



## PROJECT DESCRIPTION

The Northampton Street Toll-Supported Bridge (NHSTSB) Rehabilitation Project provided the complete rehabilitation of the bridge to extend its useful service life and preclude the need for major repairs for an additional 15 years. The bridge is owned and operated by the Delaware River Joint Toll Bridge Commission, and the need for rehabilitation stems from their commitment to the maintenance of their bridges as well as the need to provide transportation services to the communities on both sides of the Delaware River. The bridge carries Northampton Street over the Delaware River and connects Easton, PA to Phillipsburg, NJ. It is a double cantilever truss structure (125-foot spans), joined in the center by a 50-foot suspended span forming what appears to be a suspension bridge with spans of 125-300-125 feet. The bridge was constructed in 1895 with various repairs being performed since. In August of 1955, flooding along the Delaware River resulted in significant damage to the structure and the loss of approximately 100 feet of the center span. The bridge was repaired in 1957 and returned to normal service. The bridge is the last remaining structure of its type within the United States and the only one of two remaining in the world. The bridge was designated as a National Historic Civil Engineering Landmark by the American Society of Civil Engineers on September 26, 1995.



Due to the age of the structure (124 years), maintenance must be performed to ensure that this iconic structure continues to serve the adjacent communities for both vehicular and pedestrian traffic. The last major rehabilitation was performed in 2001, and since that time deterioration has continued requiring the next rehabilitation project to maintain the structure in a state of good condition. The project included a verification inspection to quantify the extent of deterioration and formulate appropriate repairs accurately. Various miscellaneous structural steel repairs were performed, including heat straightening of flood-damaged below-deck elements, restoration of various structural components to restore their strength, and replacement of the midspan top chord eyebars. The project also involved the complete repainting of the existing structure to eliminate active corrosion and extend the useful service life of existing components. During construction additional efforts were required to ensure proper cleaning of the lower chord panel points due to the tight detailing of numerous components and susceptibility to pack rust and crevice corrosion. Supplemental inspections were performed following the blast cleaning to document the lower chord panel point conditions accurately.

The project also included the replacement of the 20-year-old fiber-reinforced polymer (FRP) sidewalk decking that had come to the end of its useful service life. An evaluation of several replacement alternatives was performed, with a closed-cell FRP deck system chosen for the replacement.

In addition to performing repairs to extend the useful service life of the bridge a state-of-the-art architectural lighting system was installed to celebrate the historic structure and highlight its unique features. Installation required replacement of the existing electrical service, components (conduit and wiring), and non-functioning existing lighting. The successful low bidder for the construction project was J.D. Eckman, Inc. of Atglen, PA for \$15.5M.

### **ROLE OF FIRM**

Greenman-Pedersen, Inc. (GPI) led the engineering studies and design of the rehabilitation project and was responsible for all structural aspects; the construction staging sequence; utility coordination; and overall project management. GPI's subconsultants included: Advantage Engineering Associates, P.C. for electrical facility, highway lighting, and ITS design, Domingo Gonzalez Associates, Inc. for architectural lighting design, and ACT Engineers, Inc. for project outreach.

### **Complexity:**

Any proposed rehabilitation work on a structure of this age, complexity, and detailing requires careful attention both during design and construction. Evaluation of the structure condition required attention to every detail and a complete understanding of the function and form of the structure. As the only remaining eyebar double cantilever truss serving vehicular traffic in the United States it was imperative to understand the existing structure behavior and the effects of any documented deterioration. During the life of the structure, it has been exposed to significant damage from numerous flooding events on the Delaware River. Impacts by flood debris has damaged and distorted elements of the structure, changing load paths from the originally constructed geometry. During the historic flooding of 1955 a 100-foot section at the center of the bridge was destroyed. Reconstruction of this section, along with numerous other repairs and strengthening throughout the structure, were performed in 1957 to restore the functionality of the structure. Damages, distortion, loss of components, and reconstruction all affect how the structure behaves and distributes loads. Careful consideration of all these factors was required to ensure any proposed rehabilitation tasks would maintain the safe load-carrying capacity to ensure the continued function of this iconic structure.



### **New Application of Existing Techniques/Originality/Innovation:**

GPI evaluated construction techniques and materials that would reduce the potential for increased maintenance activities following the completion of the project as any activity in the corridor has implications on both vehicular and pedestrian travel between the two communities.

