
	3	$ -	$ 250,000	$ -		$ 825,000		$ 1,272,000			$ 100,000	$ -		$ 100,000		$ 200,000			$ 4,120,500	1.86	**$ 7,670,281**
2057	1	$ -	$ 250,000													$ 200,000			$ 675,000	2.05	**$ 1,384,621**
	2	$ -	$ 250,000									$ -				$ 200,000			$ 675,000	2.05	**$ 1,384,621**
	3	$ -	$ 250,000									$ -				$ 200,000			$ 675,000	2.05	**$ 1,384,621**
2062	1	$ -	$ 250,000	$ -	$ 2,425,000	$ -	$ 15,000,000	$ -	$ 5,750,000	$ 4,608,000	$ -	$ -	$ 1,620,000	$ -	$ 1,000,000	$ -	$ -	$ 5,000,000	$ 53,479,500	2.26	**$ 120,887,216**
	2	$ -	$ 250,000	$ -	$ -	$ -	$ 6,000,000	$ -	$ 10,600,000	$ 3,686,400	$ -	$ -	$ 1,620,000	$ -	$ 1,000,000	$ -	$ -	$ 5,000,000	$ 42,234,600	2.26	**$ 95,468,791**
	3	$ -	$ 250,000	$ -	$ -	$ -	$ 1,500,000	$ -	$ 10,600,000	$ 2,304,000	$ -	$ -	$ 1,620,000	$ -	$ 1,000,000	$ -	$ -	$ 4,000,000	$ 31,911,000	2.26	**$ 72,132,910**
2067	1	$ -	$ 250,000													$ 200,000			$ 675,000	2.49	**$ 1,681,367**
	2	$ -	$ 250,000									$ -				$ 200,000			$ 675,000	2.49	**$ 1,681,367**
	3	$ -	$ 250,000									$ -				$ 200,000			$ 675,000	2.49	**$ 1,681,367**
2072	1	$ -	$ 250,000	$ 582,000		$ 8,250,000		$ 345,000			$ 100,000			$ 200,000		$ -	$ 2,500,000		$ 18,340,500	2.74	**$ 50,342,628**
	2	$ -	$ 250,000	$ -		$ 3,300,000		$ -			$ -	$ -		$ 100,000		$ -	$ 2,500,000		$ 9,225,000	2.74	**$ 25,321,597**
	3	$ -	$ 250,000	$ -		$ 825,000		$ -			$ -	$ -		$ -		$ 200,000			$ 1,912,500	2.74	**$ 5,249,599**
2077	1	$ -	$ 250,000													$ 200,000			$ 675,000	3.02	**$ 2,041,711**
	2	$ -	$ 250,000									$ -				$ 200,000			$ 675,000	3.02	**$ 2,041,711**
	3	$ -	$ 250,000									$ -				$ 200,000			$ 675,000	3.02	**$ 2,041,711**
2082	1	$ -	$ 250,000	$ -	$ 2,425,000	$ -	$ 15,000,000	$ 345,000		$ 4,608,000	$ -	$ 540,000		$ 200,000		$ -	$ 2,500,000		$ 38,802,000	3.33	**$ 129,333,342**
	2	$ -	$ 250,000	$ -	$ -	$ -	$ 6,000,000	$ 1,272,000		$ 3,686,400	$ 100,000	$ -		$ 100,000		$ -	$ 2,500,000		$ 20,862,600	3.33	**$ 69,538,420**
	3	$ -	$ 250,000	$ -	$ -	$ -	$ 1,500,000	$ 1,272,000		$ 2,304,000	$ 100,000	$ -		$ 100,000		$ -	$ 2,000,000		$ 11,289,000	3.33	**$ 37,628,063**
2087	1	$ -	$ 250,000													$ 200,000			$ 675,000	3.67	**$ 2,479,282**
	2	$ -	$ 250,000									$ -				$ 200,000			$ 675,000	3.67	**$ 2,479,282**
	3	$ -	$ 250,000									$ -				$ 200,000			$ 675,000	3.67	**$ 2,479,282**
2092	1	$ -	$ 250,000	$ 582,000		$ 8,250,000		$ 345,000			$ 100,000			$ 200,000		$ -	$ 2,500,000	$ -	$ 18,340,500	4.05	**$ 74,233,380**
	2	$ -	$ 250,000	$ -		$ 3,300,000		$ 1,272,000			$ 100,000	$ -		$ 100,000		$ -	$ 2,500,000	$ -	$ 11,283,000	4.05	**$ 45,668,069**
	3	$ -	$ 250,000	$ -		$ 825,000		$ 1,272,000			$ 100,000	$ -		$ 100,000		$ 200,000	$ -	$ -	$ 4,120,500	4.05	**$ 16,677,770**
Sum for Alternative 1		$ 91,600,000	$ 5,250,000	$ 3,492,000	$ 10,912,500	$ 49,500,000	$ 67,500,000	$ 3,105,000	$ 8,625,000	$ 20,736,000	$ 600,000	$ 1,620,000	$ 2,430,000	$ 1,800,000	$ 1,500,000	$ 2,100,000	$ 22,500,000	$ 7,500,000	$ 300,770,500	PW	$ 593,611,647
Sum for Alternative 2		$ 102,800,000	$ 5,250,000	$ -	$ -	$ 19,800,000	$ 27,000,000	$ 7,632,000	$ 15,900,000	$ 16,588,800	$ 600,000	$ -	$ 2,430,000	$ 900,000	$ 1,500,000	$ 2,100,000	$ 22,500,000	$ 7,500,000	$ 232,500,800	PW	$ 413,866,728
Sum for Alternative 3		$ 122,600,000	$ 5,250,000	$ -	$ -	$ 4,950,000	$ 6,750,000	$ 7,632,000	$ 15,900,000	$ 10,368,000	$ 600,000	$ -	$ 2,430,000	$ 600,000	$ 1,500,000	$ 3,300,000	$ 6,000,000	$ 6,000,000	$ 193,880,000	PW	$ 292,118,022

