

# **APPENDIX A**

## **ENGINEERING REPORT**

- Appendix A.1 - Below Deck Infrastructure Matrix
- Appendix A.2 - Proposed Changes to Amtrak Yard
- Appendix A.3 - Design Process & Methodology
- Appendix A.4 - Mid Day Storage Yard Analysis
- Appendix A.5 - Deck Coverage Evaluation
- Appendix A.6 - Conceptual Deck Design
- Appendix A.7 - Potential Early Investments

## **APPENDIX A.2**

# Proposed Changes to Amtrak Yard

# Sunnyside Yard Master Plan | Proposed Changes to Amtrak Yard

PROJECT:	Sunnyside Yard Master Plan
LEAD:	HNTB
DATE:	14 September 2018
SUBJECT:	Proposed Changes to Amtrak Yard Memo

Proposed Changes to Amtrak Yard:

## 1. Executive Summary

The purpose of this memo is to discuss potential modifications to the Amtrak portion of Sunnyside Yard in order to facilitate the development of an overbuild deck and associated development scenarios. This memo considers various opportunities for flexibility in the Yard that will maximize the available space for construction of the overbuild deck structure within the constraints of the Yard operations, with minimal impact to rail operations for Amtrak, NJ TRANSIT and LIRR. Working with the railroad agencies to determine the feasibility of potential changes will result in achieving a deck height that is feasible, workable, and cost effective.

As part of the initial/preliminary evaluation of the overbuild deck design, the team performed an evaluation of the following items with the goal of identifying ways to optimize the overall design:

- Existing Amtrak Sunnyside Yard (SSY) configuration
- 2014 Amtrak Sunnyside Yard Master Plan
- Amtrak's design standards

This evaluation was conducted to determine the level of flexibility inherent to each of these elements as it pertains to potential modifications that can contribute to the optimization of the overbuild deck design. Each element of SSY – both existing and future – was evaluated in terms of its ability to be modified to accommodate the deck design and assigned a designation of More Flexibility, Moderate Flexibility, and Little to No Flexibility. Items considered in making these designations include:

- Impact to rail operations
- Constructability
- Impact to Amtrak standards/clearances

Items with **More Flexibility** can be modified to accommodate the overbuild deck design with minimal impacts to rail operations or constructability:

- Reducing standard OCS clearances
- Adjusting track spacing for column locations to support maximum 80' spans wherever feasible with 4' structural zones.

Items with **Moderate Flexibility** may require minor exceptions to rail system design standards, or are potential changes to the way the yard is currently operated while maintaining the same purpose and need (changes in this category will involve additional cost and constructability impacts):

- Utilizing subgrade duct banks
- Moving existing ancillary buildings elsewhere on the Northeast Corridor (NEC)

- Moving proposed ancillary buildings in/above the overbuild
- Eliminating existing signal bridges by implementing Reduced Aspect Signals (RAS) on the Mainline.

Items with **Little to No Flexibility** have the potential, if implemented, to fundamentally change how the Yard is utilized to a degree that is assumed to be unacceptable to Amtrak, and/or will involve significant impacts to rail operations or constructability (as well as significant cost impacts, the estimation and analysis of which were not part of the scope of this analysis):

- Moving HSR facilities, substations, and/or maintenance/repair/production facilities elsewhere on the NEC.

It is important to note that all potential changes identified and considered in this document may not be required by the future proposed overbuild deck, and that cost implications have not been evaluated against the benefits of lowering the deck; the exact needs will be determined as the deck coverage evaluation continues.

## 2. Approach

The assessment of potential changes to the Amtrak portion of Sunnyside Yard began with separating the Yard into zones of analysis (see Appendix A.2.A), and then developing a matrix of all existing and proposed infrastructure in the Yard. The matrix identifies limitations, constraints, opportunities, and parameters, setting the stage for an integrated design process between the below-deck and overbuild design teams, and a baseline understanding between stakeholders about the potential opportunities for change.

Using the completed matrix as a reference, the team has begun investigating potential non-standard designs for signals, power, and OCS which may provide opportunities for additional space to accommodate overbuild structural elements. The team has also undertaken an in-depth investigation of the operational and ancillary functions of Yard facilities to determine what elements may be moved elsewhere in the Yard, above deck, or to other locations on the NEC to provide additional space. These analyses and proposals form the bulk of this memo.

## 3. Existing Conditions Overview

Sunnyside Yard is located at the eastern portals of the East River Tunnels on the NEC near the junction of the LIRR and Amtrak-Hellgate Line to New England at Harold Interlocking. The Yard is one of the largest rail yards in the world, devoted strictly to handling passenger trains and is the primary yard for trains terminating and originating at Pennsylvania Station in Manhattan (PSNY). Sunnyside Yard is the primary location for the storage and maintenance of HSR trains operating between Washington and NYC; this facility is responsible for all starts, turns, and finishes for HSR in the southern part of the NEC.

The potential overbuild site at Sunnyside Yard contains an Amtrak HSR facility, off-peak storage for both NJ TRANSIT and Amtrak, major electrical equipment serving the NEC (e.g., frequency converter), S&I facilities and storage, maintenance facilities, Maintenance of Way (MoW) yard, LIRR storage yard, Amtrak/LIRR Mainline, Loop tracks, and private General Motors (GM) property (See Appendices A.2.A & A.2.E). Midday storage of trains for NJ TRANSIT allows for more capacity for revenue passenger trains by reducing the number of “deadhead” moves in the North River Tunnels.

#### 4. Future Conditions

In 2014, Amtrak developed a proposed Master Plan for their portion of SSY. Some of the major planned improvements to the Yard (see Appendix A.2.E) include:

- The existing two track HSR facility will be expanded from two to six tracks
- Expansion of the bowl tracks to provide additional storage and the ability to perform light servicing of the equipment
- Construction of a new MoW yard
- Construction of a new Conventional Repair Shop, Wheel True/Drop Table Building, and Commissary and Materials Management Building

The 2014 Amtrak Master Plan was developed as a guide for the coordination of long term future projects and development within the Yard. While it is understood that some elements of this plan are currently under review by Amtrak and may change, in an effort to advance the SSY Overbuild Master Plan the 2014 Master Plan was utilized as the baseline proposed future condition with the understanding that further evaluations will be necessary should any changes occur.

#### 5. Opportunities for Flexibility and Change

Items with **More Flexibility** are those elements of the Amtrak Master Plan that are more likely to be able to accommodate changes that will optimize the overbuild deck design while minimizing impacts to rail operations for Amtrak, NJ TRANSIT, and LIRR.

- Reduced OCS clearances with along- and cross-track feeder heights
  - A 35'-6" minimum vertical clearance between the bottom of deck and top of rail when along and cross track feeders are present (less than the 40' required by current Amtrak standards). This clearance is strictly related to OCS and may increase based on ventilation requirements (see Appendix A.2.B).
- Reduced OCS clearances without along- and cross-track feeder heights
  - A 22'-8" minimum vertical clearance between bottom of deck and top of rail when along and cross track feeders *are not* present (less than the 27'-9" required by current Amtrak standards). This clearance is strictly related to OCS and may increase based on ventilation requirements (see Appendix A.2.B).
- Adjust track spacing for column locations
  - Structural zones will be spaced to accommodate 80' spans where feasible; in some places span lengths will be adjusted as necessary where this is not possible.
  - Structural zones will require a minimum track spacing of 21' to accommodate a 4' wide column and 8.5' minimum horizontal clearance to the centerline of the adjacent track on either side of the column ( $8.5'+4'+8.5'=21'$ ).
  - Throughout the Yard, minor adjustments to the track centers to allow for a desired span length of 80' can be accommodated as long as the intent and functionality of the Yard tracks, as put forward in the Amtrak Master Plan, is not compromised (e.g., Ready Tracks RT1, RT2, and RA3 can accommodate a slight shift of two feet to allow for columns to be placed between tracks RT2 and RT3; this reduces spacing between tracks RA3 and YT1 from +38' to +36' which continues to allow for future access road operations between the tracks; see Appendix A.2.C).

Items with **Moderate Flexibility** are those elements of the Yard that have the potential to change, but are more difficult in nature, come with higher cost, and/or increase constructability and operational concerns. These potential changes will have to be weighed against the potential benefits to the overbuild design.

- Subgrade duct banks: underground power cables are feeding Amtrak and LIRR substations installed in duct banks and micro-tunnels; relocating these power cables will require extensive design efforts due to their size, operational impact, and limited availability of real estate.
  - 12kV duct bank/micro-tunnel from SUB#44 to Static Frequency Converter Building
  - LIRR G02 substation: positive and negative feeders, and CT Cables in the underground crossing micro-tunnels
  - 12kV Cables: S1, S2, S3 (room for S4) feeders, and 2.4kV signal power cables 122, 123, 124, and 125 from SUB#44 to East River Tunnels (ERT)
  - 26.4kV Con Ed feeders to Amtrak Substation aerial across the Loop tracks and in underground micro-tunnel across the Mainline.
- Move existing ancillary buildings elsewhere on the NEC: these two towers could potentially be incorporated into the New York control center as has been done with other towers along the NEC.
  - Q Tower is already remotely controlled from R Tower, which is a point of coordination of rail activities in the Yard
  - F Tower
- Move proposed ancillary buildings in/above the Yard. It is assumed that a new facility could be incorporated into the overbuild/deck in Zones 3 & 6 if it is more than four tracks.
  - Commissary building – SSY is a primary initial terminal for many trains on the NEC: all trains with café cars on the NEC stock at this location (moving the Commissary building out of the SSY could result in increased dwell time for trains in Manhattan, delays opening café cars, and time would be required for trains coming off the road to clear stock and for employees to go off duty).
  - Focus building – provides a location for employee welfare needs such as locker room, register point for train crews, and administration and other management needs for the Yard.
- Eliminate or reduce the height of existing signal bridges by implementing Reduced Aspect Signals (RAS) on the Main Line as done by LIRR at Jamaica. In some areas, the signals could be affixed to supporting column uprights or like the gooseneck signals used at PSNY. RAS may offer an “Entrance – Exit” feature on the east end of the Yard that controls the entire route for trains from Loop to the Yard track. Reducing the number of signals offers savings in maintenance, especially with the installation of new LED signals; eliminating the signal bridges improves safety as it is no longer necessary to climb over the catenary to change a bulb on a signal.

Items with **Little or No Flexibility** are those elements that are unlikely to be considered for relocation elsewhere in the NEC at this time because they are critical to Yard operations.

- Existing operational facilities
  - Two Track HSR Facility, Track & Structures Building (Building 8), Track & Structures Storage (Building 8a)
  - Wheel truing, running repair, engine house – the nearest equipment servicing on the NEC would be in Boston, Albany, or Washington
  - Substations (AC and DC) – the power supply for the NEC from the Commercial electric grid; moving it would require providing an alternate power source for the 25kV Hz electric traction system

- Mobile maintenance shed – a location is required in SSY to repair and maintain all the vehicles used to service trains; the size of the Yard requires the use of motor vehicles to reduce travel time between trains and the shop
- Proposed operational facilities
  - Six Track HSR Facility – moving the HSR trains to another location on the NEC would require “deadhead” moves to have the HSR trains in position to cover their schedules from PSNY
  - Wheel truing and drop table facility – the nearest repair shop with wheel truing and drop tables are Albany, Boston, and Wilmington
  - Conventional repair shop – nearly all conventional repair shops are more than 100 miles away; track and interlockings in SSY require maintenance and repair, so these features need to be maintained near the Yard, especially in the event of a failure or derailment
  - Engineering / MoW / Production shop – MoW production is located at SSY to support projects and is one of the few locations in NYC where tracks can be accessed from public roads for the delivery of materials; moving some of this work to other locations on the NEC would require delivering trackwork from New Jersey.

Following this analysis, the consultant team will begin to explore proposed changes to the Amtrak Master Plan in tandem with the Deck Coverage Evaluation. As the deck coverage evaluation identifies structural requirements for the future overbuild and further identifies yard impact requirements, the potential modifications discussed in this Proposed Changes to Amtrak Yard memo will need to be further refined and reviewed with Amtrak for incorporation into their ongoing Sunnyside Yard Master Plan efforts.