Due to the limits of the existing load-posted structure, it was necessary to ensure that the sidewalk decking replacement system did not significantly increase the dead loads as this would negatively affect the vehicular load carrying capacity of the structure, which is already posted for 3 tons. GPI's alternative analysis for the replacement decking determined that a closed cell FRP decking system was the best solution when considering material weight, installation ease on the already load posted structure, panel lengths to reduce the number of required panel interface joints, slip resistance, anticipated in-service life, and overall cost.

### **Social/Economic Considerations:**

Being the only downtown vehicular and pedestrian corridor for access across the Delaware River between the two river towns, any improvements in safety or reductions in delays directly benefit the regional economy. Minimizing disruptions during construction and providing continued safe passage upon completion of the rehabilitation project benefits both local communities by allowing this critical crossing to function for both commerce and employment.

Since the structure is a National Historic Engineering Landmark its maintenance and continued operation are critical to preserving such an important part of our engineering history.

### **Safety:**

Users of this iconic bridge, both vehicular and pedestrian, rely on this crossing to safely travel between the two river communities. Continued proper maintenance ensures the safe passage across the bridge. Pedestrians rely on a sidewalk decking that is uniform, slip resistant, free from defects, and accessible for those with disabilities. Vehicular traffic relies on a structural system capable of supporting the intended loads and appropriate guide signing and lane use indicators. Appropriate highway and pedestrian lighting is required to provide sufficient illumination, while not detracting from the historic nature of the bridge.

Safety for vehicular and pedestrian traffic, in addition to the safety of the construction workers, was critical during the project's staging analysis. Work zone signing, guidance for vehicles and pedestrians, and buffer zones for construction activities were all carefully considered and tailored to the specific project site to ensure the safety of all within and traversing through the construction zone.

### **Aesthetics and Sustainable Features:**

As part of the rehabilitation, the Delaware River Joint Toll Bridge Commission wanted to install a state-of-the-art architectural lighting system to highlight the structure's unique components and to celebrate the structure's uniqueness. The design and detailing of a complex lighting system required careful consideration of the unique historic nature of the structure, careful placement and attachment within complex components to avoid negatively impacting the existing aesthetics, and ensuring any lighting complemented and didn't detract from the graceful historic elements.

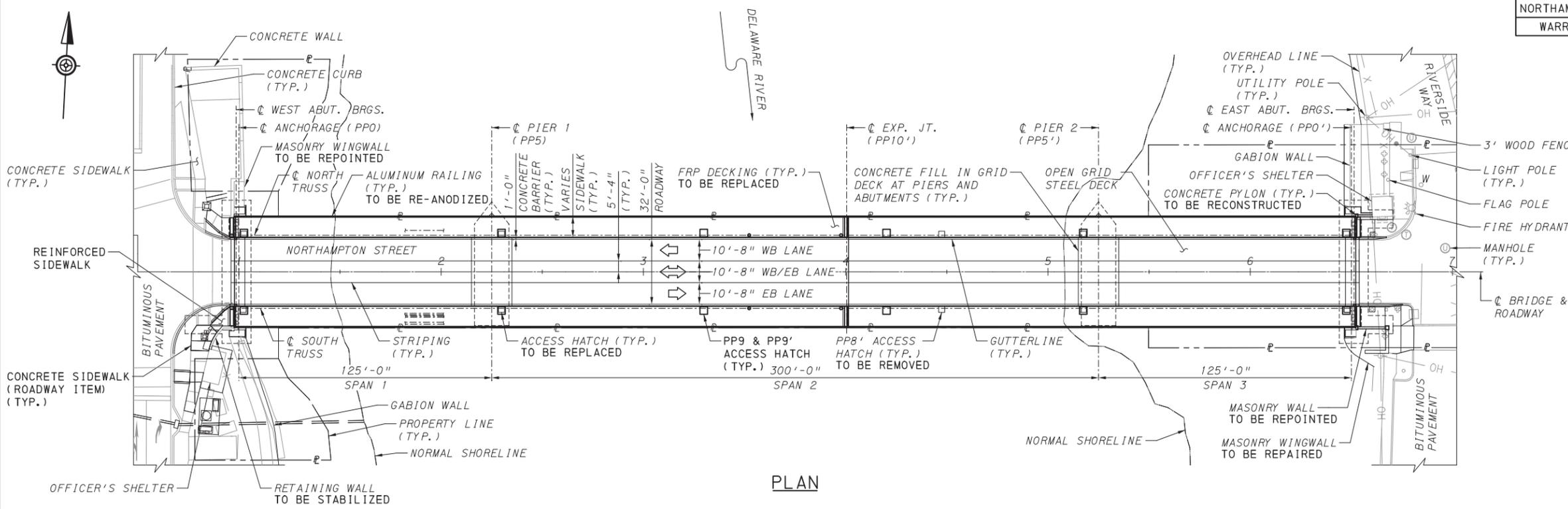
### **Meeting and Exceeding Owner's/Client's Needs:**