Sum of Maintenance Cost includes 50% Contigency

ALTERNATIVE 1		ALTERNATIVE 2		ALTERNATIVE 3	
INITIAL CONSTRUCTION COST:	$ 91,600,000	INITIAL CONSTRUCTION COST:	$ 102,800,000	INITIAL CONSTRUCTION COST:	$ 122,600,000
TOTAL MAINTENANCE COST, 2022 $	$ 209,170,500	TOTAL MAINTENANCE COST 2022 $:	$ 129,700,800	TOTAL MAINTENANCE COST $2022:	$ 71,280,000

HAKS | WEIDLINGER ASSOCIATES® INC
Joint Venture

TABLE 2.1

LIFE CYCLE COSTS - PASSERELLE PEDESTRIAN BRIDGE ALTERNATIVE 1

Mid Point of Construction:	2022	Discount Rate:	2.00%
Calculation Start	2021	Inflation Rate:	4.00%
Completion of Construction:	2024	Interest Rate (effective):	-2.00%
Construction Duration:	3 years	Escalation:	0.00

Year	Original Construction	Cleaning, Washing, and Joint Sealing (All 3 Alternatives)	Timber Deck Partial Replacement (Alternative 1 Only)	Timber Deck Full Replacement (Alternative 1 Only)	Steel Repair and Localized Painting	Steel Repair	Concrete Deck Repair (All 3 Alternatives)	Concrete Deck Full Replacement	Steel Painting 100%	Railing and Fence Repair	Railing and Fence Repair Timber Deck	Complete Railing and Fence Replacement Corresponding to Full Deck Replacement	Lighting Repairs	Complete Lighting Replacement Due to Full Deck Replacement	LIRR and TA Force Account for Minor Maintenance	LIRR and TA Force Account for Preventative Maintenance	LIRR and TA Force Account for Rehabilitation	Total Major Maintenance Cost with 50% Contingency (before inflation)	Present Worth Factor	**Present Worth of Total Major Maintenance Costs**
2022 Unit Price	$ 91,600,000	$ 250,000	$ 60	$ 50	$ 55	$ 50	$ 120	$ 100.00	$ 4,608,000	$ 250	$ 400	$ 600	$ 200,000	$ 1,000,000	$ 200,000	$ 2,500,000	$ 5,000,000			
Unit	LS	LS	SF	SF	LB	LB	SF	SF	LS	LF	LF	LF	LS	LS	LS	LS	LS			
Quantity	1	1	9,700	48,500	150,000	300,000	2,875	57,500	1	400	1,350	2,700	1	1	1	1	1			
Cost (2022 dollars)	$ 91,600,000	$ 250,000	$ 582,000	$ 2,425,000	$ 8,250,000	$ 15,000,000	$ 345,000	$ 5,750,000	$ 4,608,000	$ 100,000	$ 540,000	$ 1,620,000	$ 200,000	$ 1,000,000	$ 200,000	$ 2,500,000	$ 5,000,000			
Frequency (in years)	-	5	10	20	10	20	10	40	20	10	20	40	10	40	5	10	40			
2021	$ 30,533,333																	$ 30,533,333	1.000	**$ 30,533,333**
2022	$ 30,533,333																	$ 30,533,333	1.000	**$ 30,533,333**
2023	$ 30,533,333																	$ 30,533,333	1.000	**$ 30,533,333**
2029		$ 250,000													$ 200,000			$ 675,000	1.146	**$ 773,279**
2034		$ 250,000	$ 582,000		$ 8,250,000		$ 345,000			$ 100,000			$ 200,000			$ 2,500,000		$ 18,340,500	1.262	**$ 23,153,102**
2039		$ 250,000													$ 200,000			$ 675,000	1.391	**$ 939,004**
2044		$ 250,000		$ 2,425,000		$ 15,000,000	$ 345,000		$ 4,608,000		$ 540,000		$ 200,000			$ 2,500,000		$ 38,802,000	1.533	**$ 59,481,758**
2049		$ 250,000													$ 200,000			$ 675,000	1.689	**$ 1,140,248**
2054		$ 250,000	$ 582,000		$ 8,250,000		$ 345,000			$ 100,000			$ 200,000			$ 2,500,000		$ 18,340,500	1.861	**$ 34,140,709**
2059		$ 250,000													$ 200,000			$ 675,000	2.051	**$ 1,384,621**
2064		$ 250,000		$ 2,425,000		$ 15,000,000		$ 5,750,000	$ 4,608,000			$ 1,620,000		$ 1,000,000			$ 5,000,000	$ 53,479,500	2.260	**$ 120,887,216**
2069		$ 250,000													$ 200,000			$ 675,000	2.491	**$ 1,681,367**
2074		$ 250,000	$ 582,000		$ 8,250,000		$ 345,000			$ 100,000			$ 200,000			$ 2,500,000		$ 18,340,500	2.745	**$ 50,342,628**
2079		$ 250,000													$ 200,000			$ 675,000	3.025	**$ 2,041,711**
2084		$ 250,000		$ 2,425,000		$ 15,000,000	$ 345,000		$ 4,608,000		$ 540,000		$ 200,000			$ 2,500,000		$ 38,802,000	3.333	**$ 129,333,342**
2089		$ 250,000													$ 200,000			$ 675,000	3.673	**$ 2,479,282**
2094		$ 250,000	$ 582,000		$ 8,250,000		$ 345,000			$ 100,000			$ 200,000			$ 2,500,000		$ 18,340,500	4.048	**$ 74,233,380**