## 6. Appendices

Appendix A.2.A – Zones

Appendix A.2.B – OCS Clearance Diagrams

Appendix A.2.C – Typical Structural Sections

Appendix A.2.D – Signal Bridges

Appendix A.2.E – Existing and Proposed Facilities

Appendix A.2.F – Facilities Overlaid with Column Analysis

## 7. Acronyms

ERT – East River Tunnels

GM – General Motors

HSR – High Speed Rail

LIRR – Long Island Rail Road

MoW – Maintenance of Way

NEC – Northeast Corridor

OCS – Overhead Contact System

PSNY – Pennsylvania Station

RAS – Reduced Aspect Signals

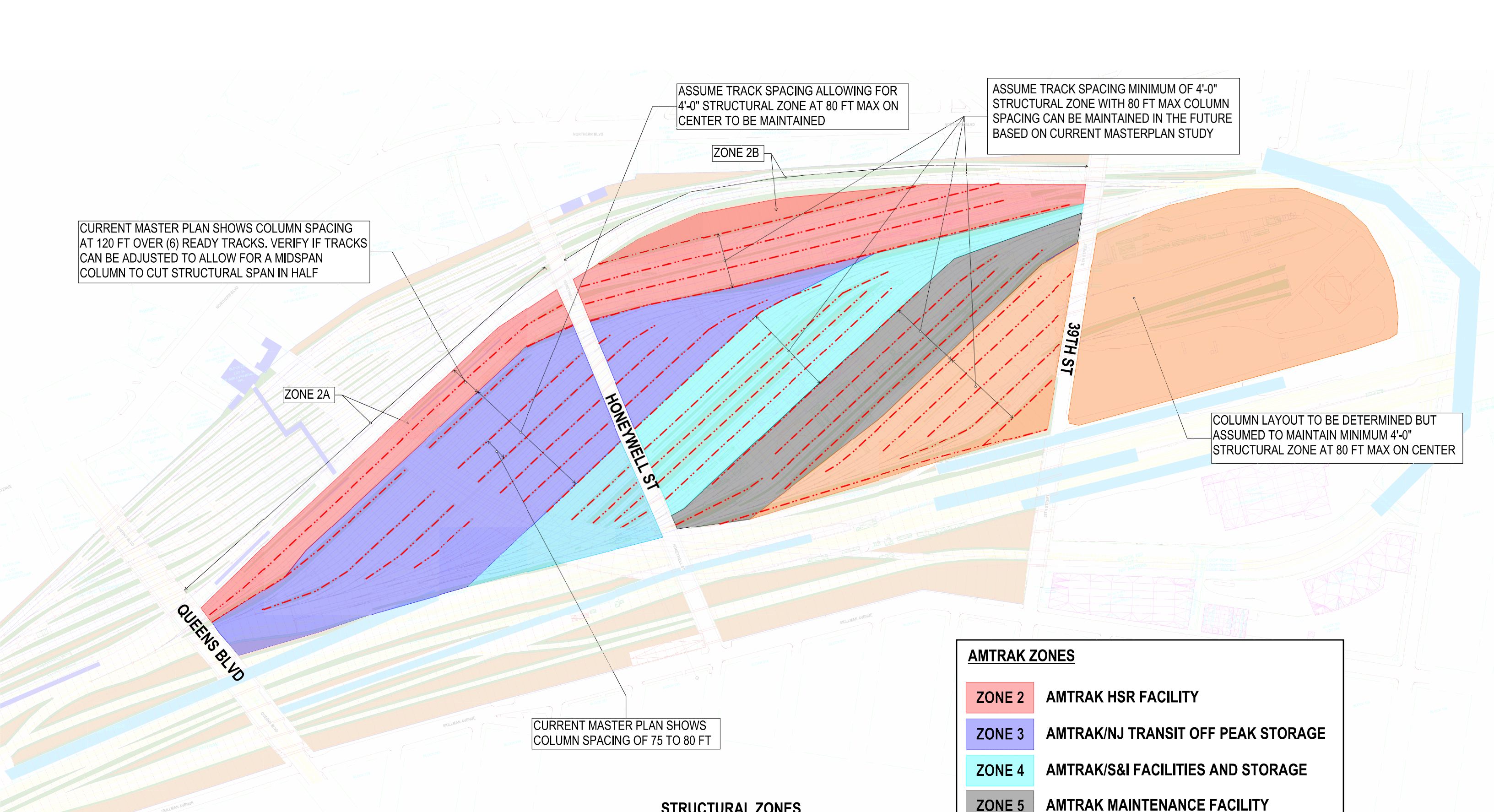
SUB - Substation

SSY – Sunnyside Yard

# **APPENDIX A.2.A**

## **ZONES**





ASSUME TRACK SPACING ALLOWING FOR 4'-0" STRUCTURAL ZONE AT 80 FT MAX ON CENTER TO BE MAINTAINED

ASSUME TRACK SPACING MINIMUM OF 4'-0" STRUCTURAL ZONE WITH 80 FT MAX COLUMN SPACING CAN BE MAINTAINED IN THE FUTURE BASED ON CURRENT MASTERPLAN STUDY

CURRENT MASTER PLAN SHOWS COLUMN SPACING AT 120 FT OVER (6) READY TRACKS. VERIFY IF TRACKS CAN BE ADJUSTED TO ALLOW FOR A MIDSPAN COLUMN TO CUT STRUCTURAL SPAN IN HALF

COLUMN LAYOUT TO BE DETERMINED BUT ASSUMED TO MAINTAIN MINIMUM 4'-0" STRUCTURAL ZONE AT 80 FT MAX ON CENTER

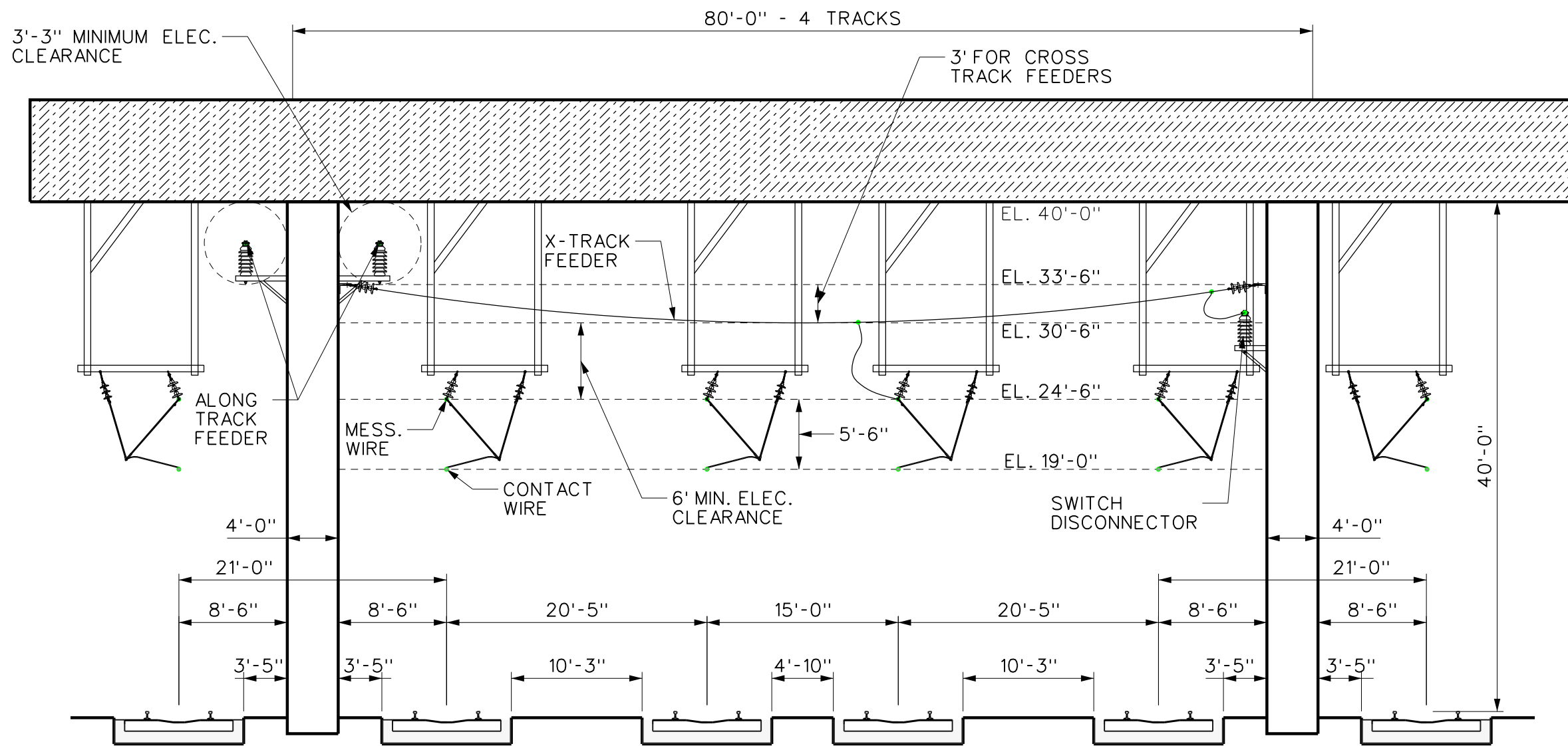
CURRENT MASTER PLAN SHOWS COLUMN SPACING OF 75 TO 80 FT

AMTRAK ZONES	
ZONE 2	AMTRAK HSR FACILITY
ZONE 3	AMTRAK/NJ TRANSIT OFF PEAK STORAGE
ZONE 4	AMTRAK/S&I FACILITIES AND STORAGE
ZONE 5	AMTRAK MAINTENANCE FACILITY
ZONE 6	AMTRAK MoW YARD
- - - - -	ANTICIPATED STRUCTURAL ZONES

**STRUCTURAL ZONES**

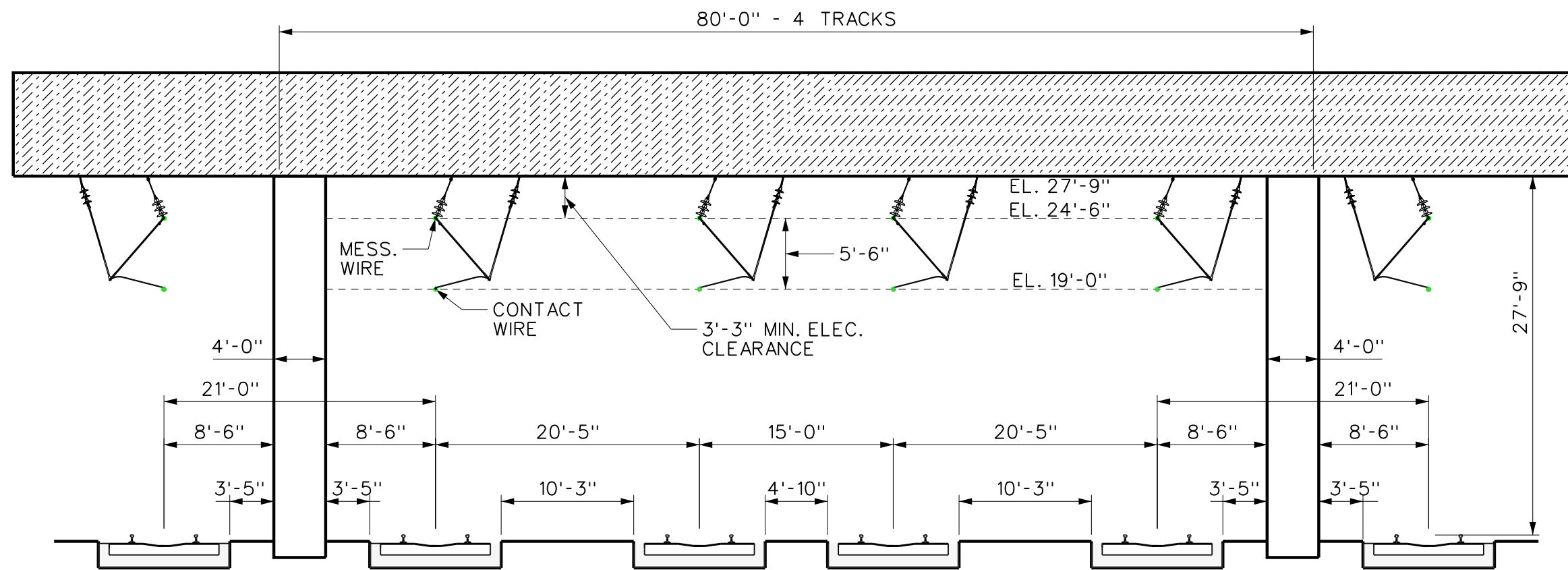
# **APPENDIX A.2.B**

## OCS Clearance Diagrams



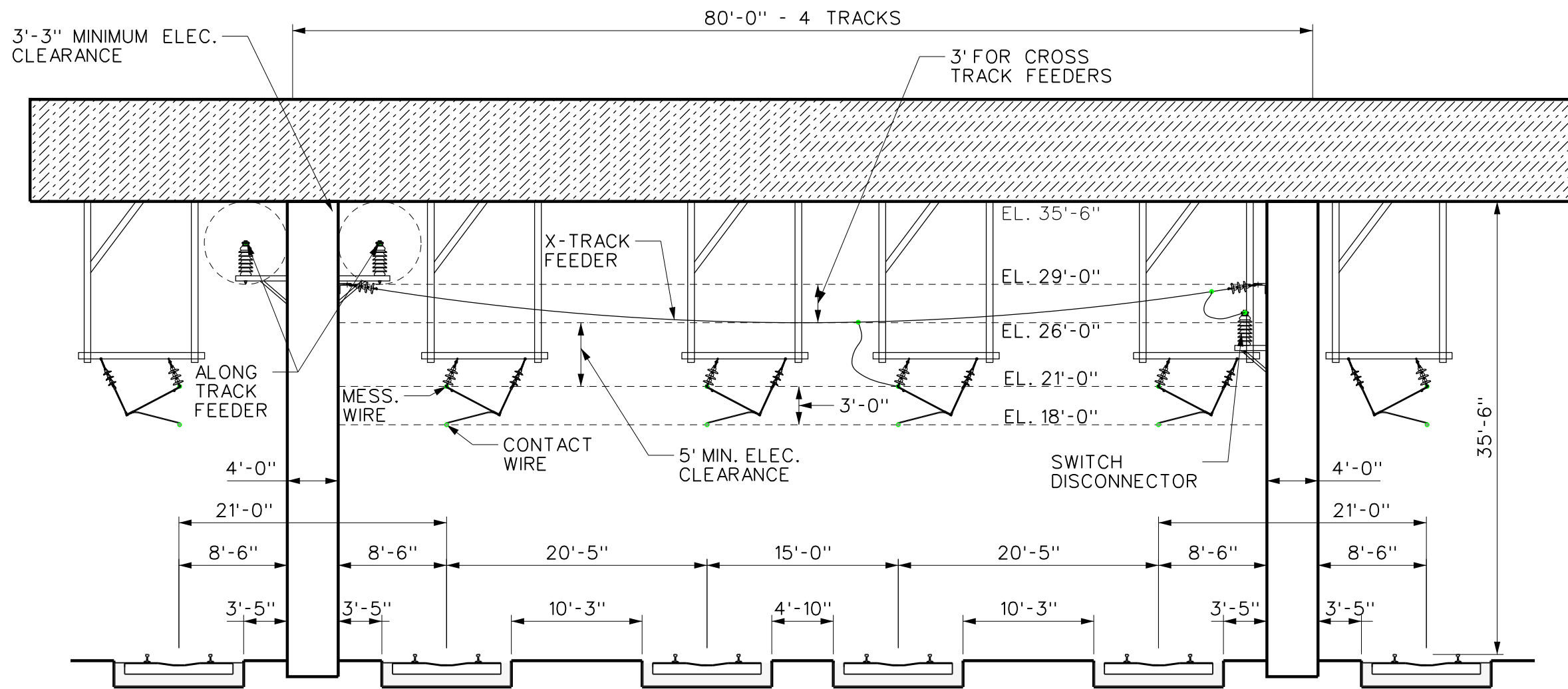
- NOTES:**
1. For Minimum Roadway Clearances refer to AMTRAK ET-200 Drawing.
  2. For electrical clearances shown for cross track feeders, the Gibbs & Hill Principals of Design was used.
  3. SAP assemblies are shown, but other Amtrak approved assemblies may be used.