The Delaware River Joint Toll Bridge Commission is committed to the maintenance of its bridge to continue to serve the communities they connect while maintaining the individual historic values of the structures. GPI formulated a proposed rehabilitation approach that would perform repairs that would preclude significant repairs for a minimum of 15 years following the Commission's project goals. The project design contract was delayed by one month due to the onset of the Covid-19 pandemic, however, GPI completed the inspection and design on schedule with final contract documents being delivered by the end of 2020. Due to unforeseen delays related to the pandemic, the construction contract was not advertised and awarded until mid-2021, with the majority of construction-related tasks being completed on time by late 2022. Due to additional supply chain issues related to the architectural lighting component delivery the entire project wasn't completed until October of 2023.

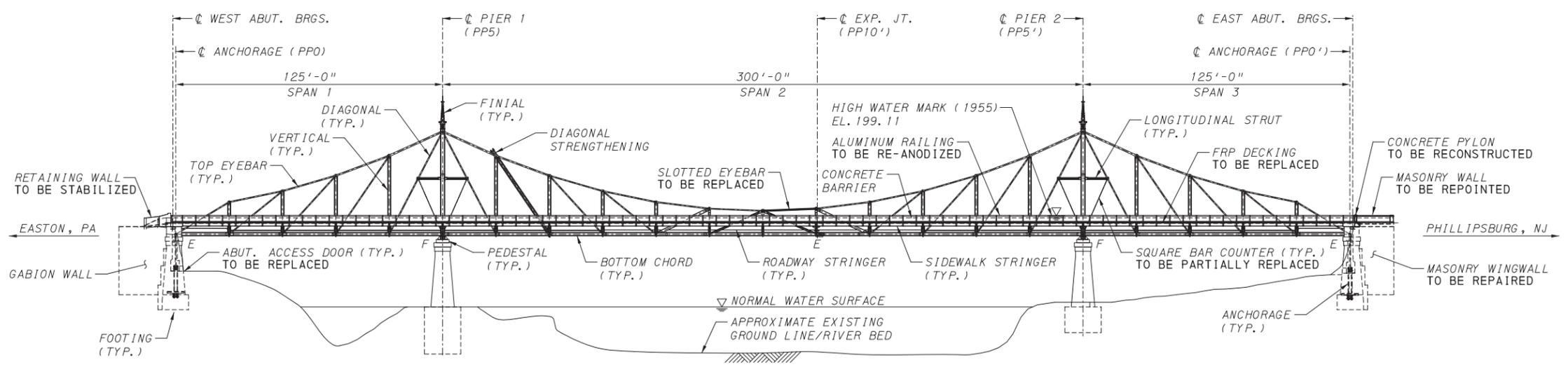
### **Summary**

This project is worthy of special recognition because of its innovative multi-disciplined approach to completing the rehabilitation of a National Historic Engineering Landmark and ensuring continued function to connect the two river towns.

During design and construction GPI, with the support of our client, subconsultants, local stakeholders, and contractor, addressed all the challenges of the project by providing solutions that best fit all considered needs. The project demonstrated a true team effort from all involved working towards the same goal while navigating the industry effects of the pandemic.



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109	SOUTHWEST RETAINING WALL STABILIZATION DETAILS
110	REINFORCEMENT BAR SCHEDULE



- REFERENCES:**
- FOR ROADWAY/PEDESTRIAN LIGHTING NOT SHOWN, SEE HIGHWAY LIGHTING PLANS.
  - FOR ARCHITECTURAL LIGHTING NOT SHOWN, SEE ARCHITECTURAL LIGHTING PLANS.

- LEGEND:**
- E EXPANSION
  - F FIXED

INVENTORY LOAD RATINGS (TONS)	
ELEMENT	H2O LOADING
TRUSS	14.7
STRINGERS	14.5
FLOORBEAMS	12.0

SUPPLEMENTAL DRAWING LIST		
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS	JANUARY 31, 2019
BC-755M	BEARINGS	JANUARY 31, 2019
BC-767M	NEOPRENE STRIP SEAL DAM	JANUARY 31, 2019
BC-783M	REINFORCED CONCRETE REPAIR	JANUARY 31, 2019

- RATING NOTES:**
- THE BRIDGE IS CURRENTLY POSTED FOR 3 TONS.
  - RATINGS UTILIZE LFR METHODOLOGY. TRUSS AND STRINGER RATINGS OBTAINED FROM 2019 PENNONI REHABILITATION STUDY SUMMARY REPORT.