TOTAL PRESENT WORTH:	**$ 593,611,647**
TOTAL MAINTENANCE EXPENDITURES (2022):	$ 209,170,500

TABLE 2.2

LIFE CYCLE COSTS - PASSERELLE PEDESTRIAN BRIDGE ALTERNATIVE 2

Mid Point of Construction:	2022	Discount Rate:	2.00%
Calculation Start	2020	Inflation Rate:	4.00%
Completion of Construction:	2024	Interest Rate (effective):	-2.00%
Construction Duration:	3 years	Escalation:	0.00

Year	Original Construction	Cleaning, Washing, and Joint Sealing (All 3 Alternatives)	Timber Deck Partial Replacement (Alternative 1 Only)	Timber Deck Full Replacement (Alternative 1 Only)	Steel Repair and Localized Painting	Steel Repair	Concrete Deck Repair (All 3 Alternatives)	Concrete Deck Full Replacement	Steel Painting 100%	Railing and Fence Repair	Railing and Fence Repair Timber Deck	Complete Railing and Fence Replacement Corresponding to Full Deck Replacement	Lighting Repairs	Complete Lighting Replacement Due to Full Deck Replacement	LIRR and TA Force Account for Minor Maintenance	LIRR and TA Force Account for Preventative Maintenance	LIRR and TA Force Account for Rehabilitation	Total Major Maintenance Cost with 50% Contingency (before inflation)	Present Worth Factor	**Present Worth of Total Major Maintenance Costs**
2022 Unit Price	$ 102,800,000	$ 250,000	$ 55	$ 65	$ 55	$ 50	$ 120	$ 100.00	$ 3,686,400	$ 250	$ 400	$ 600	$ 100,000	$ 1,000,000	$ 200,000	$ 2,500,000	$ 5,000,000			
Unit	LS	LS	SF	SF	LB	LB	SF	SF	LS	LF	LF	LF	LS	LS	LS	LS	LS			
Quantity	1	1			60,000	120,000	10,600	106,000	1	400		2,700	1	1	1	1	1			
Cost (2022 dollars)	$ 102,800,000	$ 250,000	$ -	$ -	$ 3,300,000	$ 6,000,000	$ 1,272,000	$ 10,600,000	$ 3,686,400	$ 100,000	$ -	$ 1,620,000	$ 100,000	$ 1,000,000	$ 200,000	$ 2,500,000	$ 5,000,000			
Frequency (in years)	-	5	10	20	10	20	10	40	20	10	1	40	10	40	5	10	40			
2021	$ 34,266,667																	$ 34,266,667	1.000	**$ 34,266,667**
2022	$ 34,266,667																	$ 34,266,667	1.000	**$ 34,266,667**
2023	$ 34,266,667																	$ 34,266,667	1.000	**$ 34,266,667**
2029		$ 250,000									$ -				$ 200,000			$ 675,000	1.146	**$ 773,279**
2034		$ 250,000	$ -		$ 3,300,000						$ -		$ 100,000			$ 2,500,000		$ 9,225,000	1.262	**$ 11,645,667**
2039		$ 250,000									$ -				$ 200,000			$ 675,000	1.391	**$ 939,004**
2044		$ 250,000	$ -	$ -		$ 6,000,000	$ 1,272,000		$ 3,686,400	$ 100,000	$ -		$ 100,000			$ 2,500,000		$ 20,862,600	1.533	**$ 31,981,448**
2049		$ 250,000									$ -				$ 200,000			$ 675,000	1.689	**$ 1,140,248**
2054		$ 250,000	$ -		$ 3,300,000		$ 1,272,000			$ 100,000	$ -		$ 100,000			$ 2,500,000		$ 11,283,000	1.861	**$ 21,003,223**
2059		$ 250,000									$ -				$ 200,000			$ 675,000	2.051	**$ 1,384,621**
2064		$ 250,000	$ -	$ -		$ 6,000,000		$ 10,600,000	$ 3,686,400		$ -	$ 1,620,000		$ 1,000,000			$ 5,000,000	$ 42,234,600	2.260	**$ 95,468,791**
2069		$ 250,000									$ -				$ 200,000			$ 675,000	2.491	**$ 1,681,367**
2074		$ 250,000	$ -		$ 3,300,000						$ -		$ 100,000			$ 2,500,000		$ 9,225,000	2.745	**$ 25,321,597**
2079		$ 250,000									$ -				$ 200,000			$ 675,000	3.025	**$ 2,041,711**
2084		$ 250,000	$ -	$ -		$ 6,000,000	$ 1,272,000		$ 3,686,400	$ 100,000	$ -		$ 100,000			$ 2,500,000		$ 20,862,600	3.333	**$ 69,538,420**
2089		$ 250,000									$ -				$ 200,000			$ 675,000	3.673	**$ 2,479,282**
2094		$ 250,000	$ -		$ 3,300,000		$ 1,272,000			$ 100,000	$ -		$ 100,000			$ 2,500,000		$ 11,283,000	4.048	**$ 45,668,069**