**STANDARD AMTRAK OCS CLEARANCES WITH ALONG AND CROSS TRACK FEEDERS**



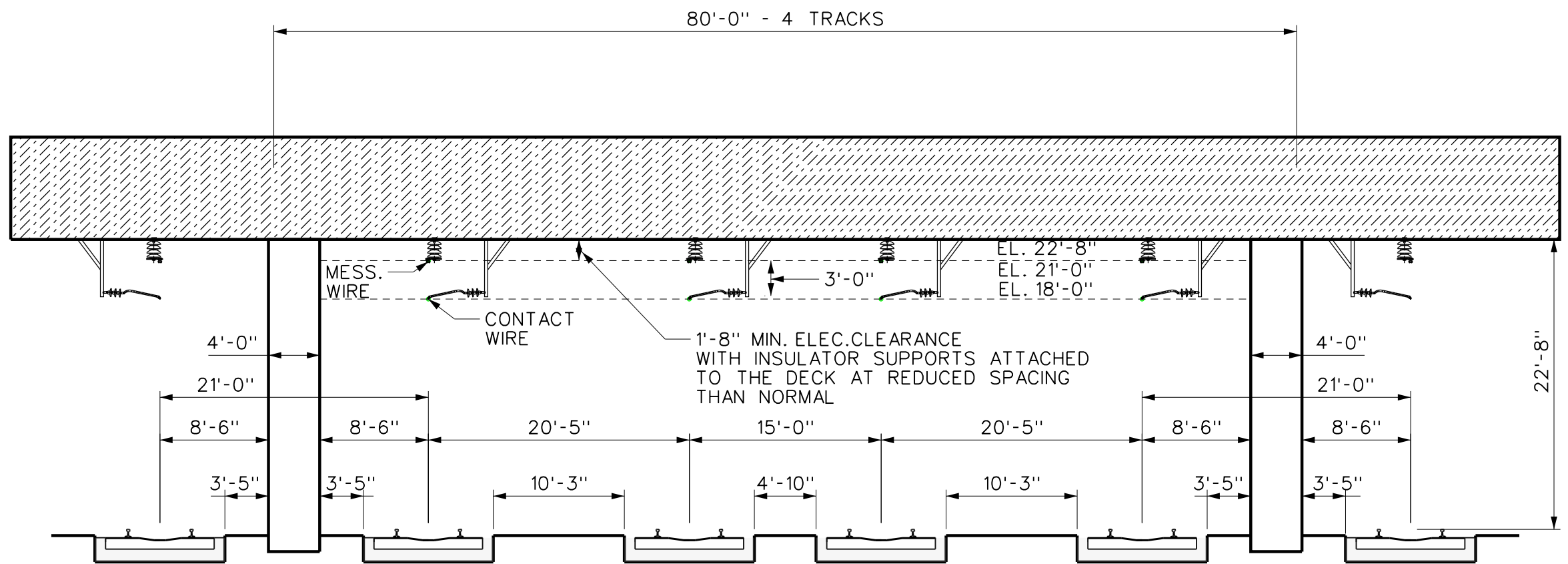
- NOTES:**
1. For Minimum Roadway Clearances refer to AMTRAK ET-200 Drawing.
  2. For electrical clearances shown for cross track feeders, the Gibbs & Hill Principals of Design was used.
  3. SAP assemblies are shown, but other Amtrak approved assemblies may be used.

**STANDARD AMTRAK OCS CLEARANCES WITHOUT ALONG AND CROSS TRACK FEEDERS**



- NOTES:**
1. For Minimum Roadway Clearances refer to AMTRAK ET-200 Drawing.
  2. For electrical clearances shown for cross track feeders, the Gibbs & Hill Principals of Design was used.
  3. SAP assemblies are shown, but other Amtrak approved assemblies may be used.

**REDUCED AMTRAK OCS CLEARANCES WITH ALONG AND CROSS TRACK FEEDERS**

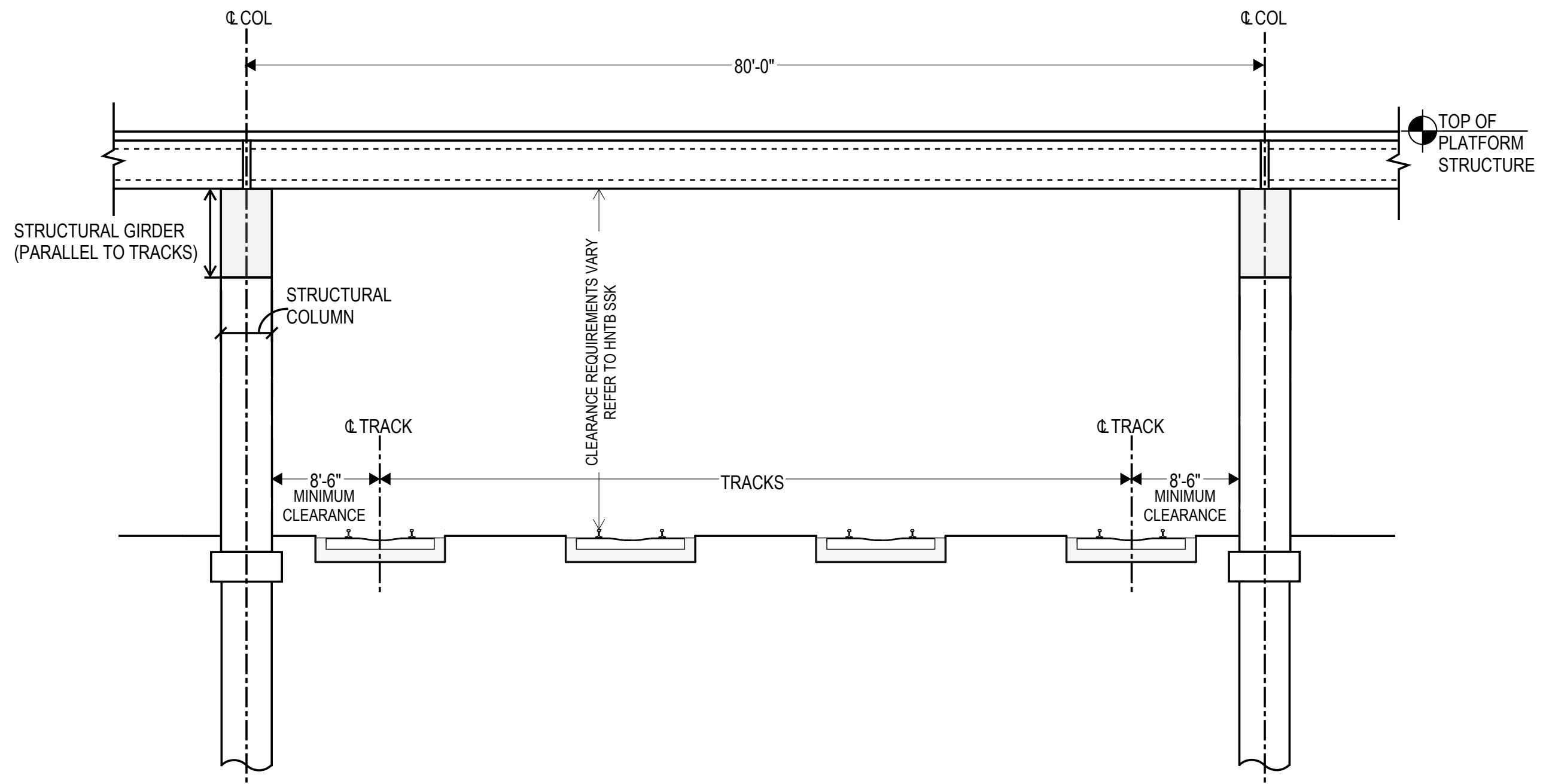


- NOTES:**
1. For Minimum Roadway Clearances refer to AMTRAK ET-200 Drawing.
  2. For electrical clearances shown for cross track feeders, the Gibbs & Hill Principals of Design was used.
  3. Typical registration assemblies are shown, but other Amtrak-approved assemblies may be used.

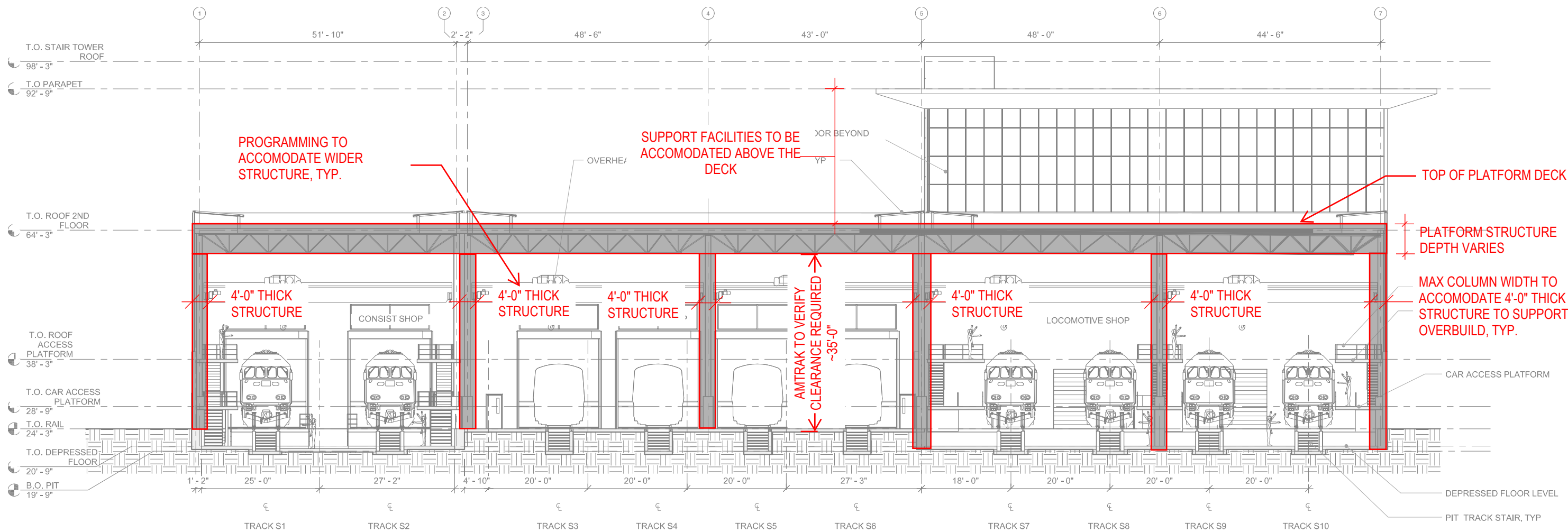
**REDUCED AMTRAK OCS CLEARANCES WITHOUT ALONG AND CROSS TRACK FEEDERS**

# **APPENDIX A.2.C**

## Typical Structural Sections







1  
-  
CONVENTIONAL SHOP - TRANSVERSE SECTION (EXAMPLE SECTION)  
SCALE: 1" = 10'-0"  
0 5' 10' 20'  
1" = 10'-0"

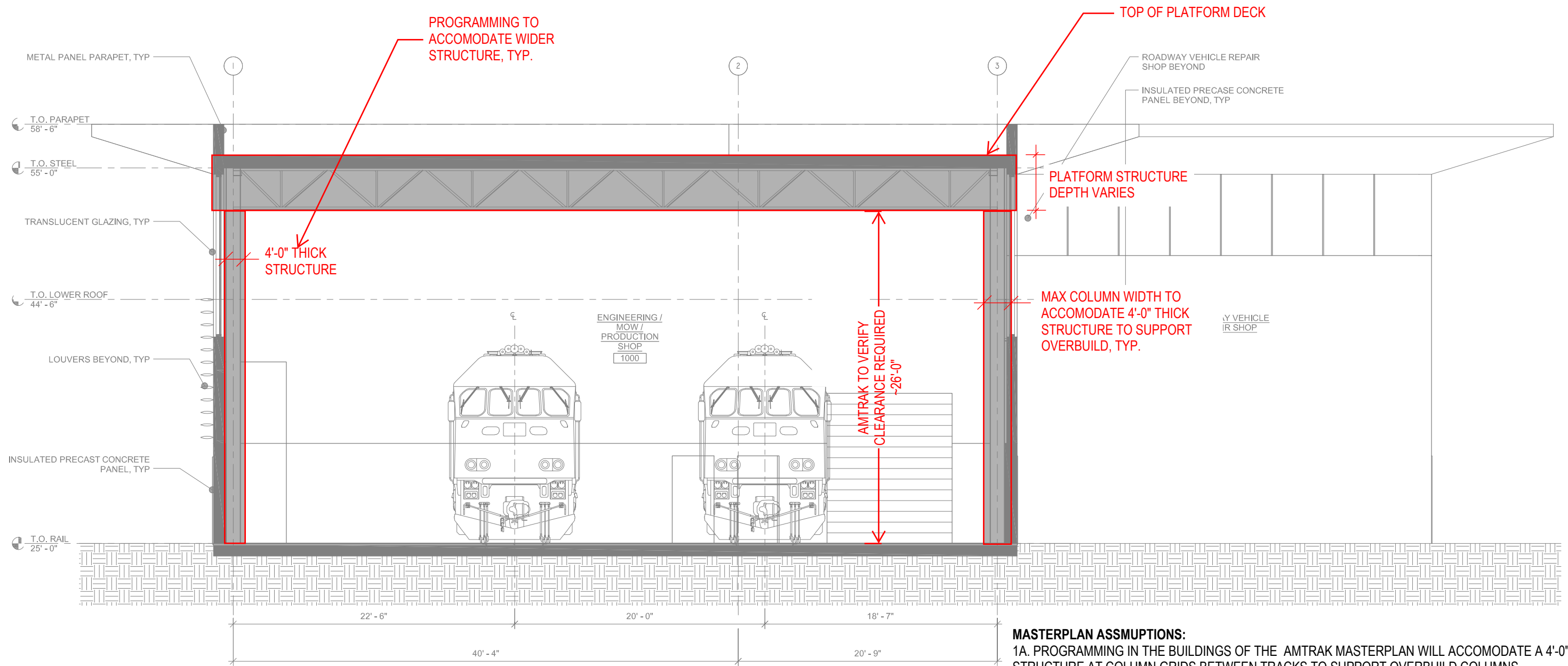
**MASTERPLAN ASSUMPTIONS:**

1A. PROGRAMMING IN THE BUILDINGS OF THE AMTRAK MASTERPLAN WILL ACCOMODATE A 4'-0" WIDE STRUCTURE AT COLUMN GRIDS BETWEEN TRACKS TO SUPPORT OVERBUILD COLUMNS