MARK	DESCRIPTION	BY	CHK.	APP'D.	DATE
REVISIONS					



DELAWARE RIVER JOINT TOLL BRIDGE COMMISSION  
YARDLEY, PENNSYLVANIA

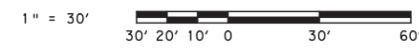
NORTHAMPTON STREET  
TOLL-SUPPORTED BRIDGE REHABILITATION

GENERAL PLAN, ELEVATION &  
INDEX OF DRAWINGS

SCALE: 1" = 30'-0"  
DATE: JULY 2, 2021

CONTRACT NO.  
TS-590A

SHEET NO. 71 OF 110



PLOT BY: mbrldges  
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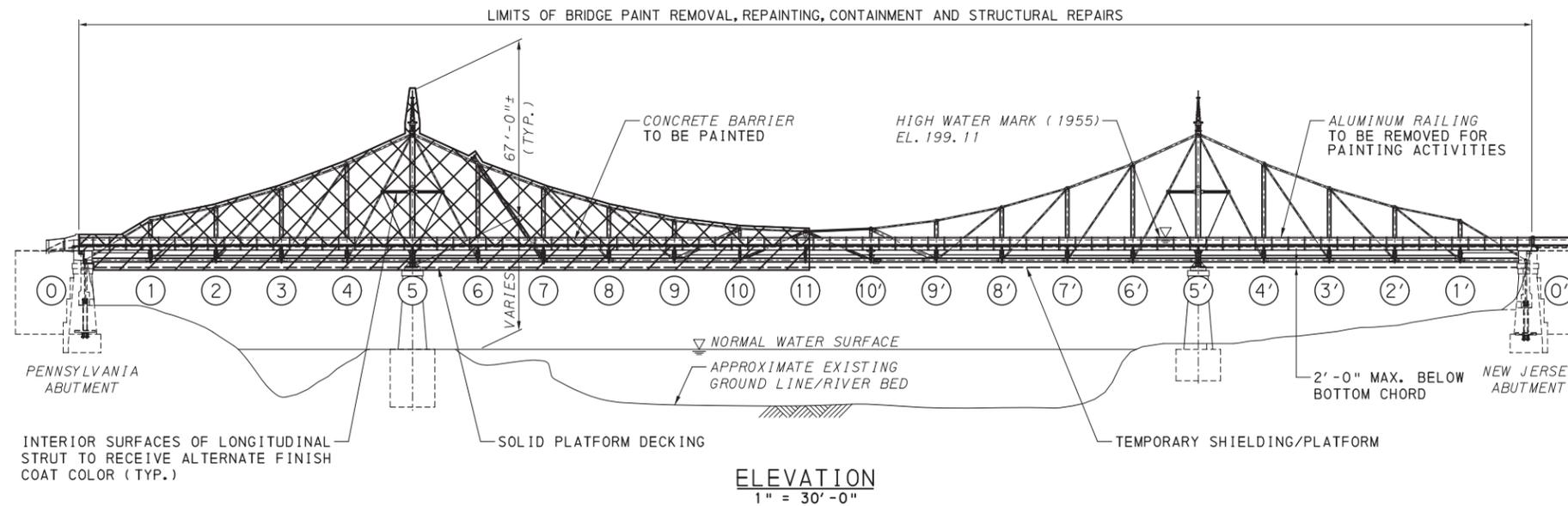
COUNTY	TOWNSHIP / CITY	ROUTE	TOTAL SHEETS
NORTHAMPTON, PA	EASTON	NORTHAMPTON STREET	110
WARREN, NJ	PHILLIPSBURG		