TOTAL PRESENT WORTH:	**$ 413,866,728**
TOTAL MAINTENANCE EXPENDITURES (2022):	$ 129,700,800

TABLE 2.3

LIFE CYCLE COSTS - PASSERELLE PEDESTRIAN BRIDGE ALTERNATIVE 3

Mid Point of Construction:	2022	Discount Rate:	2.00%
Calculation Start	2020	Inflation Rate:	4.00%
Completion of Construction:	2024	Interest Rate (effective):	-2.00%
Construction Duration:	4 years	Escalation:	0.00

Year	Original Construction	Cleaning, Washing, and Joint Sealing (All 3 Alternatives)	Timber Deck Partial Replacement (Alternative 1 Only)	Timber Deck Full Replacement (Alternative 1 Only)	Steel Repair and Localized Painting	Steel Repair	Concrete Deck Repair (All 3 Alternatives)	Concrete Deck Full Replacement	Steel Painting 100%	Railing and Fence Repair	Railing and Fence Repair Timber Deck	Complete Railing and Fence Replacement Corresponding to Full Deck Replacement	Lighting Repairs	Complete Lighting Replacement Due to Full Deck Replacement	LIRR and TA Force Account for Minor Maintenance	LIRR and TA Force Account for Preventative Maintenance	LIRR and TA Force Account for Rehabilitation	Total Major Maintenance Cost with 50% Contingency (before inflation)	Present Worth Factor	**Present Worth of Total Major Maintenance Costs**
2022 Unit Price	$ 122,600,000	$ 250,000	$ 55	$ 65	$ 55	$ 50	$ 120	$ 100.00	$ 2,304,000	$ 250		$ 600	$ 100,000	$ 1,000,000	$ 200,000	$ 2,000,000	$ 4,000,000			
Unit	LS	LS	SF	SF	LB	LB	SF	SF	LS	LF	LF	LF	LS	LS	LS	LS	LS			
Quantity	1	1			15,000	30,000	10,600	106,000	1	400		2,700	1	1	1	1	1			
Cost (2022 dollars)	$ 122,600,000	$ 250,000	$ -	$ -	$ 825,000	$ 1,500,000	$ 1,272,000	$ 10,600,000	$ 2,304,000	$ 100,000	$ -	$ 1,620,000	$ 100,000	$ 1,000,000	$ 200,000	$ 2,000,000	$ 4,000,000			
Frequency (in years)	-	5	10	20	10	20	10	40	20	10	5	40	10	40	5	20	40			
2021	$ 40,866,667																	$ 40,866,667	1.000	**$ 40,866,667**
2022	$ 40,866,667																	$ 40,866,667	1.000	**$ 40,866,667**
2023	$ 40,866,667																	$ 40,866,667	1.000	**$ 40,866,667**
2029		$ 250,000									$ -				$ 200,000			$ 675,000	1.146	**$ 773,279**
2034		$ 250,000	$ -		$ 825,000						$ -				$ 200,000			$ 1,912,500	1.262	**$ 2,414,346**
2039		$ 250,000									$ -				$ 200,000			$ 675,000	1.391	**$ 939,004**
2044		$ 250,000	$ -	$ -		$ 1,500,000	$ 1,272,000		$ 2,304,000	$ 100,000	$ -		$ 100,000			$ 2,000,000		$ 11,289,000	1.533	**$ 17,305,540**
2049		$ 250,000									$ -				$ 200,000			$ 675,000	1.689	**$ 1,140,248**
2054		$ 250,000	$ -		$ 825,000		$ 1,272,000			$ 100,000	$ -		$ 100,000		$ 200,000			$ 4,120,500	1.861	**$ 7,670,281**
2059		$ 250,000									$ -				$ 200,000			$ 675,000	2.051	**$ 1,384,621**
2064		$ 250,000	$ -	$ -		$ 1,500,000		$ 10,600,000	$ 2,304,000		$ -	$ 1,620,000		$ 1,000,000			$ 4,000,000	$ 31,911,000	2.260	**$ 72,132,910**
2069		$ 250,000									$ -				$ 200,000			$ 675,000	2.491	**$ 1,681,367**
2074		$ 250,000	$ -		$ 825,000						$ -				$ 200,000			$ 1,912,500	2.745	**$ 5,249,599**
2079		$ 250,000									$ -				$ 200,000			$ 675,000	3.025	**$ 2,041,711**
2084		$ 250,000	$ -	$ -		$ 1,500,000	$ 1,272,000		$ 2,304,000	$ 100,000	$ -		$ 100,000			$ 2,000,000		$ 11,289,000	3.333	**$ 37,628,063**
2089		$ 250,000									$ -				$ 200,000			$ 675,000	3.673	**$ 2,479,282**
2094		$ 250,000	$ -		$ 825,000		$ 1,272,000			$ 100,000	$ -		$ 100,000		$ 200,000			$ 4,120,500	4.048	**$ 16,677,770**