1B. COLUMNS WITHIN BUILDINGS OF THE AMTRAK MASTERPLAN WILL BE DESIGNED TO ACCOMODATE OVERBUILD LOADS

2. PLATFORM STRUCTURE WILL ACCOMODATE VERTICAL CLEARANCE REQUIREMENTS AND SERVE AS THE ROOF OF THE BUILDINGS. THE BUILDINGS WILL BE FITTED OUT AFTER THE PLATFORM IS CONSTRUCTED.

3. FOR MULTI-STORY BUILDINGS IN THE MASTER PLAN, THE SECOND FLOOR CONTAINING ANY SUPPORT FACILITIES WILL BE COORDINATED TO BE PLACED ABOVE THE DECK



1  
-  
ENGINEERING / MOW / PRODUCTION SHOP - TRANSVERSE SECTION (EXAMPLE SECTION)  
SCALE: 1/4" = 1'-0"  
1' 0 2' 4' 8'  
1/4" = 1'-0"

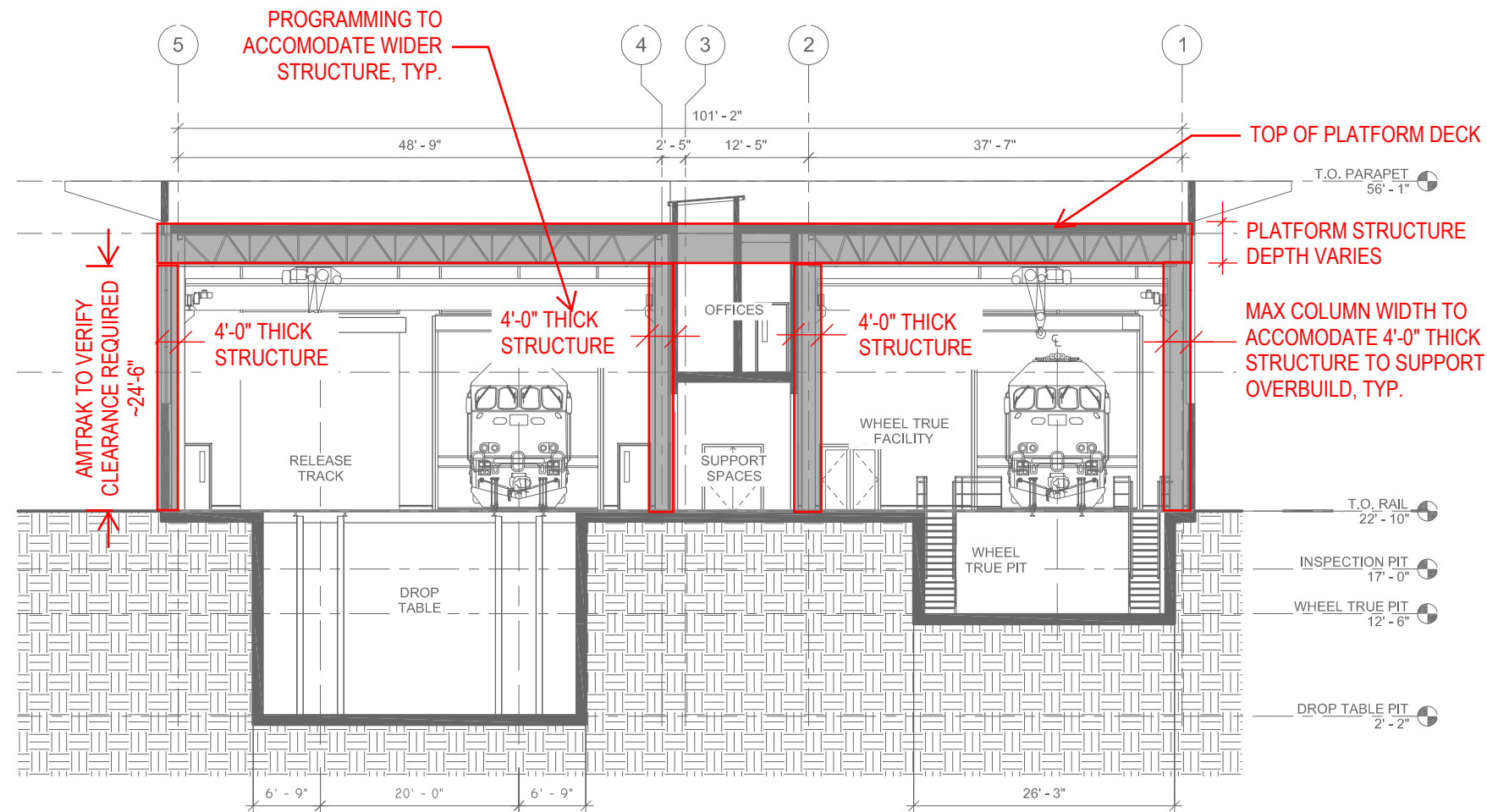
**MASTERPLAN ASSUMPTIONS:**

1A. PROGRAMMING IN THE BUILDINGS OF THE AMTRAK MASTERPLAN WILL ACCOMODATE A 4'-0" WIDE STRUCTURE AT COLUMN GRIDS BETWEEN TRACKS TO SUPPORT OVERBUILD COLUMNS

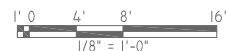
1B. COLUMNS WITHIN BUILDINGS OF THE AMTRAK MASTERPLAN WILL BE DESIGNED TO ACCOMODATE OVERBUILD LOADS

2. PLATFORM STRUCTURE WILL ACCOMODATE VERTICAL CLEARANCE REQUIREMENTS AND SERVE AS THE ROOF OF THE BUILDINGS. THE BUILDINGS WILL BE FITTED OUT AFTER THE PLATFORM IS CONSTRUCTED.

3. FOR MULTI-STORY BUILDINGS IN THE MASTER PLAN, THE SECOND FLOOR CONTAINING ANY SUPPORT FACILITIES WILL BE COORDINATED TO BE PLACED ABOVE THE DECK



1  
-  
WHEEL TRUE FACILITY & DROP TABLE - TRANSVERSE SECTION (EXAMPLE SECTION)  
SCALE: 1/8" = 1'-0"



**MASTERPLAN ASSUMPTIONS:**

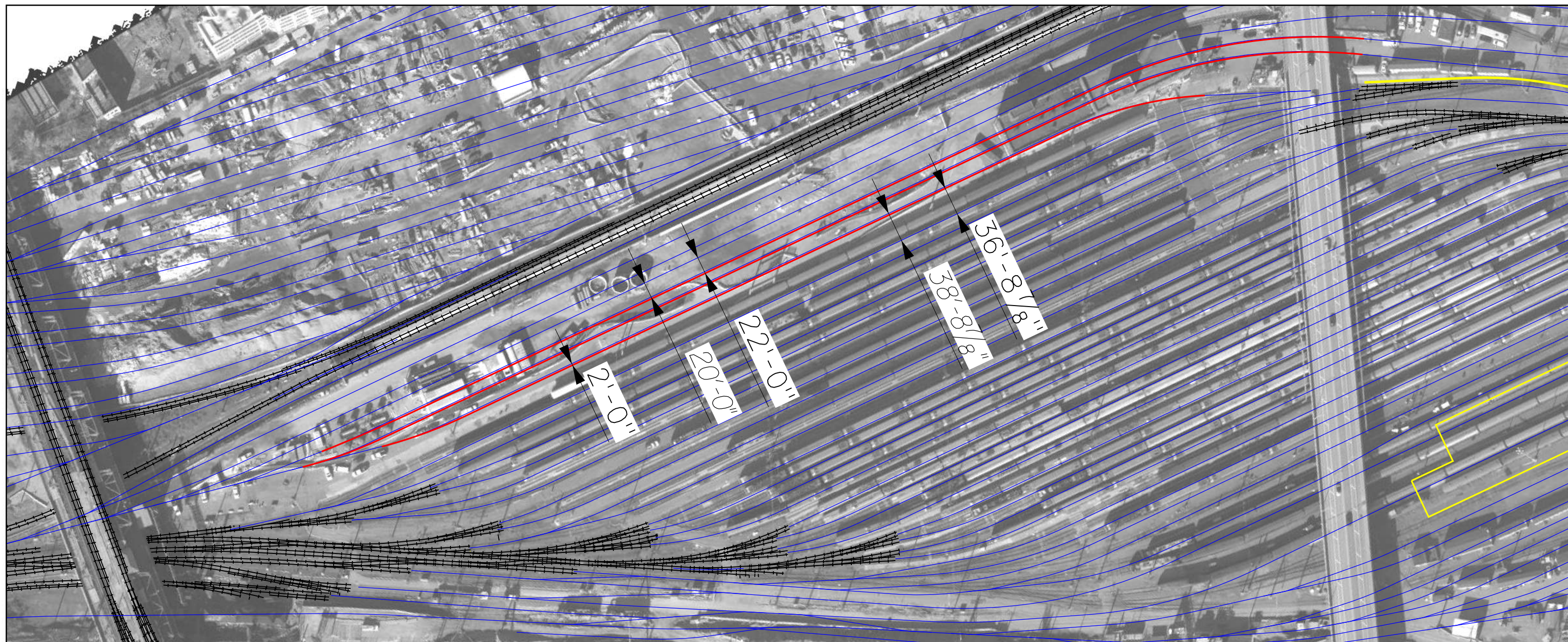
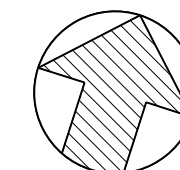
1A. PROGRAMMING IN THE BUILDINGS OF THE AMTRAK MASTERPLAN WILL ACCOMODATE A 4'-0" WIDE STRUCTURE AT COLUMN GRIDS BETWEEN TRACKS TO SUPPORT OVERBUILD COLUMNS

1B. COLUMNS WITHIN BUILDINGS OF THE AMTRAK MASTERPLAN WILL BE DESIGNED TO ACCOMODATE OVERBUILD LOADS

2. PLATFORM STRUCTURE WILL ACCOMODATE VERTICAL CLEARANCE REQUIREMENTS AND SERVE AS THE ROOF OF THE BUILDINGS. THE BUILDINGS WILL BE FITTED OUT AFTER THE PLATFORM IS CONSTRUCTED.