**NOTES:**

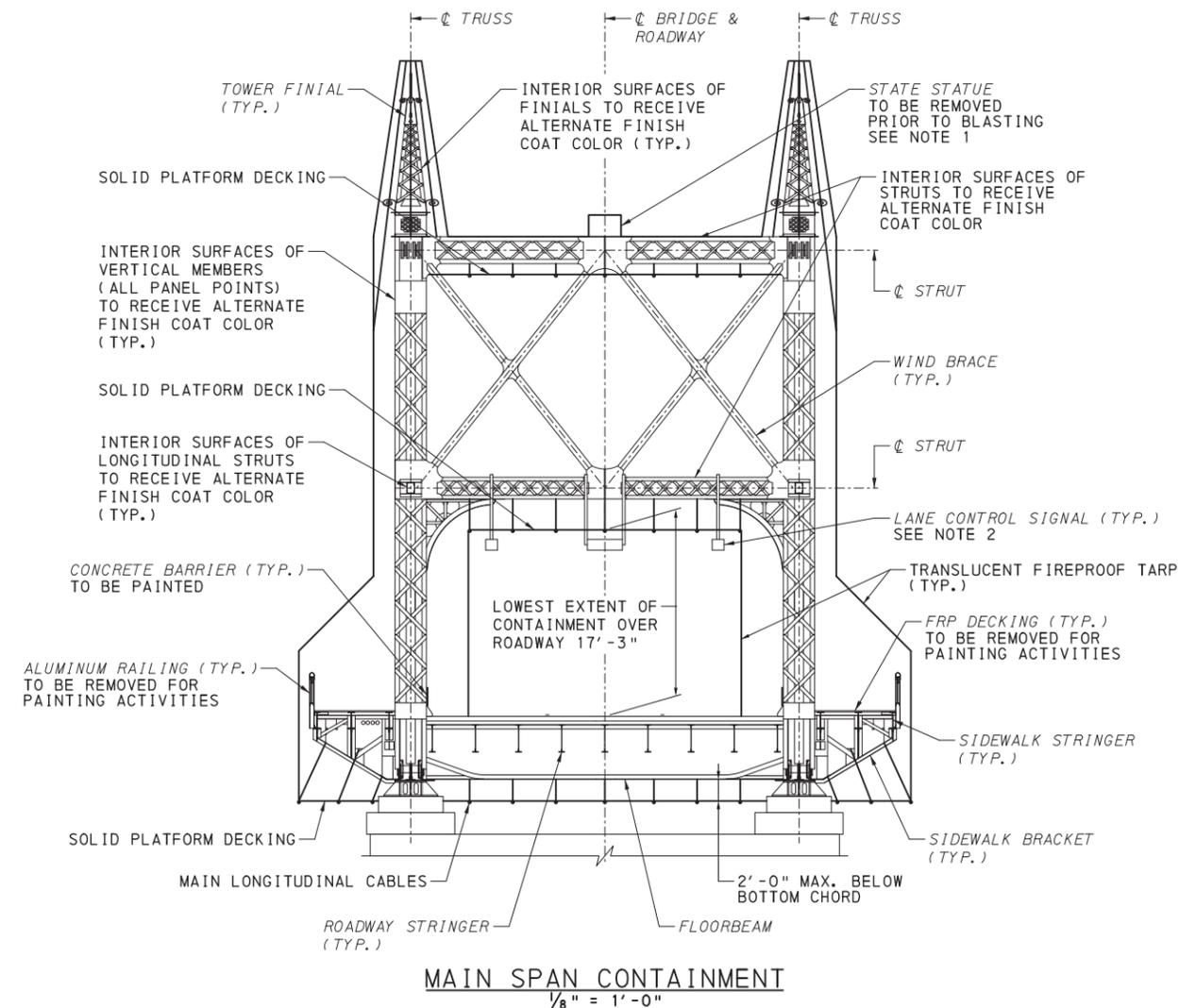
- STATE STATUES ARE TO BE REMOVED, DELIVERED FOR RE-GILDING, PICKED UP FROM GUILDER, AND REINSTALLED UPON COMPLETION OF PAINTING.
- LANE CONTROL SIGNALS ARE TO BE MAINTAINED DURING CONSTRUCTION.
- THE CONCEPTUAL CONTAINMENT SCHEME IS SHOWN FOR INFORMATION PURPOSES. THE CONTRACTOR IS RESPONSIBLE FOR DESIGN AND APPROVAL OF THE PROPOSED SYSTEM.