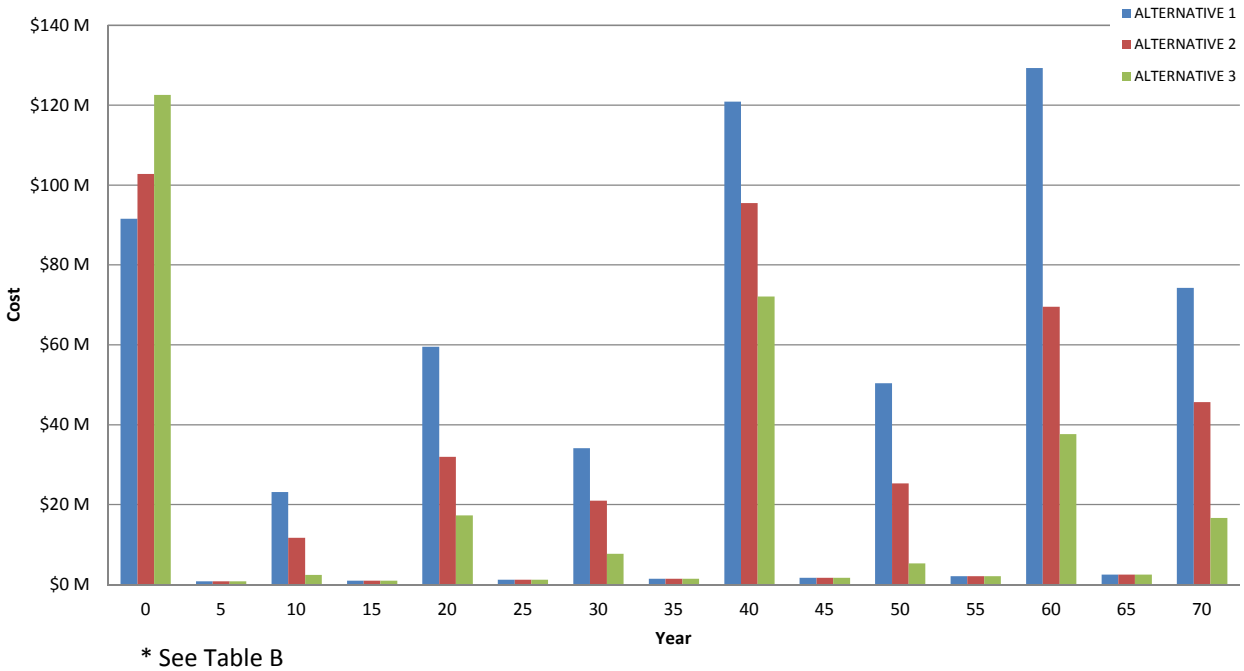
TOTAL PRESENT WORTH:	**$ 292,118,022**
TOTAL MAINTENANCE EXPENDITURES (2022):	$ 71,280,000

		TABLE A CONSTRUCTION AND MAINTENANCE COST (2022 DOLLAR VALUE)			TABLE B CONSTRUCTION AND MAINTENANCE (PRESENT WORTH)		
		ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
INITIAL COST	0	$91.60 M	$102.80 M	$122.60 M	$91.60 M	$102.80 M	$122.60 M
MAINTENANCE COST	5	$0.68 M	$0.68 M	$0.68 M	$0.77 M	$0.77 M	$0.77 M
	10	$18.34 M	$09.23 M	$01.91 M	$23.15 M	$11.65 M	$02.41 M
	15	$0.68 M	$0.68 M	$0.68 M	$0.94 M	$0.94 M	$0.94 M
	20	$38.80 M	$20.86 M	$11.29 M	$59.48 M	$31.98 M	$17.31 M
	25	$0.68 M	$0.68 M	$0.68 M	$01.14 M	$01.14 M	$01.14 M
	30	$18.34 M	$11.28 M	$04.12 M	$34.14 M	$21.00 M	$07.67 M
	35	$0.68 M	$0.68 M	$0.68 M	$01.38 M	$01.38 M	$01.38 M
	40	$53.48 M	$42.23 M	$31.91 M	$120.89 M	$95.47 M	$72.13 M
	45	$0.68 M	$0.68 M	$0.68 M	$01.68 M	$01.68 M	$01.68 M
	50	$18.34 M	$09.23 M	$01.91 M	$50.34 M	$25.32 M	$05.25 M
	55	$0.68 M	$0.68 M	$0.68 M	$02.04 M	$02.04 M	$02.04 M
	60	$38.80 M	$20.86 M	$11.29 M	$129.33 M	$69.54 M	$37.63 M
	65	$0.68 M	$0.68 M	$0.68 M	$02.48 M	$02.48 M	$02.48 M
	70	$18.34 M	$11.28 M	$04.12 M	$74.23 M	$45.67 M	$16.68 M
Total		**$300.77 M**	**$232.50 M**	**$193.88 M**	**$593.61 M**	**$413.87 M**	**$292.12 M**
EUAC	1%				$11.29 M	$07.87 M	$05.55 M
	2%				$15.35 M	$10.70 M	$07.55 M
	3%				$19.99 M	$13.93 M	$09.84 M