3. FOR MULTI-STORY BUILDINGS IN THE MASTER PLAN, THE SECOND FLOOR CONTAINING ANY SUPPORT FACILITIES WILL BE COORDINATED TO BE PLACED ABOVE THE DECK

— AMTRAK MASTER PLAN ALIGNMENTS  
— MODIFIED ALIGNMENTS



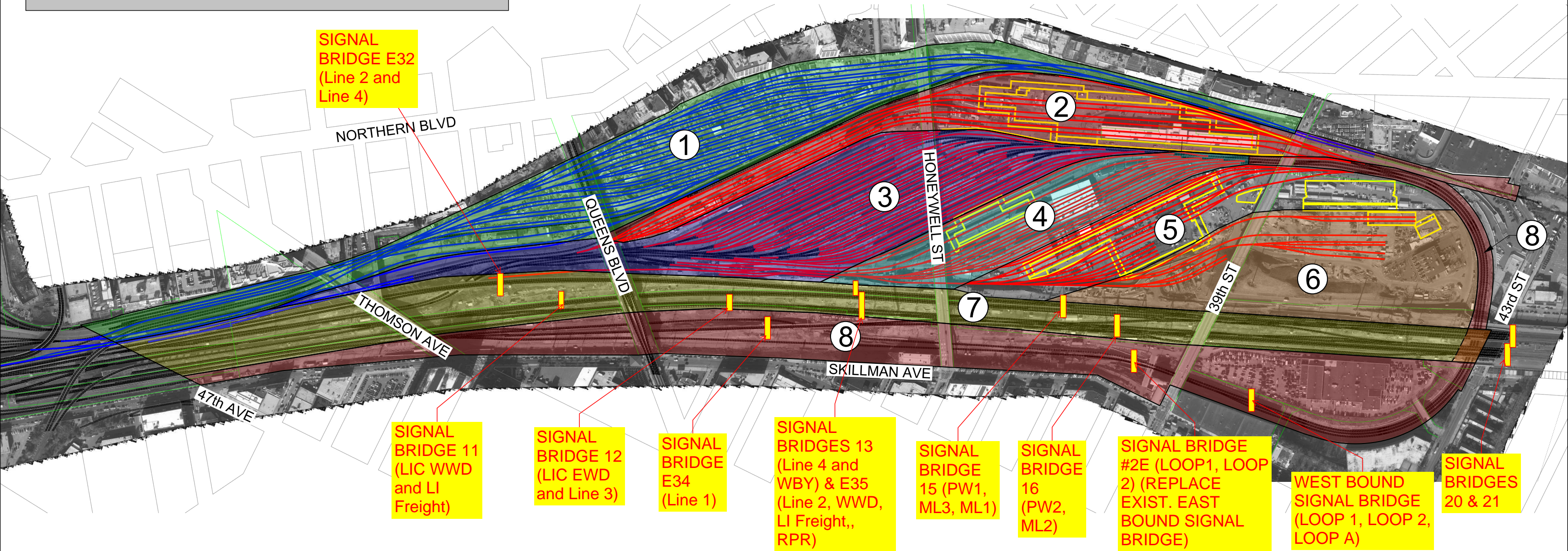
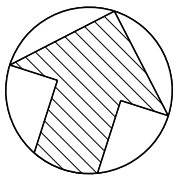
PROPOSED 2' SHIFT OF BOWL TRACKS TO CREATE ZONE FOR 4' COLUMNS

# **APPENDIX A.2.D**

## Signal Bridges

**LEGEND:**

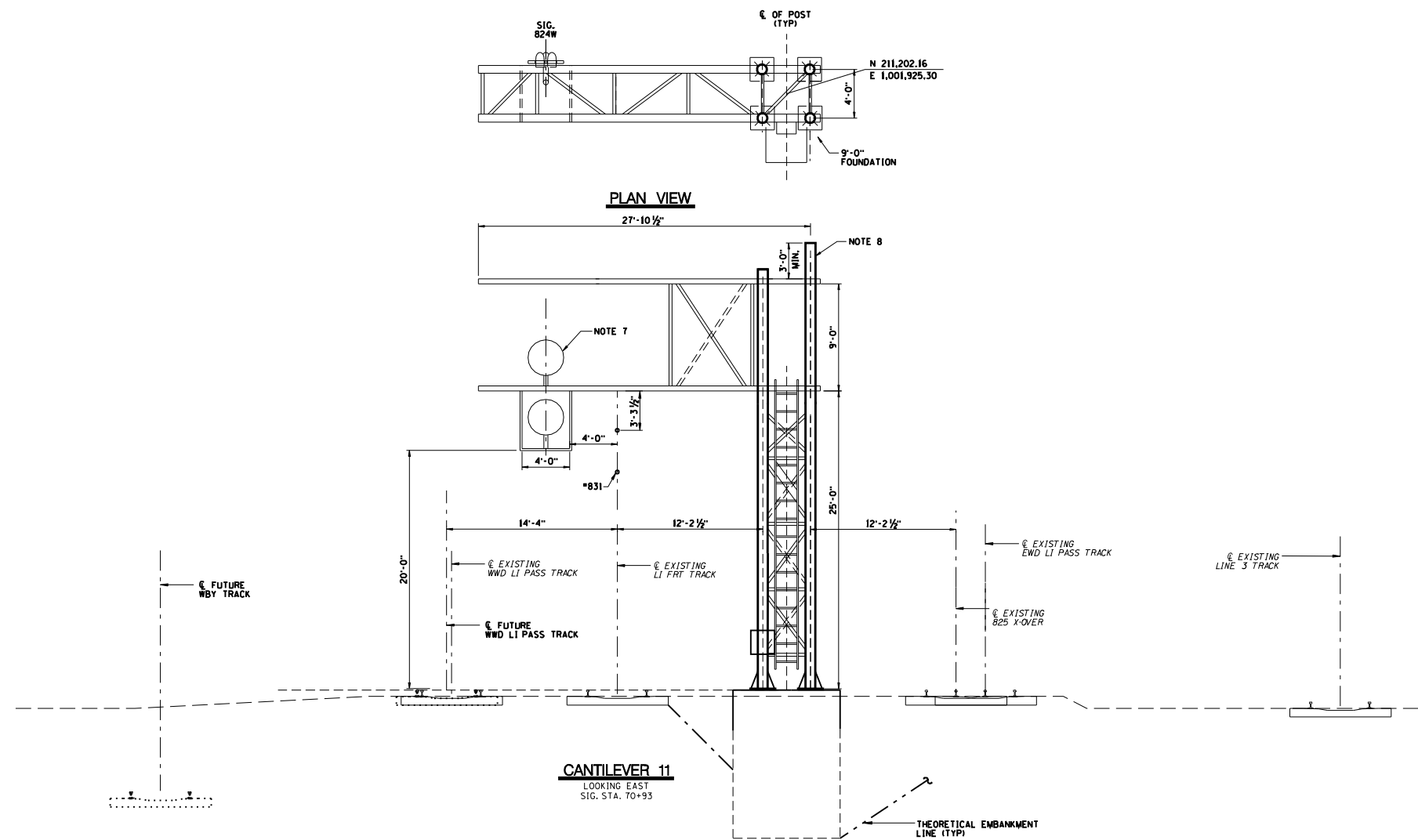
- NEW LIRR MID-DAY STORAGE YARD TRACKS
- NEW AMTRAK MASTER PLAN TRACKS
- NEW AMTRAK MASTER PLAN FACILITIES
- EXISTING TRACKS TO REMAIN



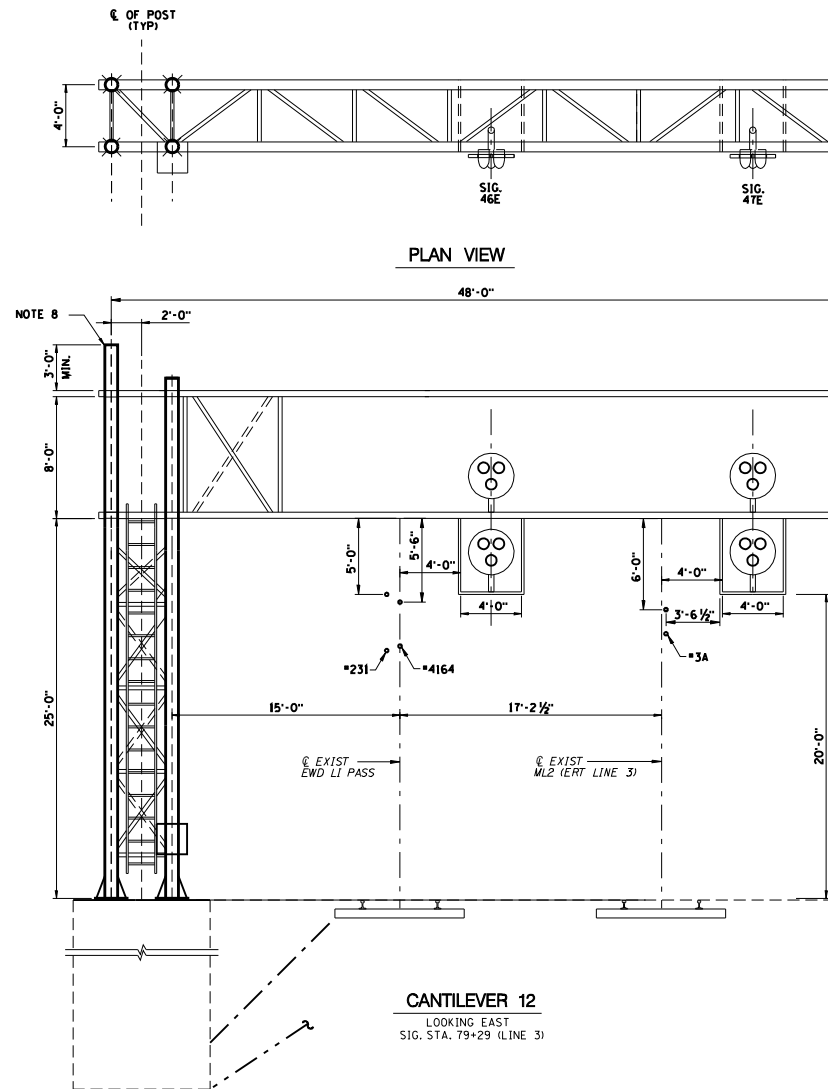
- |                                      |                                 |
|--------------------------------------|---------------------------------|
| ① LIRR STORAGE YARD                  | ⑤ AMTRAK MAINTENANCE FACILITIES |
| ② AMTRAK HSR FACILITY                | ⑥ AMTRAK MoW YARD               |
| ③ AMTRAK/NJ TRANSIT OFF PEAK STORAGE | ⑦ AMTRAK/LIRR MAINLINE          |
| ④ AMTRAK S&I FACILITIES AND STORAGE  | ⑧ LOOP TRACKS                   |



# SIGNAL BRIDGE/CANTILEVER #11

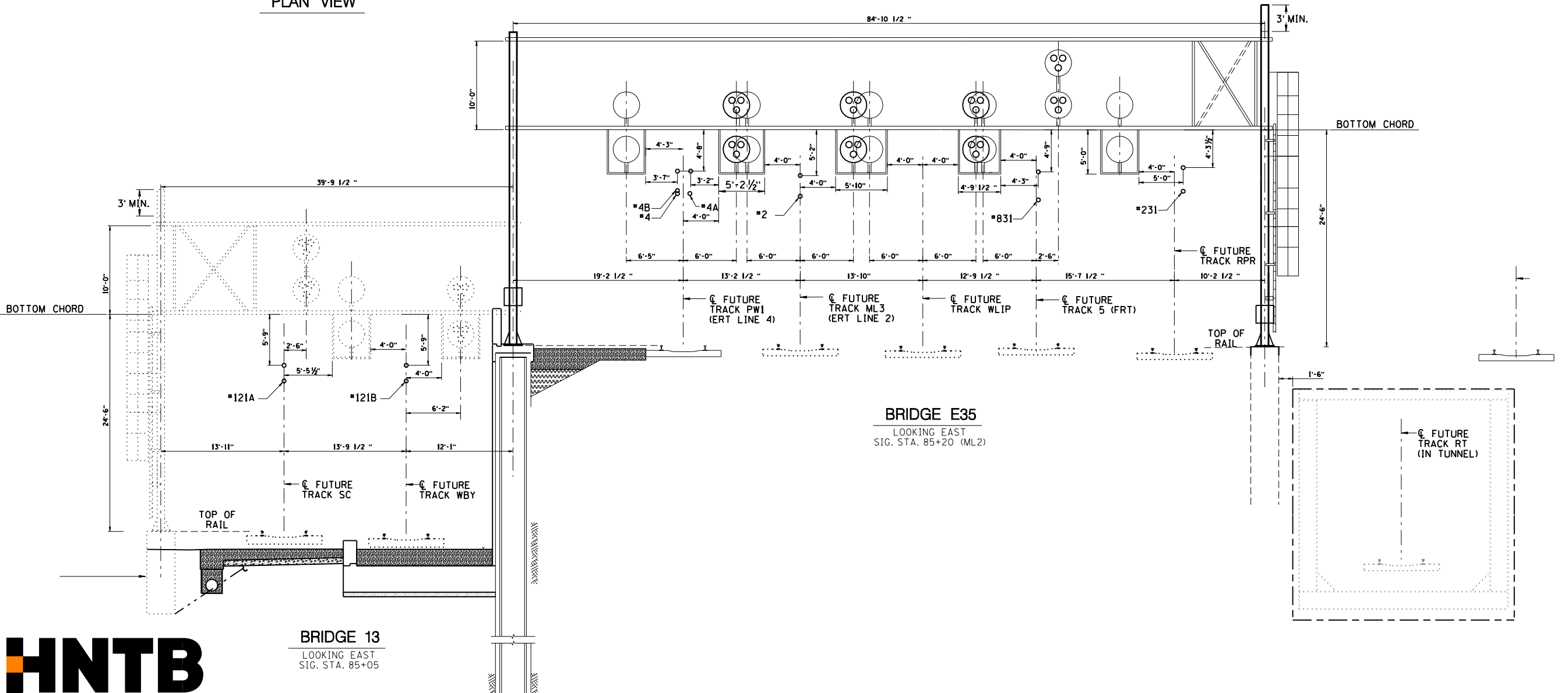
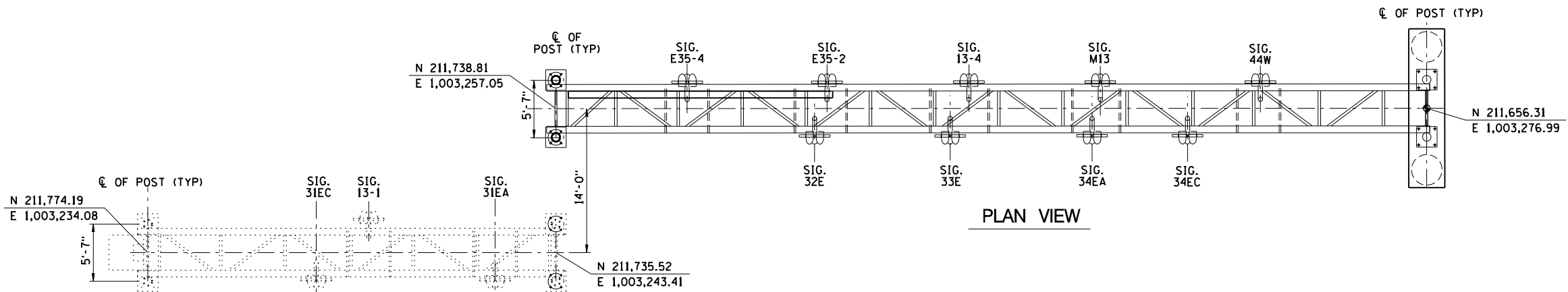