**LEGEND:**

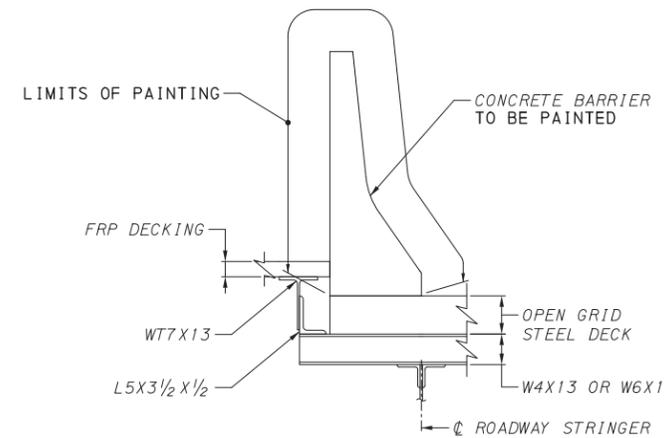
- (X) TRUSS PANEL POINT
- [Cross-hatched box] MAXIMUM PERMISSIBLE ABOVE DECK CONTAINMENT LIMITS TO BE INSTALLED AT ANY ONE TIME (1/2 OF BRIDGE LENGTH AND ONE TRUSS LINE)
- [Diagonal hatched box] MAXIMUM PERMISSIBLE BELOW DECK CONTAINMENT LIMITS TO BE INSTALLED AT ANY ONE TIME (1/2 OF BRIDGE LENGTH)



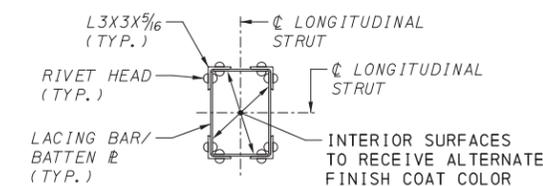
**ELEVATION**  
1" = 30'-0"



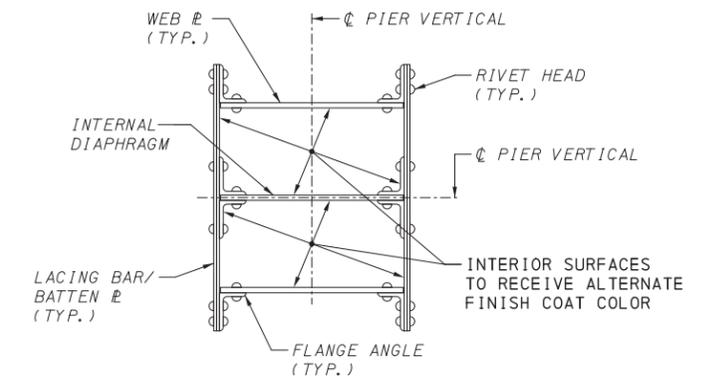
**MAIN SPAN CONTAINMENT**  
1/8" = 1'-0"



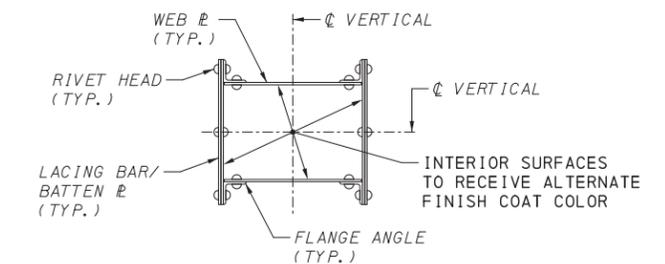
**CONCRETE BARRIER SECTION**  
1" = 1'-0"