		TABLE C ACCUMALATIVE COST (PRESENT WORTH)			TABLE D ACCUMALATIVE COST (2022 DOLLAR VALUE)		
		ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
INITIAL COST	0	$91.60 M	$102.80 M	$122.60 M	$91.60 M	$102.80 M	$122.60 M
MAINTENANCE COST	5	$92.37 M	$103.57 M	$123.37 M	$92.28 M	$103.48 M	$123.28 M
	10	$115.53 M	$115.22 M	$125.79 M	$110.62 M	$112.70 M	$125.19 M
	15	$116.47 M	$116.16 M	$126.73 M	$111.29 M	$113.38 M	$125.86 M
	20	$175.95 M	$148.14 M	$144.03 M	$150.09 M	$134.24 M	$137.15 M
	25	$177.09 M	$149.28 M	$145.17 M	$150.77 M	$134.91 M	$137.83 M
	30	$211.23 M	$170.28 M	$152.84 M	$169.11 M	$146.20 M	$141.95 M
	35	$212.61 M	$171.67 M	$154.23 M	$169.78 M	$146.87 M	$142.62 M
	40	$333.50 M	$267.14 M	$226.36 M	$223.26 M	$189.11 M	$174.53 M
	45	$335.18 M	$268.82 M	$228.04 M	$223.94 M	$189.78 M	$175.21 M
	50	$385.52 M	$294.14 M	$233.29 M	$242.28 M	$199.01 M	$177.12 M
	55	$387.57 M	$296.18 M	$235.33 M	$242.95 M	$199.68 M	$177.80 M
	60	$516.90 M	$365.72 M	$272.96 M	$281.76 M	$220.54 M	$189.08 M
	65	$519.38 M	$368.20 M	$275.44 M	$282.43 M	$221.22 M	$189.76 M
	70	$593.61 M	$413.87 M	$292.12 M	$300.77 M	$232.50 M	$193.88 M

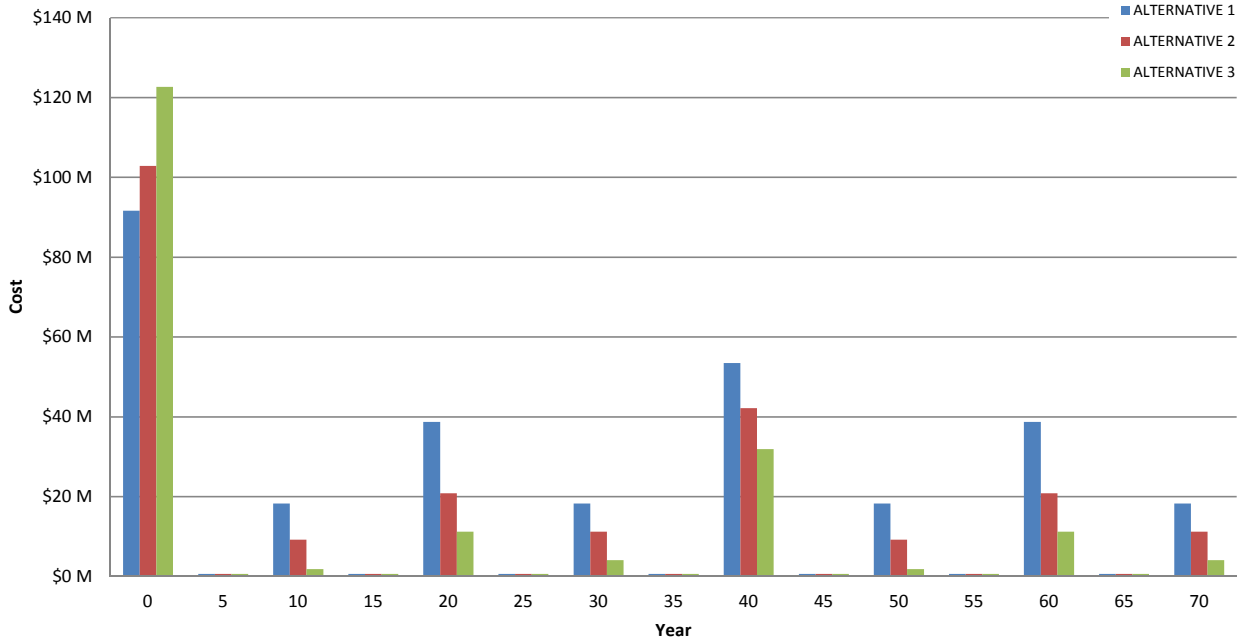
TABLE E EQUAL UNIFORM ANNUAL COST		
ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
$15.35 M	**$10.70 M**	**$7.55 M**