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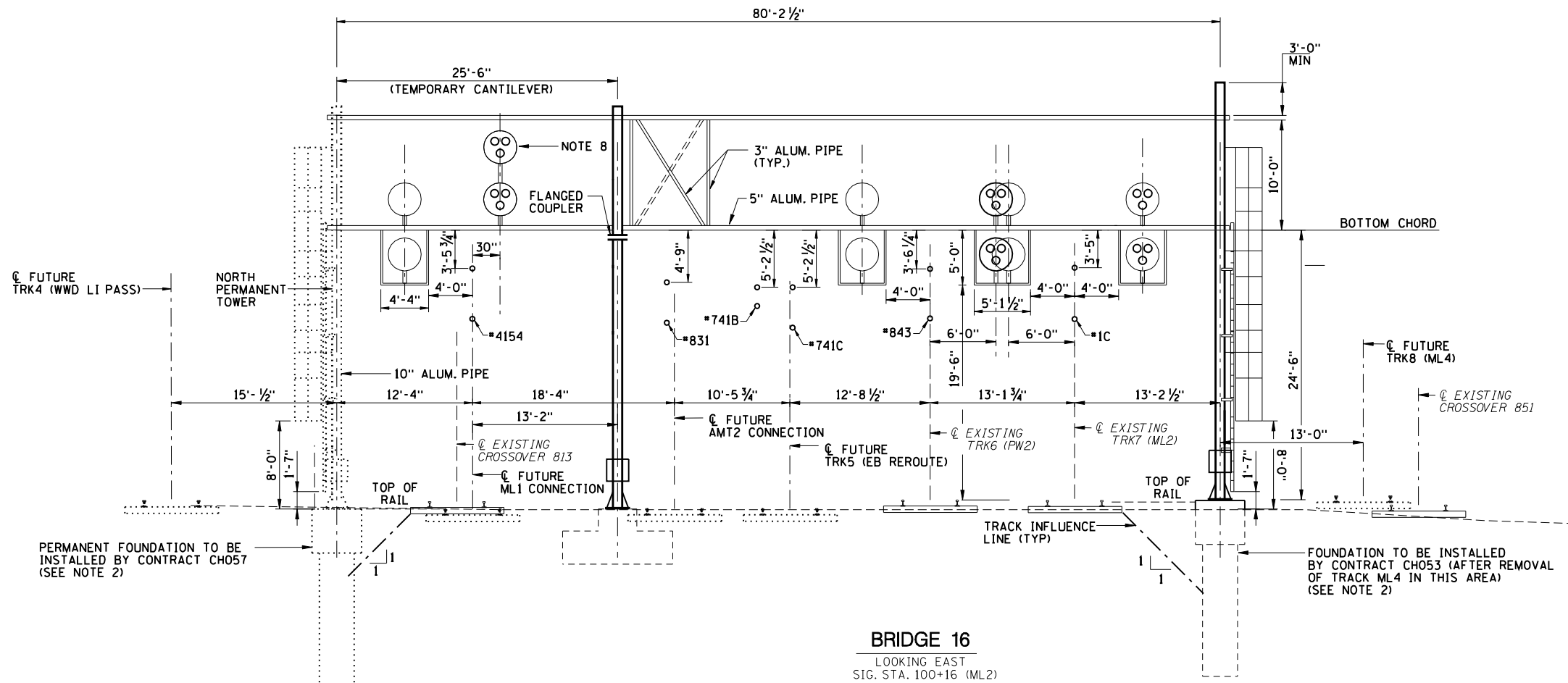
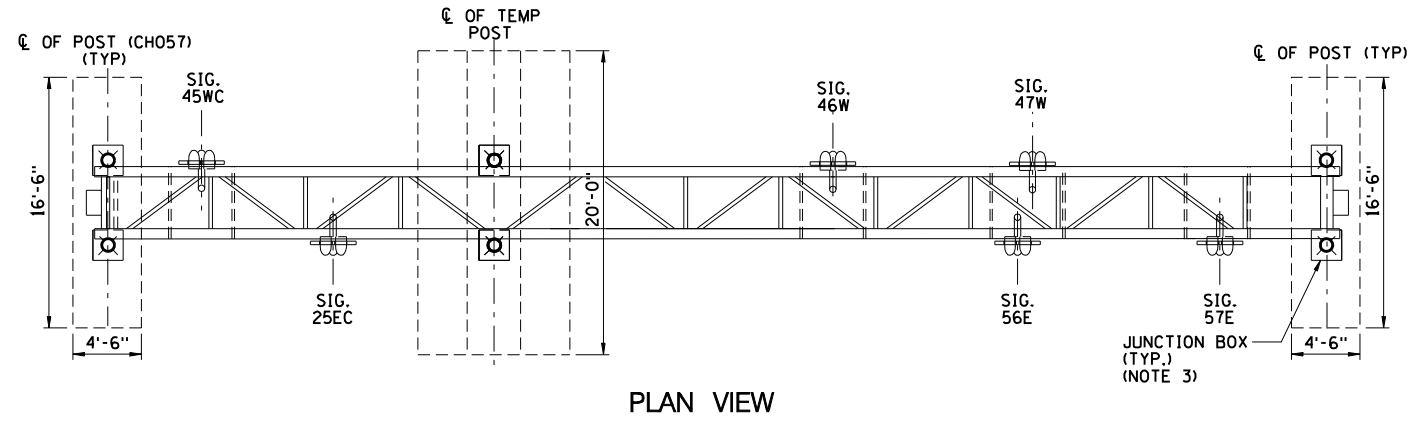