**LONGITUDINAL STRUT SECTION**  
1" = 1'-0"



**PIER VERTICAL SECTION**  
1" = 1'-0"



**VERTICAL SECTION**  
1" = 1'-0"

MARK	DESCRIPTION	BY	CHK.	APP'D.	DATE
REVISIONS					

**GPI** Engineering Design Planning Construction Management  
100 Corporate Drive, Suite 301  
Lebanon, NJ 08833

DELAWARE RIVER JOINT TOLL BRIDGE COMMISSION  
YARDLEY, PENNSYLVANIA

NORTHAMPTON STREET  
TOLL-SUPPORTED BRIDGE REHABILITATION

CONTAINMENT AND PAINTING  
DETAILS

SCALE: AS NOTED  
DATE: JULY 2, 2021

CONTRACT NO.  
TS-590A

SHEET NO. 82 OF 110

PLOT BY: mbrldges  
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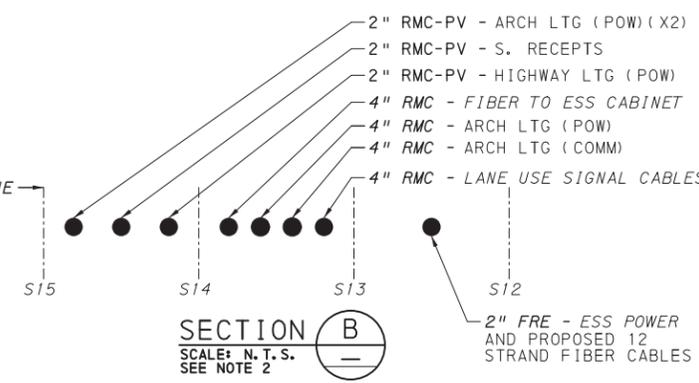
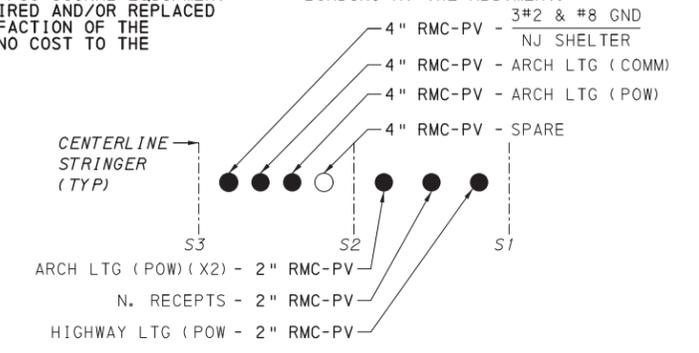
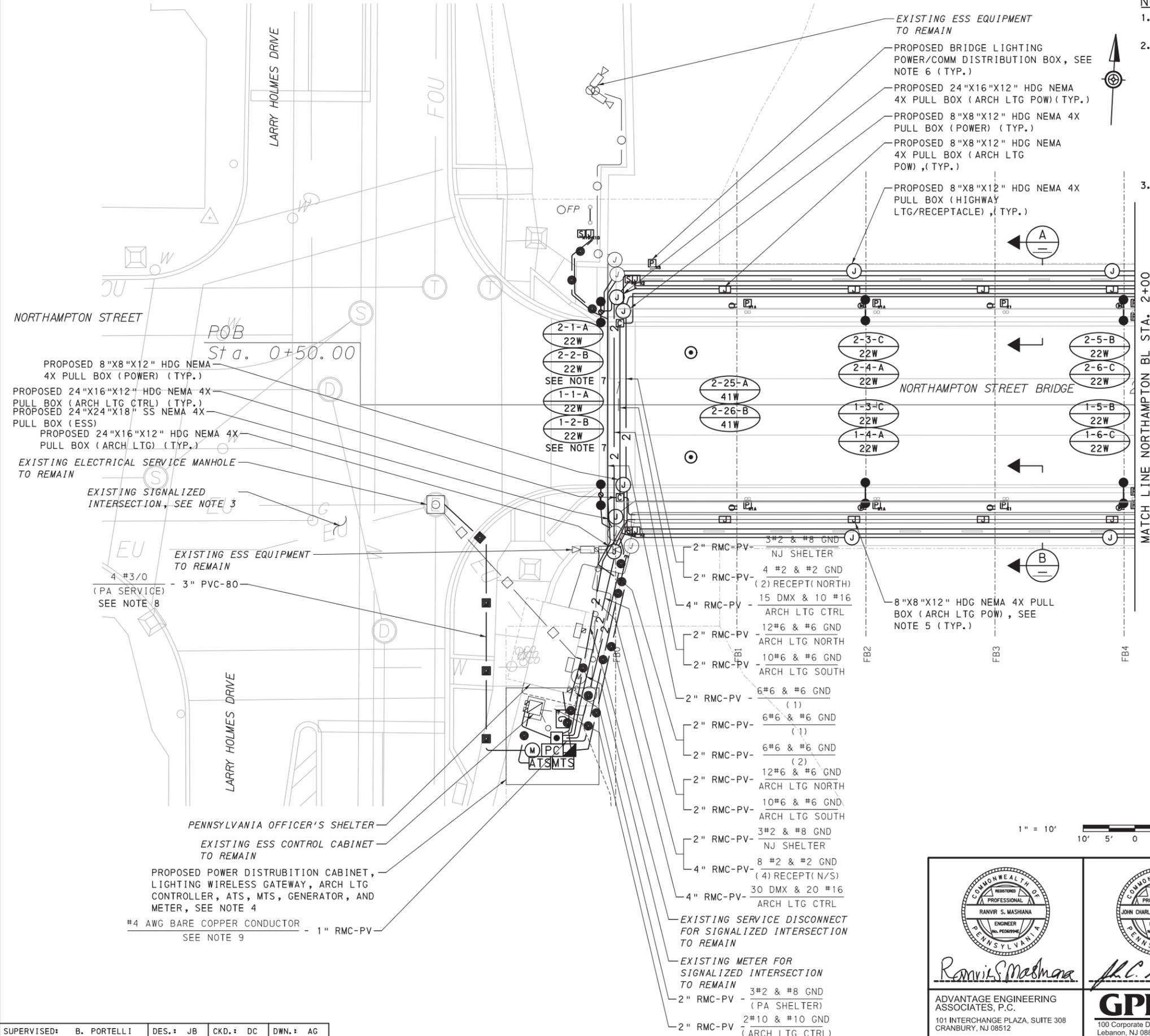
SUPERVISED: J. SCHROETTNER DES.: JWB CKD.: MED DWN.: MJB