Chart 1:
Rehabilitation and Maintenance Costs (Present Worth, 75 Years)
Per Maintenance Cycle



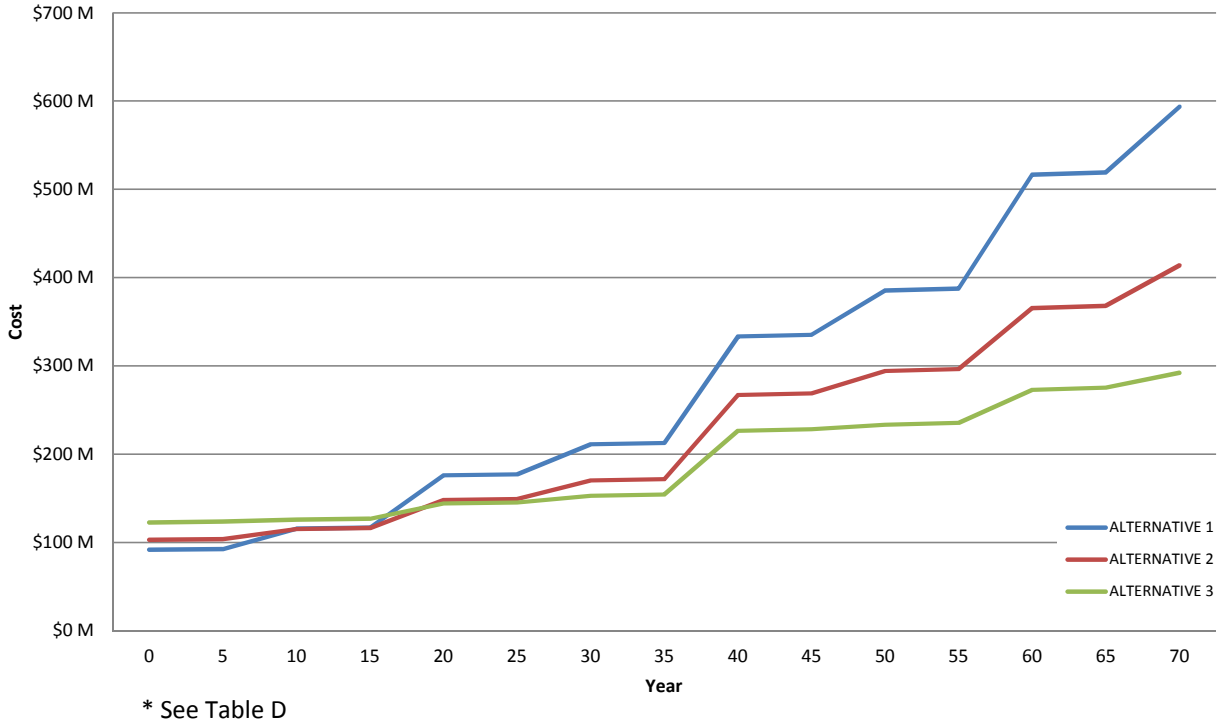
* See Table B

Chart 2:
Rehabilitation and Maintenance Costs (2022 Dollar Value)
Per Maintenance Cycle