# SIGNAL BRIDGES #13 & #E35

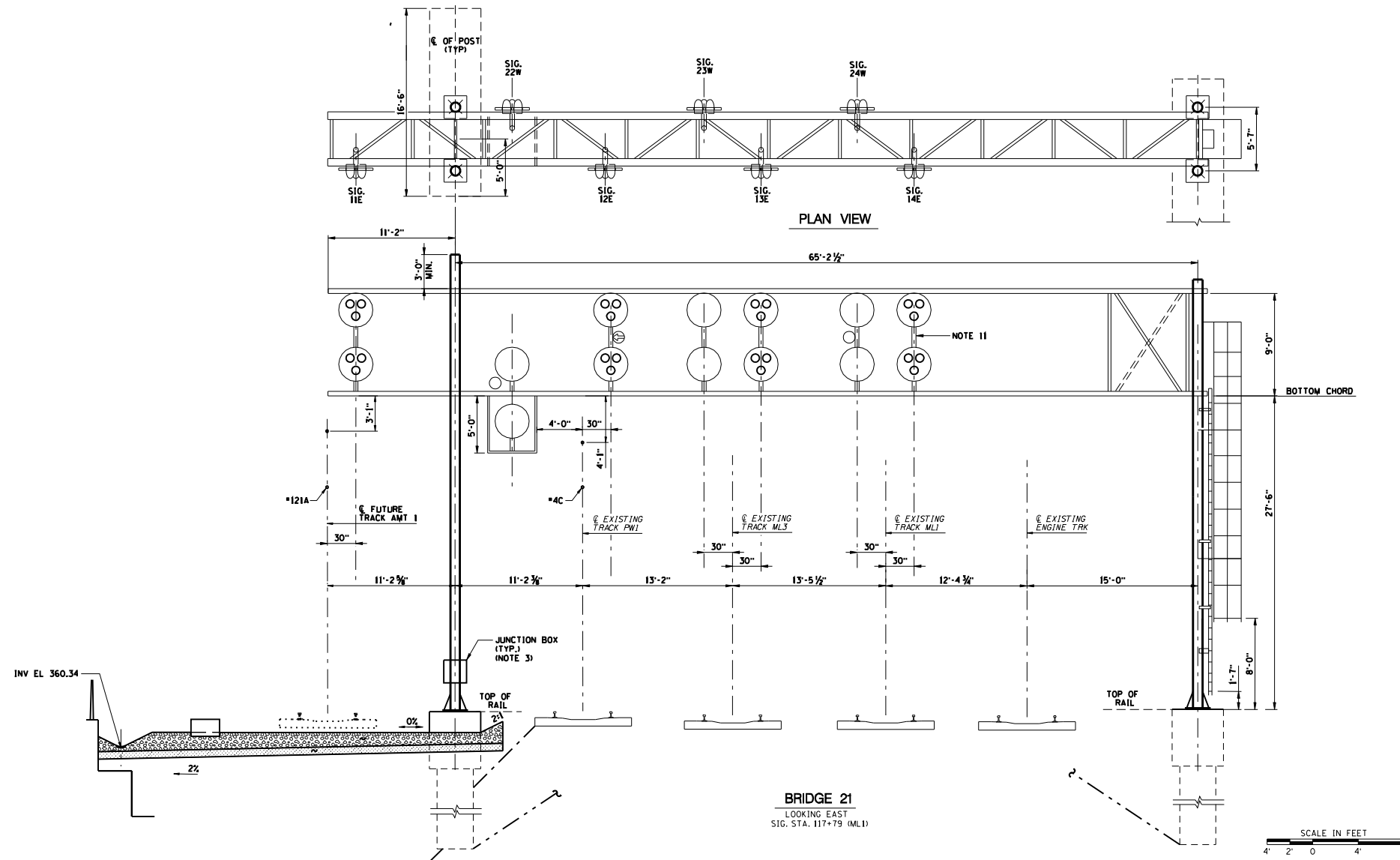




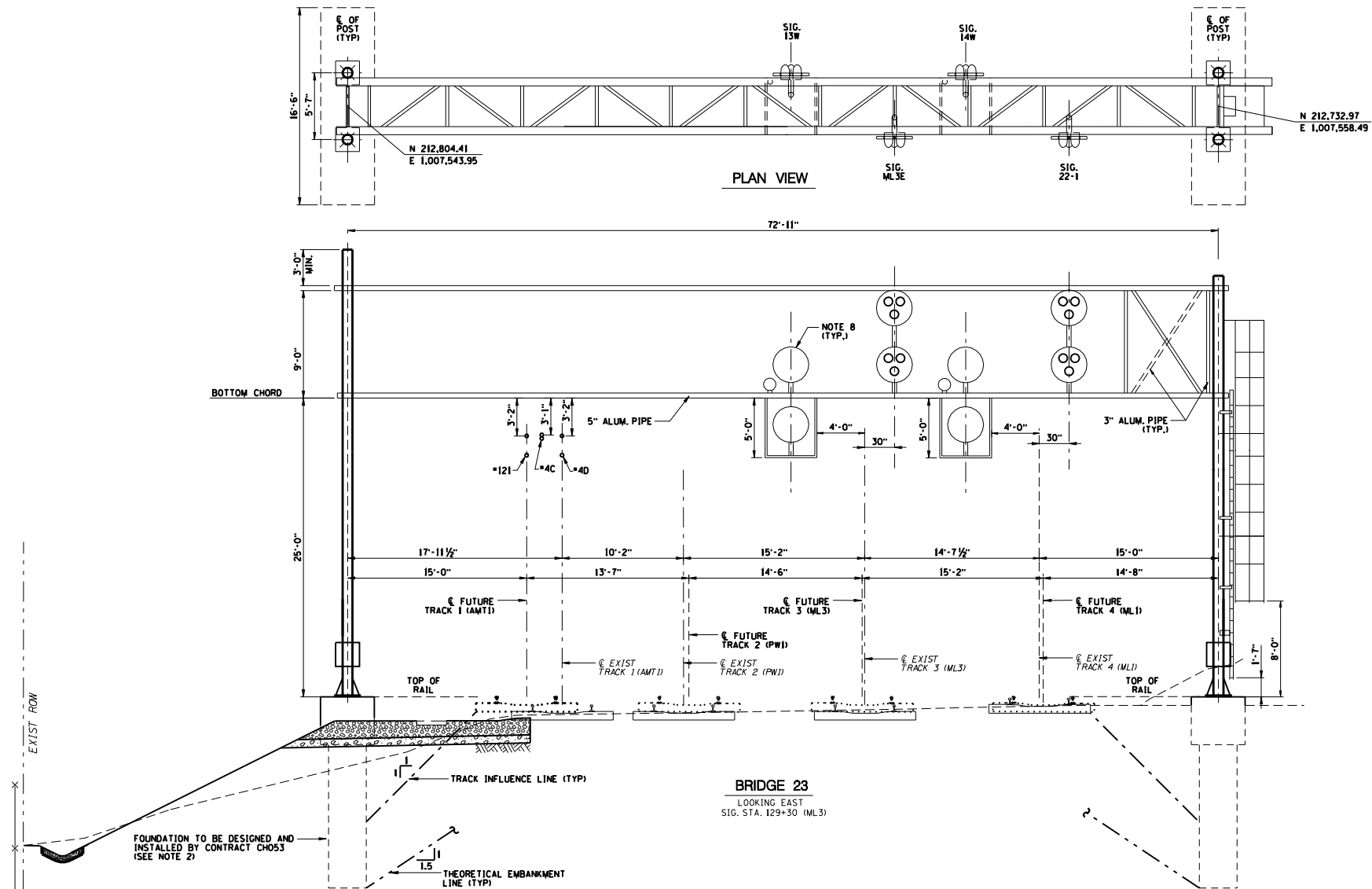
# SIGNAL BRIDGE #16



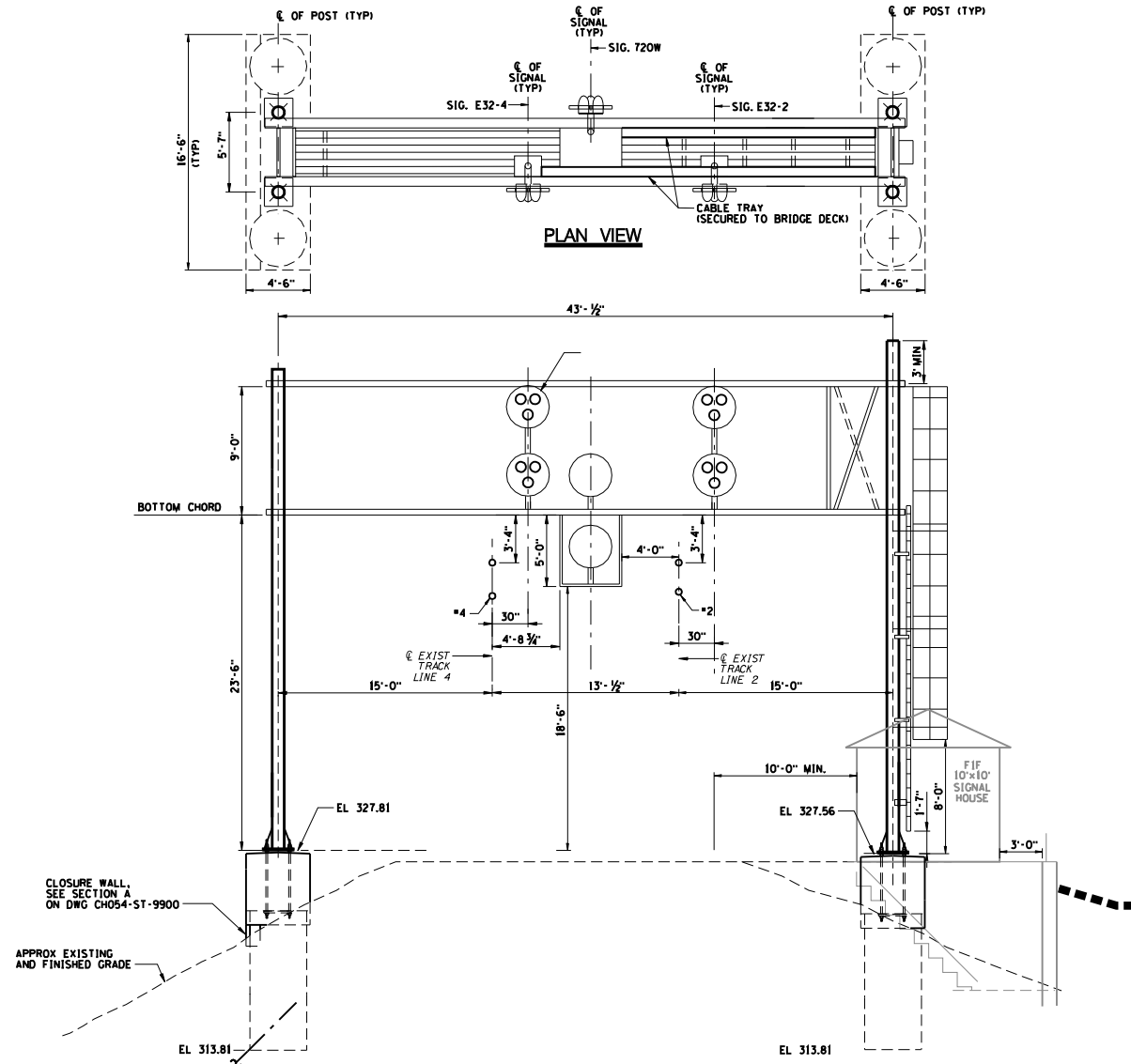
# SIGNAL BRIDGE #21



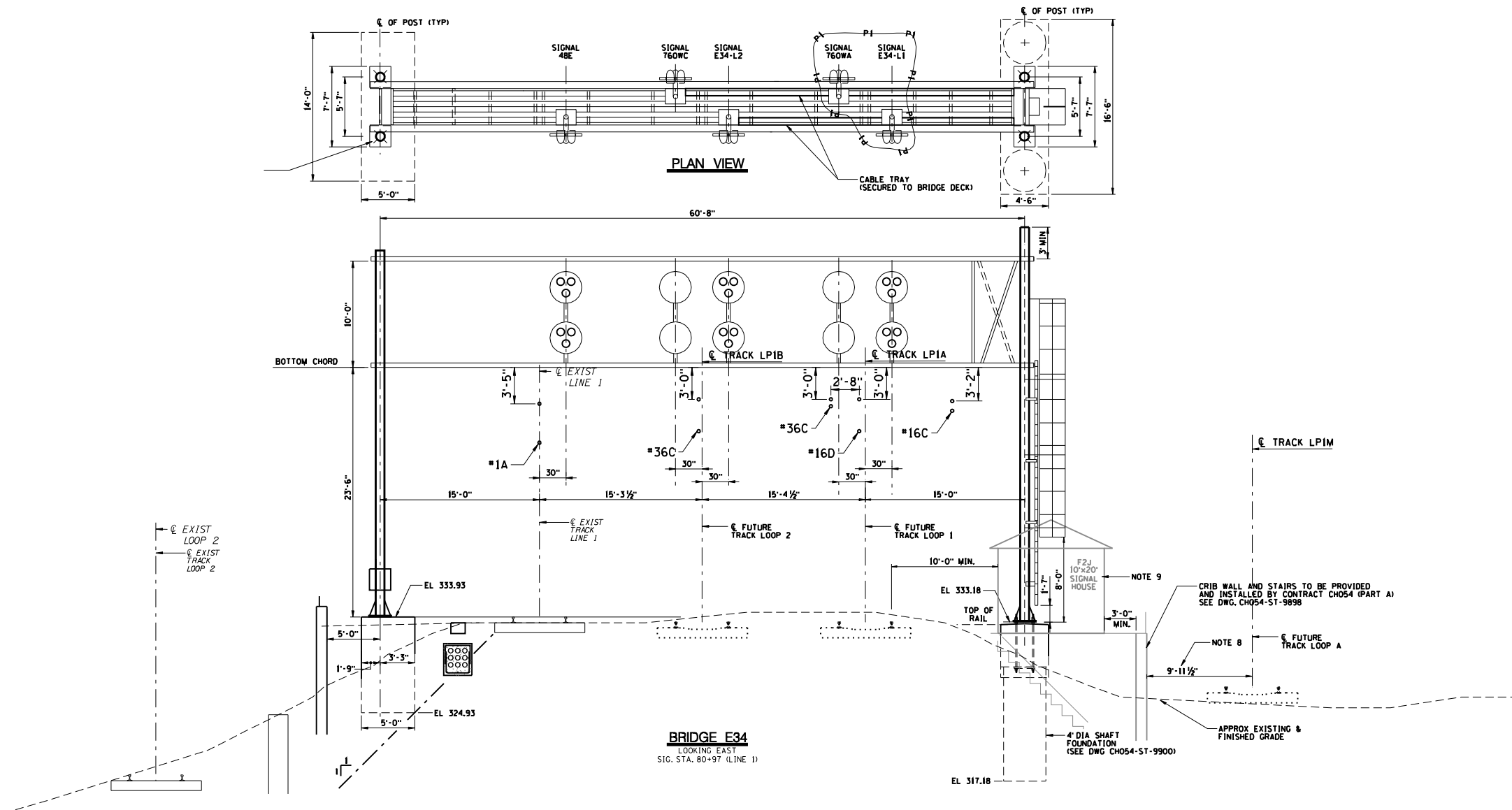
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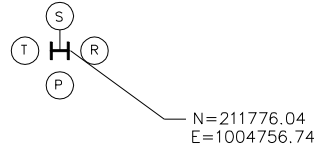
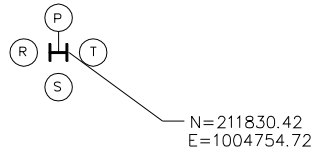
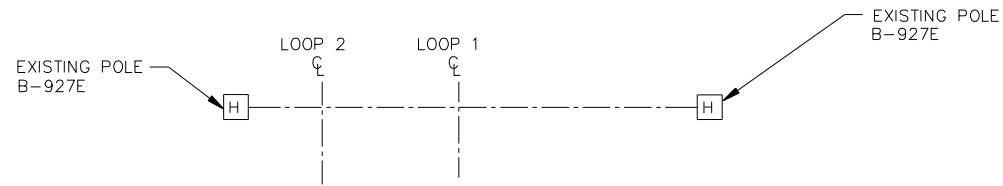


# SIGNAL BRIDGE #E32

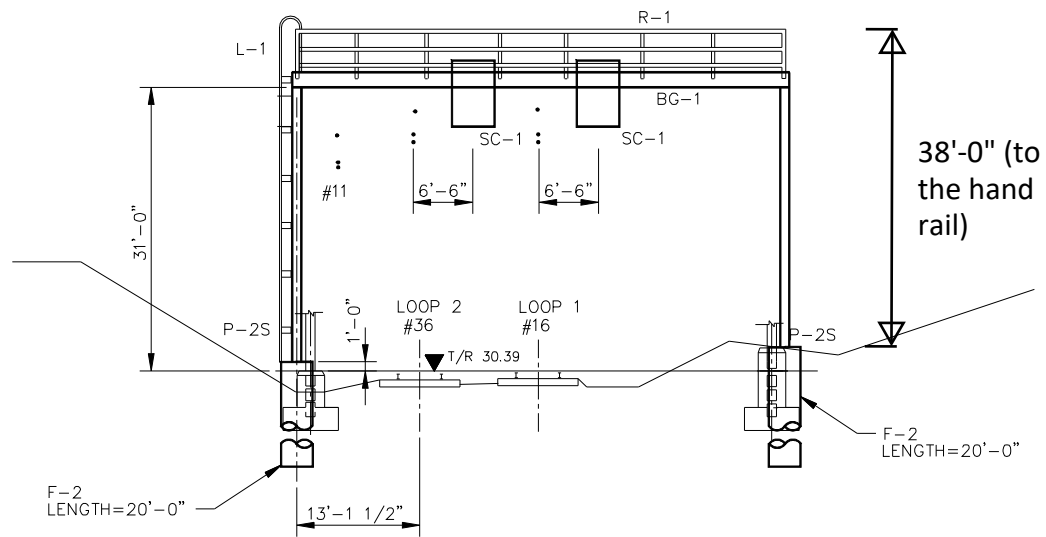


# SIGNAL BRIDGE E34





PLAN  
N.T.S.



B-926 2/3E  
(LOOKING EAST)

EAST BOUND BRIDGE  
(B-926 2/3 E)  
TO BE REPLACED BY FUTURE SIGNAL BRIDGE #2E

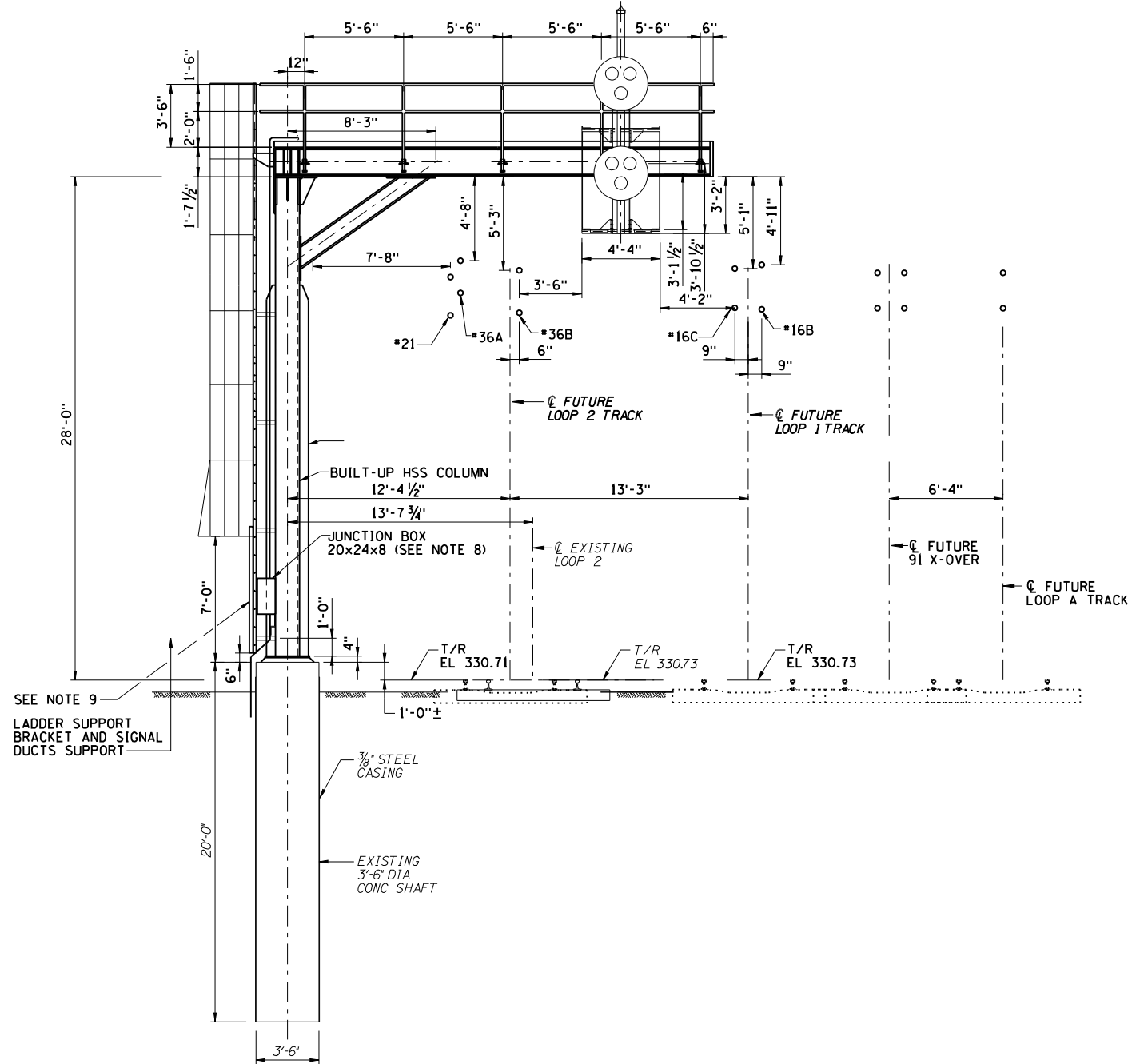
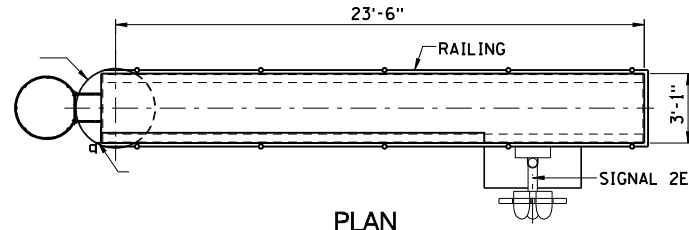