COUNTY	TOWNSHIP / CITY	ROUTE	TOTAL SHEETS
NORTHAMPTON, PA	EASTON	NORTHAMPTON STREET	110
WARREN, NJ	PHILLIPSBURG		

**NOTES:**

- SEE SHEET 21 AND 22 FOR LEGEND, ABBREVIATIONS, AND GENERAL NOTES.
- NOT ALL CONDUITS AND CABLES SHOWN FOR CLARITY. CALL OUTS FOR ARCHITECTURAL AND HIGHWAY LIGHTING FIXTURES AND TRUSS MOUNTED RECEPTACLES BRANCH CONDUITS AND CABLES ARE NOT SHOWN FOR CLARITY. SEE SHEETS 50 THROUGH 69 FOR ARCHITECTURAL LIGHTING PLANS AND DETAILS. SEE SHEET 42 FOR HIGHWAY LIGHTING POWER WIRING DIAGRAM. SEE ON SHEET 43 FOR ARCHITECTURAL LIGHTING POWER WIRING DIAGRAM. SEE SHEET 48 FOR ASSOCIATED CABLE AND CONDUIT SCHEDULES.
- EXISTING TRAFFIC SIGNALS FOR SIGNALIZED INTERSECTION AND LIGHTING ARE NOT OWNED OR MAINTAINED BY THE COMMISSION. MAINTAIN EXISTING SERVICE TO TRAFFIC SIGNALS. ANY DAMAGE TO EXISTING TRAFFIC SIGNAL EQUIPMENT WILL BE REPAIRED AND/OR REPLACED TO THE SATISFACTION OF THE ENGINEER AT NO COST TO THE COMMISSION.
- SEE SHEETS 33 THROUGH 35 FOR POWER DISTRIBUTION CENTER, ATS, MTS, AND METER ELECTRICAL SERVICE PAD DETAILS.
- INTERCEPT EXISTING 4" CONDUIT AND INSTALL 8"X8"X12" HDG NEMA 4X PULL BOX. SEE SHEETS 36 AND 37 FOR TYPICAL BRIDGE RACEWAY MOUNTING DETAILS.
- UTILIZE CONDUIT BODIES TO ROUTE DMX CABLES TO AND FROM ARCH LIGHTING POWER/DATA CONVERTER BOXES AND JUNCTION BOXES.
- SEE STRUCTURAL DETAILS ON RECONSTRUCTION OF WALL AND SIDEWALK FOR LIGHT POLE FOUNDATION DETAILS.
- FIRSTENERGY/MET-ED TO FURNISH AND INSTALL CONDUIT AND CABLE FROM MANHOLE TO METER. SEE SHEETS 32 AND 33.
- SEE SHEET 39 FOR GROUNDING AND BONDING AT THE ABUTMENT.



MARK	DESCRIPTION	BY	CHK.	APP'D.	DATE

REVISIONS



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DELAWARE RIVER JOINT TOLL BRIDGE COMMISSION  
YARDLEY, PENNSYLVANIA

**NORTHAMPTON STREET  
TOLL-SUPPORTED BRIDGE REHABILITATION**

**HIGHWAY LIGHTING PLAN - 1**

SCALE: 1"=10'  
DATE: JULY 2, 2021

CONTRACT NO. TS-590A

SHEET NO. 28 OF 110

PLOT BY: alex.enr.iguaz  
 PLOT DATE: 9/22/2021 2:58:10 PM  
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NO TURN ON RED

WEIGHT LIMIT STRICTLY ENFORCED  
WEIGHT LIMIT 3 TONS  
GVWR

OPEN GRATING





January 12, 2024

**ASHE 2024 Project of the Year Award  
Northampton Street Toll-Supported Bridge Rehabilitation**

**Re: Attendance Commitment**

I certify that at least one representative from the project team will be in attendance for the ASHE awards luncheon.

Sincerely,  
**GREENMAN-PEDERSEN, INC.**



John C. Schroettner, PE  
Assistant Vice President/Project Manager  
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