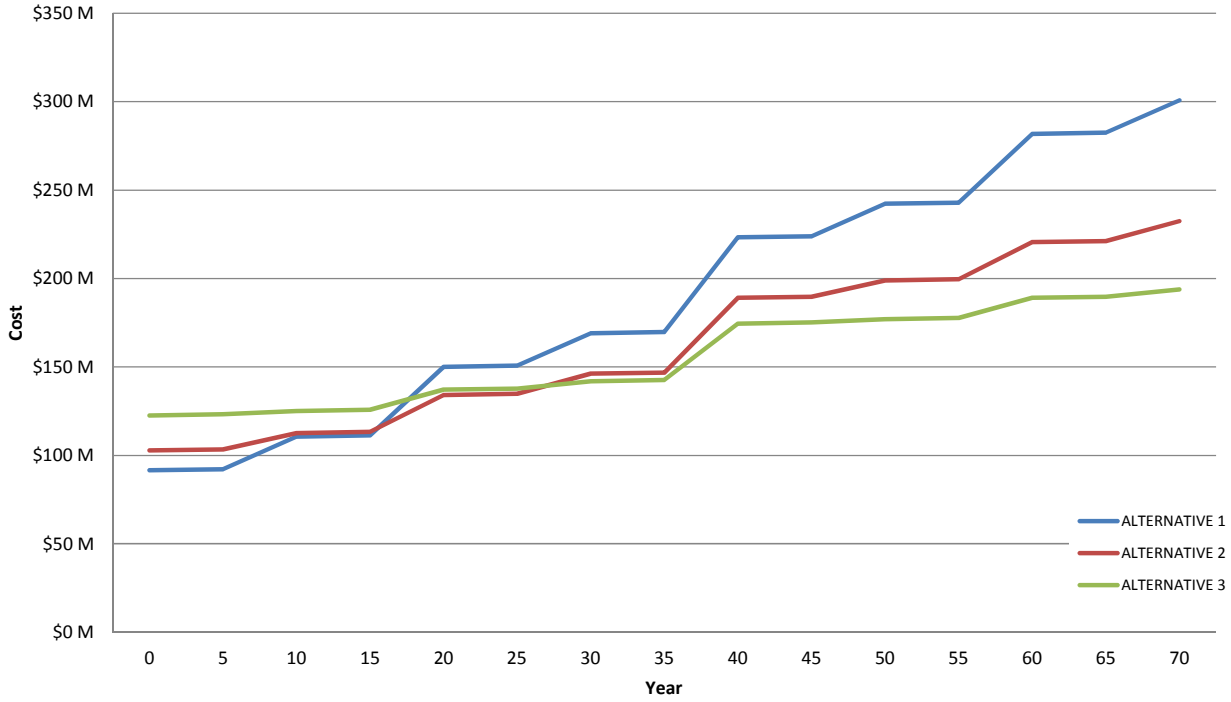
* See Table A

Chart 3:
Accumalative Cost (Present Worth, 75 Years)



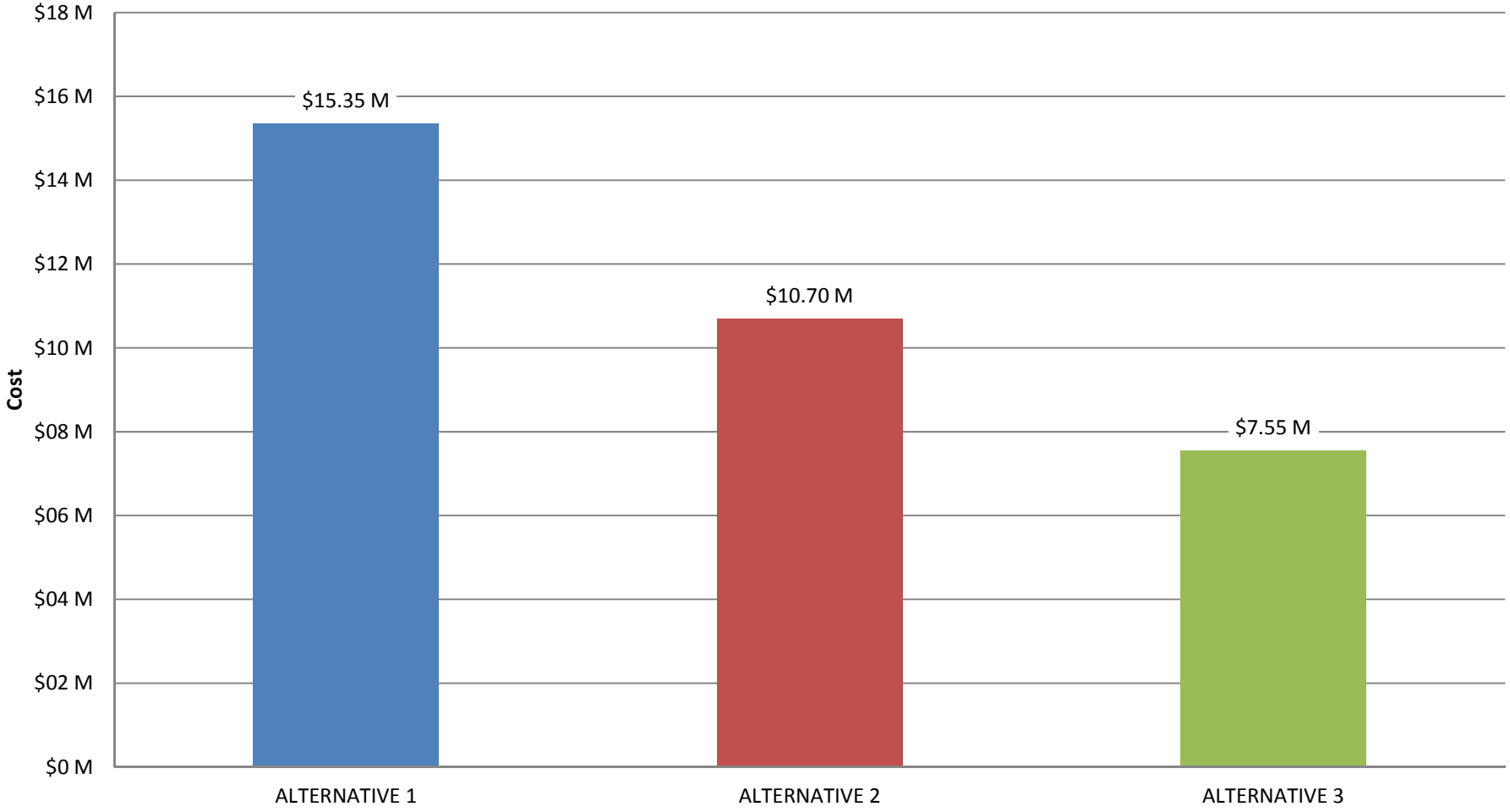
* See Table D

Chart 4:
Accumalative Cost (2022 Dollar Value)



* See Table C

Chart 5:
Equal Uniform Annual Cost



* See Table E