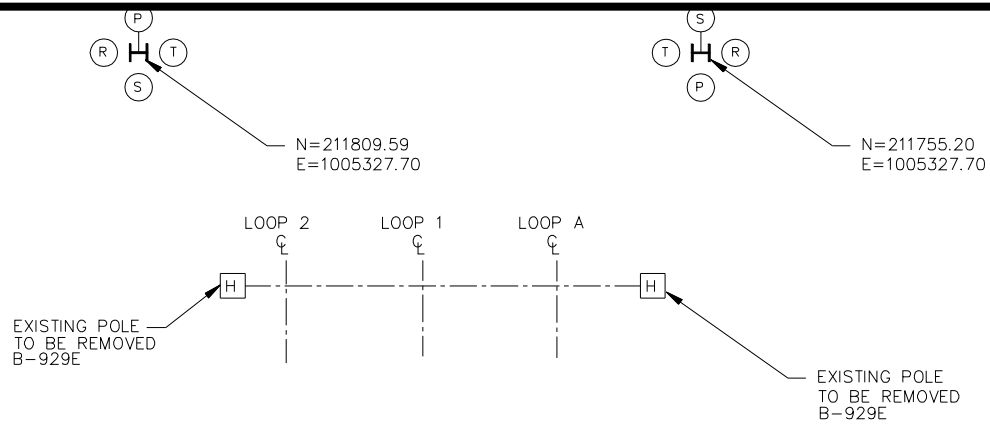
WIRING #	#11	#36	#16
STEADY HEIGHT	N/A	N/A	N/A
MESSENGER HEIGHT			
STEADY HEIGHT	N/A	N/A	N/A
TROLLEY HEIGHT			

NOTE:

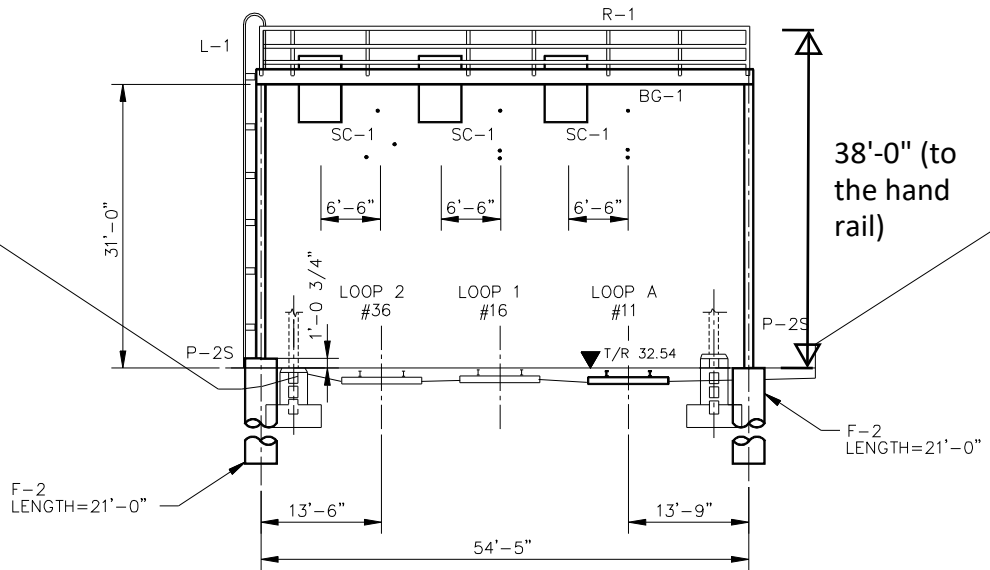


# SIGNAL #2E





PLAN  
N.T.S.



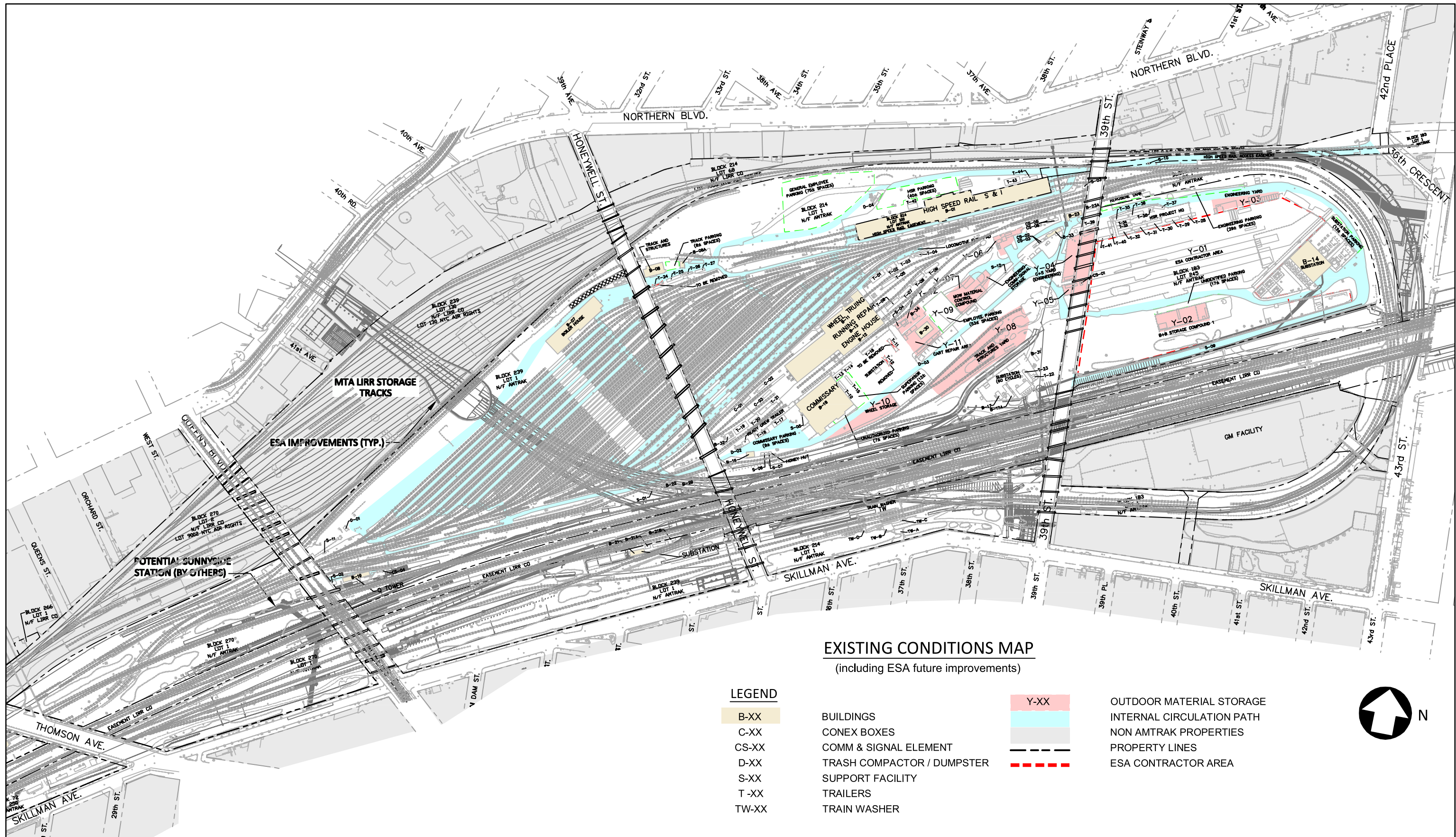
B-929 1/3E WEST BOUND BRIDGE  
(LOOKING EAST) (B-929 1/3 E)



WIRING #	#36	#16	#11
STEADY HEIGHT	N/A	N/A	N/A
MESSENGER HEIGHT			
STEADY HEIGHT	N/A	N/A	N/A
TROLLEY HEIGHT			

# **APPENDIX A.2.E**

## **Existing and Proposed Facilities**



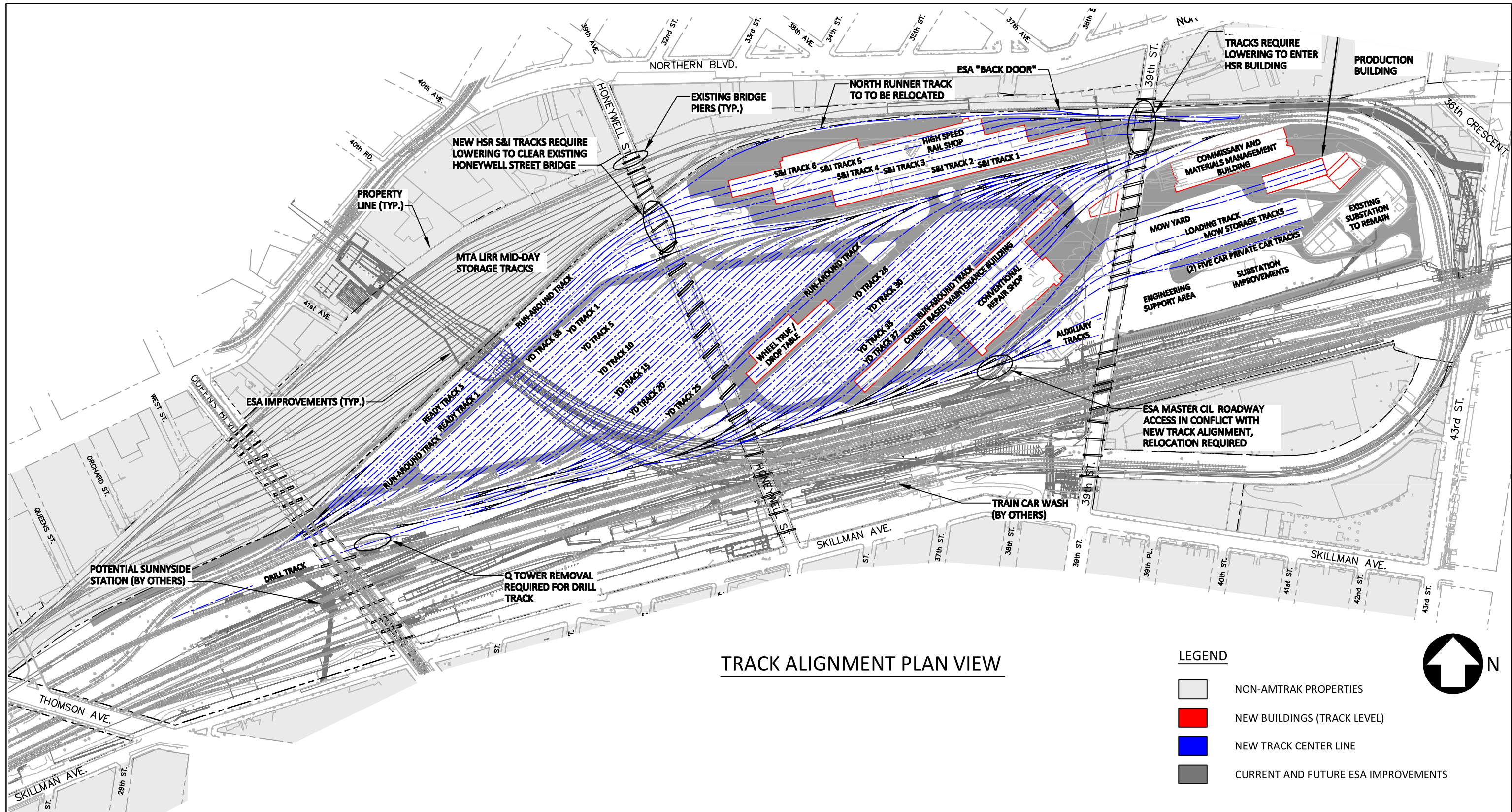
**EXISTING CONDITIONS MAP**

(including ESA future improvements)

**LEGEND**

- B-XX BUILDINGS
- C-XX CONEX BOXES
- CS-XX COMM & SIGNAL ELEMENT
- D-XX TRASH COMPACTOR / DUMPSTER
- S-XX SUPPORT FACILITY
- T-XX TRAILERS
- TW-XX TRAIN WASHER
- Y-XX OUTDOOR MATERIAL STORAGE
- INTERNAL CIRCULATION PATH
- NON AMTRAK PROPERTIES
- PROPERTY LINES
- ESA CONTRACTOR AREA





TRACK ALIGNMENT PLAN VIEW

LEGEND

- NON-AMTRAK PROPERTIES
- NEW BUILDINGS (TRACK LEVEL)
- NEW TRACK CENTER LINE
- CURRENT AND FUTURE ESA IMPROVEMENTS



## **APPENDIX A.2.F**

# Facilities Overlaid with Column Analysis

**Thornton Tomasetti**  
SUNNYSIDE YARDS  
COLUMNS WITH CLOSE CLEARANCE  
08/28/2018

